

Chapter 1

Introduction

1.1 Background of the Study

The limited supply of today's main energy sources (Oil, coal, uranium) will force us - sooner or later to replace most of the currently used power plants with *renewable* energy sources. (D. Adam, 1993) the inevitable permanent decline in the global oil production rate is expected to start within the next 10-20 years.

Energy has long recognized as an essential ingredient for the sustenance of the life and as of power full booster of for an economy. The recent revelation of its strong relationship with the environmental issues has further strengthened its social implications. Every service moves today civilization, such as independent element has also become a cause of concern to the global community primary for two reasons; declining (dwindling) fossil fuels resource and the environmental impacts on unsustainable consumption and production pattern.

Fossil fuel reserves, which are limited, are available only on the few countries that do not have the financial resource to produce petroleum and coal there for have up meet energy needs, and this has affected their economic growth. Hydropower, geothermal energy, solar energy and bio-mass becomes management must have due to diversity their energy mix by exploring indigenous energy resources.

So we have so many alternative form of energy. We depend only with firewood and petroleum product as a major energy pattern during this rapid increasing of population growth and demand of energy is also a one of major factor of our economic liquidation. Improving energy utilization is good options for reducing, energy demand at all level and sectors of society, result in energy and financial saving and ultimately contributes to economic development.

There is no doubt that the availability of electricity (energy) is an important factors in many development economic projects. Because it is important to development, it is often perceived that the present of or absent of rural electricity is a major determining factor in the rate of progress of rural economic development. In fact world widely experiment has clearly demonstrated that simply having electrical power available on rural area rarely provides strong impetus to economic developments. For rural electrification to cause economic development, all and many other factor necessary for economic development must present. As this situation is rare rural electrification projects that have triggered economic development are also rare.

Worldwide, oil prices will then rise considerably favoring the introduction of various renewable energy sources such as the direct conversion of solar energy (solar cells), but also others like for example, hydroelectric- and wind-power *systems*.

However, the combustion of fossil fuels in the past has *already* harmful effects on the delicate balance of nature on our planet. Today, about $20 \cdot 10^{12}$ kg of carbon dioxide are put into the atmosphere every year, mainly by burning fossil fuel.

Today's plants are unable to absorb this huge amount of extra CO₂. As a result the CO₂ concentration in the atmosphere continues to mount adding considerably to the greenhouse effect which will increase the global mean surface temperature - depending on future emission scenarios and the actual climate sensitivity - by another 0.6-7.0°C by the year 2100.

Global mean surface temperature has increased by 0.3-0.6°C since the late 19th century and the global sea level has risen by 10-25cm, Projected sea level rises from the present to the year 2100 is 15-95cm (IPCC, 1995) most likely due to human activities. The consequences of this temperature change have already increased the frequency and severity of natural disasters and are likely to have more devastating effects for humans and other life forms in all parts of Earth within the next decades.

Sunlight provides the energy for almost all life on Earth. It is harvested by plants, including the microscopic algae living in water. Photons of sunlight enter the food-producing regions within the algal cell which act like solar panels. Here the molecules of the green pigment, chlorophyll, are arranged in clusters and absorb the energy of the photons. That energy is used to turn carbon dioxide and water into food, release excess oxygen. Algae are eaten by daphnia (water fleas) and these are caught by roach, small fish which are preyed on by herons. The heron ultimately depends on a vast number of algal cells to supply it

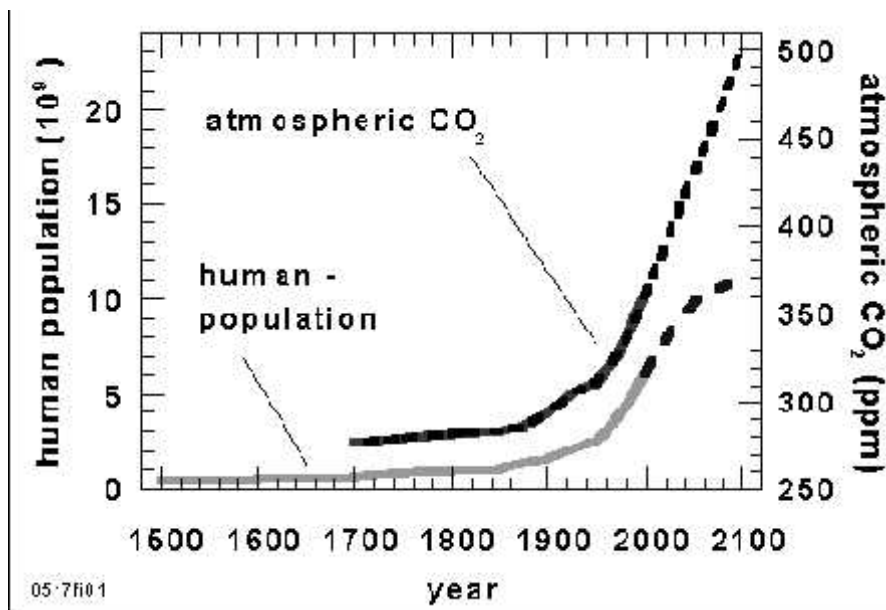


Figure 1.1: The atmospheric concentration of greenhouse gases like CO₂ has grown significantly since pre-industrial times. This can be largely at tribute to human activities, mostly fossil-fuel use. Dashed lines are possible (optimistic) future scenarios.

with food. The scale of sizes in the painting gradually changes from the magnified part of a single algal cell, covering the lower third of the painting, to the Earth's atmosphere at the top of the painting. The oxygen in our atmosphere was itself created by ancestral forms of algae, beginning millions of years ago, when they were among the most advanced life forms on Earth. They changed the ancient atmosphere of the Earth, making it possible for oxygen breathing animals to evolve. Even today, about 90% of all oxygen production and carbon dioxide use is carried out by algae living in the seas and freshwaters.

1.2 Statements of Problems: -

The present world demands excess amount of energy. Rate of energy consumption is increases day by day in accordance of geometric ratio.

Table 1.1: - Human Civilization and Development of Energy Technology and use

Energy Resource	Application	Period	
Human	Mechanical Power	About 500,000 Years ago.	
Fire Wood	Domestic use, Craft industry	About 10 to 12 thousand years ago.	
Animal	Agricultural, transportation, Industry, Replacement of Human Energy	About 10 to 12 thousand years ago.	
Wind	Ship	About 5 to 6 thousand years ago.	
	Agro-processing Mill		
Water	Agro-processing Mill	About 2 to 3 thousand years ago.	
Coal	Steam Engine, Iron and mineral processing	19 th century	Industrial revolution
Steam	Transportation, Industry		
Electricity	Cheap Fuels , Industry, domestic all economic and scientific use	End of 19 th century and beginning of 20 th century.	
Oil			
Gas			
Nuclear			

Source: Shrestha,2003.

The above table indicates that the importance of energy, the table also indicates the relation of human being during different period and application of energy, for the human civilization though the most indication mention above are laying down continuously day by day this we must look for wards alternative source of energy which may taken Solar energy.

So in general, this study has attempts to find out the real sequences of study area of energy crisis and people moments accordingly to the energy demand. Specifically, the present study has tried to explain following research questions.

1. What are the main purpose people are using solar energy?
2. Can energy supply play a motivate role to rural life?
3. Is there any ecological and environmental impact arisen due to energy using pattern?

These above and likely so many question are enrolling since then and now but so many school of thought trying to answer it but no one give with satisfaction though the demand and supply of energy increasing as a forth bridge process up to end less energy generation.

1.3 Renewable Energy Sources

Fortunately, we have *renewable* energy sources which neither run out nor have any significant harmful effects on our environment. Naturally, power plants that use wind, the potential, wave or tidal energy of water, the heat from the Earth's crust or direct solar radiation rely on the local supply of their primary energy source. Thus, using the existing energy storage technology, the amount of power they can supply over a longer period often depends on geographical and weather conditions.

It is important to recognize that the installation of these power systems should *always* be preferred as long as they supply more energy throughout their life time than they have consumed during their fabrication, installation and maintenance. Although this criterion is fulfilled for all of them their prices are not yet low enough.

1.4 Objectivity of the Study

The following are the objectives of the study.

The main objectives of the study are to identify the possibility and challenges of energy demand and supply which may enhance the economic and social progress in the study area. The specific objectives of the study area as follows:-

1. To explain the socio-economic status of people in the study area.
2. To find out the status of solar energy uses.
3. To explore the problems of SHS.

1.5 Rationale of Study

Solar energy becomes the one of believable and long lasting source of energy. In context of Nepal, is suffering energy crises not only due to economic condition but also by geographical condition of our country, with such scenario we must look towards the solar energy as an energy solution of energy trends.

1.6 Limitation of the study

This research work is completely an academic work and the researcher, being a student, does not have any experiences of such social researches. The researcher is not a professional one so he might suffer from methodological weaknesses.

Following are the limitations in brief.

- I. The study is based on only one VDC of Syangja district's VDC, thus the application of the study to the whole country may not be conclusive.
- II. Only the researcher was involved in the field study.
- III. Study has been conducted with limited time and budget.

While studying on the present topic the researcher has concentrated his attention on those rural people who are far away from use of hydropower energy, nuclear energy, coal, gas and other forms of Non-renewable Source of energy which are easily purchased from the energy market.

1.7 Organization of the Study

The project work in title "A Study on Home Application of Solar Photo Voltaic System, A Case Study of Malayngkot VDC of Syangja district", contains six different chapters. The first chapter contains introduction, where the background of study, statement of problems, objectivity of the study, rationality of study and limitation of study are defined. The first chapter is more important because it defines the problems and generates an idea of solution through objectivity. The second chapter contains literature review, in the literature review, some specific ideas about solar PV system are borrowed from different books, articles, journals and others published and unpublished materials. The essential portion of the research design carries chapter three, where the methodology of research is defined. The introduction of the study is contained in chapter four, where the interpretation and analysis of data are contained in chapter five. Chapter six contains the summary, conclusion and recommendations of the study.

Chapter 2

Literature Review

2.1 General Background

Not many books have been written about the energy in the context of Nepal despite some academic research. Those reports reflect the picture of energy reliability and fulfillment of Nepalese. Various governmental and non-governmental organizations are giving indeed knee interest towards the energy issues on Nepal. Beside all of this people them self taking one of most serious effects on their life. On filling their energy they has always spend huge amount of time and money too. To taking 1 lit of kerosene oil people must stay on more than one hour queue, this show the real picture of the energy demand.

Though on depict of different study sources the researcher consult several book relocating to the energy and solar PV system those materials what the researcher taking during the study all are mention on the bibliography.

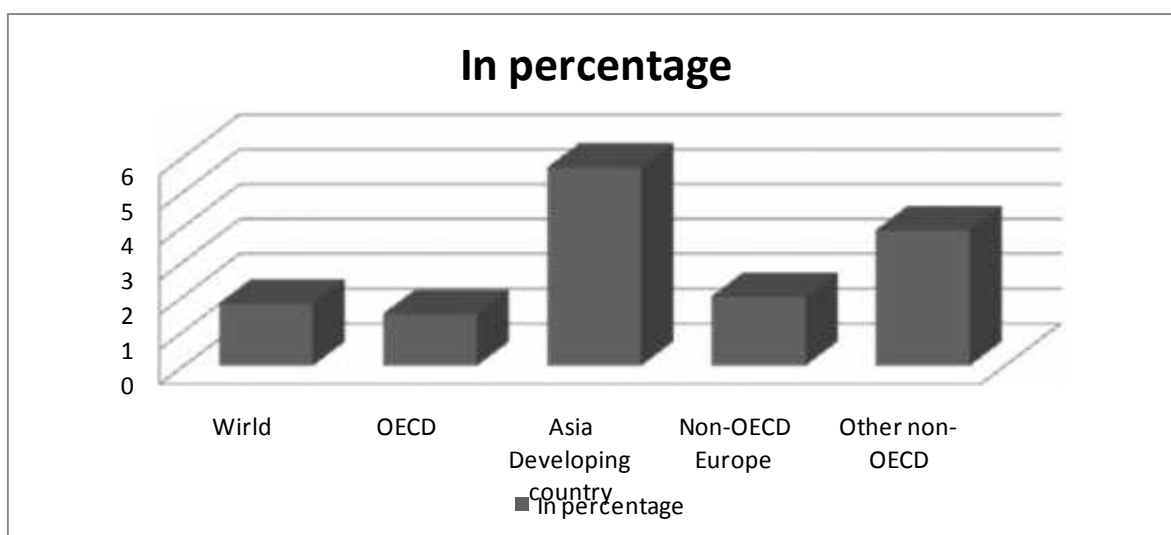
Solar Photovoltaic Power Generation, Using PV Technology, vol. I, ii & iii, provides different types of materials where as on vol.- I provides inside in to the different PV cell technology and their efficiencies, and discuss the major technical issues related to the balance system component necessary to complete a PV power supply system. It also noted that through the PV systems are normally used to provide electricity in location that are not compact to the grid connection area and discuss the advantage of different hybrid systems such as PV diesel, PV wind and PV diesel- wind systems. This volume also highlights the experiences in developing countries in using PV systems for water pumping, vaccine refrigeration, battery charging and home lightning.

Vol. ii cover the economic aspects of PV- systems. It discusses the cost structure of the PV systems. Examine their cost effectiveness and compares or verify of standalone PV- appliances with alternatively power supply system commonly used. The economics of hybrid PV system is also discussed. The report include that the PV is economically for many stand alone applications; the market is small because of financially and institutional barriers. On a half cycle basis, PV technology is shown to be particularly economics for voltage electrification where as house hold energy demand is limited to lightening, radio and small TV loads as in case of Srilanka, Phillipine, India and Indonesia where several hundred systems are used. Large scale power generation through PV generation by utilizes is expected to become more economic in next decade, particularly when the environmental cost of production electricity from the fossil fuels are taken in to consideration in power system planning.

Volume iii on the institutional aspect discuss the financial and institutional arrangements necessary to handle the high front end costs of PV installation and their sustainability. This volume also examine the past role of bilateral and multilateral agencies, developing country governments, utilities, development finance installations, non-governmental organizations and manufacture and traders in promoting PV use and note that institutional barriers are main cause that limit the PV market. The report recommends the financing mechanism that needs to be established such as resolving funds, leasing schemes, renting arrangements and cooperative schemes. The report recognized the importance of private companies involved in manufacture, sale, installation and service of PV system in promoting of PV technology

The 5- Asian countries in this study India, Korea, Thailand, China and Indonesia account for more than 80% of total energy consumption during the 1980s was higher than any other part of the world.

Table 2.1: - composition of growth Rate of primary energy consumption 1981-1990



Source: - Asian Development Bank, 2004,

The analysis of energy demand focuses on the industries, transportation and household and commercial sector.

Salient features of energy use in Asian Developing Countries:-

-) High energy intensity
-) High energy consumption In the industrial sector
-) Rapid growth in demand for electricity
-) Rapid motorization
-) Large losses in electricity or (: energy loss during supply)
-) Low energy prices

2.2 The Necessity of energy conservation

Given rapid in energy demand and country should pay much more attention to energy conservation on:-

Industrial sector:- in low income countries, firm tends to limit investment in energy conservation because of capital scarcity, in state of investing on energy conservation they are inclined to invest in expansion of production capacity, which tends to give better financial returns, especially in the short run.

Transportation sector: - The rapid growth rate on transportation and identification of new route for public transportation also one of sine of energy demands. The energy use on transportation is fossil energy.

House hold (commercial sector):- energy demand in this sector is expected to increase rapid as much as more rural areas are electrified, electric appliances became more widely used and electricity is substituted for traditional energy sources. Demand for electricity in this sector is expected to increase more than demand for other forms of energy because electricity is a cleaner and more conveniently form of energy.

The thermal efficiency of firewood stove is about half that common coal stove and 1 of 5th that of oil of gas stove. The traditional energy is still widely used for cooking and home heating in rural houses.

Electric Power Sector:-High losses in electric power generation reduce the supply of electricity more than 30% some times 35% in Nepal, it becomes one of terrible problem facing Nepal. One of recent report published on Kantipur National Daily shows that Lalitpur and Chitwan District carry about 90% of electrical energy loss on year 2064/065, since it is the poor management of Nepal Electrical Authority but generally there may few others factors which may cause the energy losses, generally the energy losses cause by:-

-) Small size of plants
-) Poor plant maintenances
-) Inefficient plant operation
-) High auxiliary consumption.

Table 2.2: - Projection in energy demand in 5 countries 1990-2005

Growth Rate , million tons oil equivalent , % p.a.						
	1980	1990	2000	2005	1980-1990	1991-2005
China	369	612	1198	1587	6.2	6.5
India	72	119	213	284	5.3	5.6
Indonesia	18	30	62	88	3.3	7.2
Korea	34	70	135	193	8.2	6.9
Thailand	8	19	44	66	10.2	8.7

Source: - IEA & IEC World Bank

Historically, industrialized countries have dominated global energy consumption. However, this situation is changing. Developing countries have contributed to industrialize, where as the industrialized countries have gradually shifted towards great production of services. As a result, developing countries are consuming more energy as ever before. Conversely, industrialized countries are maintaining low growth rate of energy consumption.

2.3 Energy Policy:-

Many developing countries adopted supply side energy policies, which regard energy developing supply and distribution through the use of tariff and quotas. While those policies contributed to industrialization and modernization in the early stage of development, they caused many problems in latter stages, including the following:-

1. Energy shortage, because energy demand tended to increase much more rapid than energy supply, low energy prices, coupled with increasing energy consumption, caused financial problem in energy supply industries.
2. Effort to conserve energy and improve efficiency were unsuccessful because energy could be purchased at price below it's true value &
3. Environmental problem: - Those arise from acid rain, particular matter & CO₂ emission.

In our country petroleum becomes the main source of energy. The price of most oil product has been fully liberalized. The government must start energy conservation programs, including such measures as energy audits, technical assistance, and research to development and financial incentives.

2.4 Characters of Energy Utilization

- I. High depend on firewood
- II. Inefficient industries: - growth rapidly which makes high energy demand.
- III. Incomplete price liberalizations up to now.

The pulp and paper industries are the 2nd most energy insensitive industries in the world, ranking behind only to the iron and steel industry. Except china, the pulp and paper production in the Asia country is small.

Energy use in house sector

-) Firewood
-) charcoal
-) LPG
-) Electricity

(Main purpose of energy use on home appliances is for cooking, lightening, refrigerating, AC and others.)

Number of households by main types of Fuel Used for Cooking®

No. of household surveyed: 4,174,457

Wood 65.59%

Kerosene 13.53%

Kerosene Imported in 2000/2001 316381 K. Lit°

No. of households using kerosene 564,804

Consumption of Kerosene per house per day 1.556 lit

Cow-dung 9.97%

LP Gas 7.67%

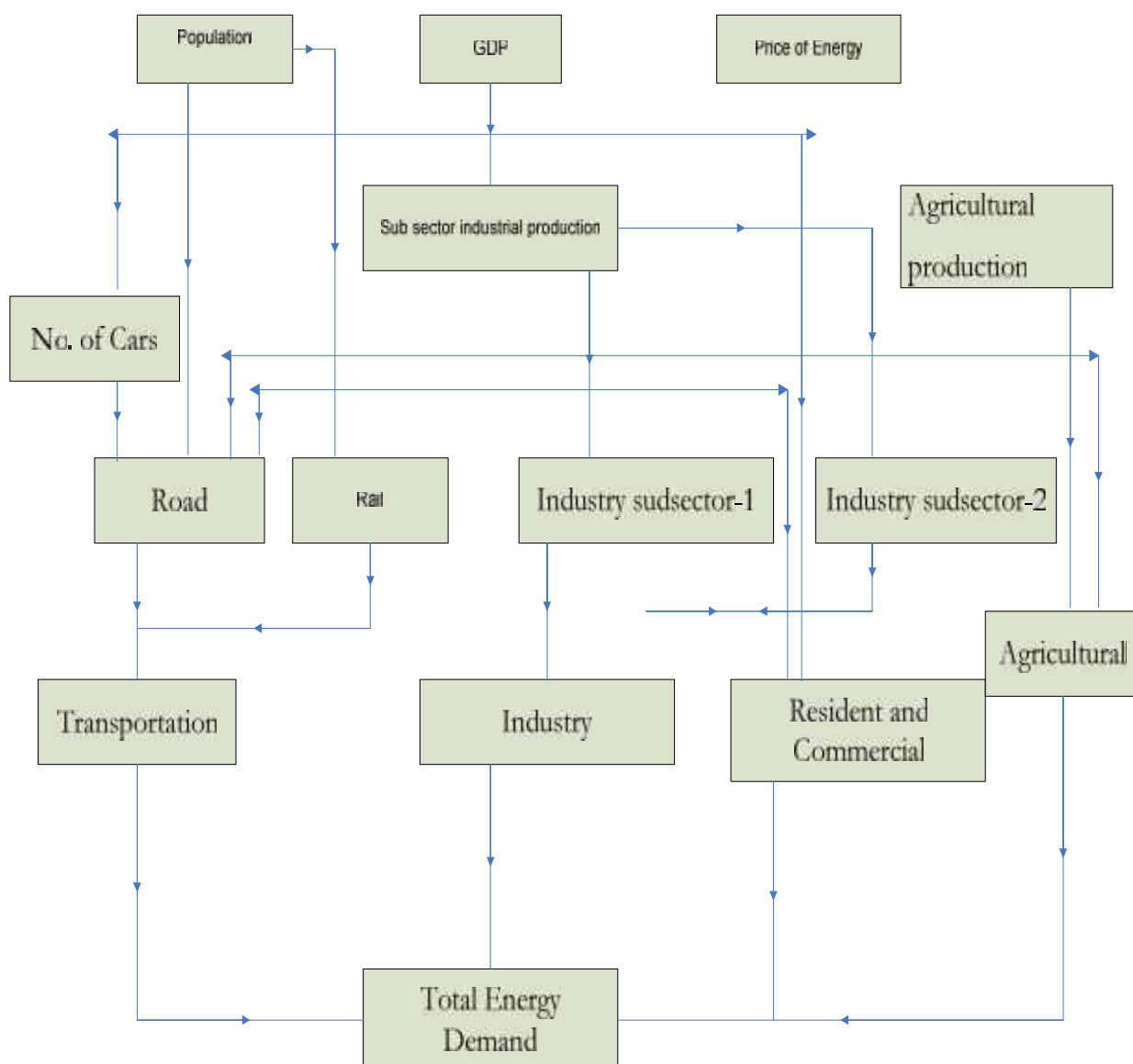
Bio Gas 1.66%

Others 0.69%

Not stated 0.89%

® Source: National population census 2001, Summary sheet, & Nepal in figures 2002, CBS, NPC, Nepal Government

Table 2.3 Structure of Energy Demand Model



Source: - International Economic Department (IEC), World Bank

Very large investment in energy related infrastructure will be required to meet expected energy demand. They includes power generator to dam, expansion of electricity distribution system, expansion of port facilities to import coal petroleum and natural gas and expansion of transportation capabilities to transports fuel domestically and internationally.

The great energy demand may cause substantially increase world energy price in the coming future too. Hence energy conservation efforts are importance not only at the individual firm or personal level but also at the country & regional levels. Regional and possible global cooperation in energy conservation thus became important

Many countries in the regions are already importing fossil fuels. Some countries are almost totally dependent. On external resource to meet their domestic requirement for fossil fuel for ex.- Singapore, Nepal, Kyrgyzstan, Tajikistan and Hong-Kong, China. Accordingly to table presentation on above may conclude that the present words energy demand level is going to rapidly increasing day by day but reservation of fossil energy sources becoming decreasing in order which is in the form of non-renewable energy sources.

Table 2.4: - Estimated Reserved of Fossil Fuels, 2002.

Countries	Reserved (mtoe)	Countries	Reserved (mtoe)
Russia Federation	134611	Turkmenistan	1859
China	7366	Azerbaijan	1743
Australia	51884	Uzbekistan	1740
India	41878	Pakistan	1672
Iran	32426	Thailand	1229
Kazakhstan	17771	Bangladesh	963
Indonesia	6268	Japan	402
Turkey	2324	Newzealand	395
Malaysia	2258	S. Korea	366

Source: - BP, 2003, Statistical Review of World Energy 2003, 53rd Edition.

The table listed on below, also forecasting sine of indication of energy level and demand on presenting world. The developed country, they are using energy since then and now, are becoming the most successful in development thus now they in the position of world leading countries. Here we must not be satisfied through the using the energy we may get success in economic growth, the energy using patter must involve on development. The present world not merely advocating the development as the economic growth, now, development defining on different prosperity which is includes on education, health and sanitation, drinking water, transportation, communication and others human

needs including basic needs too. Here the main point focusing the developing not only in term of using aspect of energy denotes the casualty effect on environment pollution due to fossil energy. Since and then, the different from of energies are many purpose which may result the hazardous effect on human lives, the depletion of ozone layers and global warming are the few example of unhealthy environment, which contributes the hap-hazardous condition of human life on the world.

Table 2.5: - Total Final Consumption by Sector in Selected Asian Countries, 2001

Country	Total (mtoe)	Taken Share in a Percentage				
		Industry	Transportation	Road (shared in transportation)	Commercial & Residential	Others
World	6995	31	26	79.8	-	43
ESCAP Region	2785	34	18	73	40	7
Developing Countries	2356	34	16	71	43	8
Developed countries	429	36	30	80	28	6
China	785	40	10	63.4	42	8
Japan	342	36	28	82.5	31	5
India	380	26	12	87.9	57	5
Nepal	8	5	3	84.1	90	1
Pakistan	52	27	17	86.3	54	2
Srilanka	7	19	26	80.9	51	4

Source: - IEA (2003), Energy Balance of non-OECD (Paris, OECD/IEA) & energy of OECD Country (Paris OECD®/ IEA)

Almost any technology will have an impact on the environment in to which it is introduced. It is a question of the scale of the impact and usually the scale of the impact in relation to the benefits received.

A large hydro scheme may have quite a large impact in term of the number of people displaced but it may be deemed that the size of the impact is acceptable in the light of the expected benefits. Tension however quickly surface when those whose who are making the decisions about what is acceptable in terms of environmental impact are not the ones directly affected.

The level of pollution that is caused by the installation of a particular technology should be at the level that the environment can cope with without cumulative long term adverse effects. For example many large cities are now finding that he immediate atmospheric environment cannot cope with the level of noxious gases being discharged by cars, buses and trucks.

Table 2.6: - Challenges Related on the Energy and it's Prosperity

E N V I R O M E N T A L	Greenhouse gases	<ul style="list-style-type: none">) Carbon dioxide and Methane) Greenhouse effect) Global warming (increasing in temperature 1.5 to 4.5 °C) results glaciations heavy rain etc)
	Acid rain	<ul style="list-style-type: none">) Nitrogen oxide and Sulphur dioxide) NO₂/SO₂ + water steam = Acid Rain) Acid rain Results :- Effect on plant and oxidation of metal
	Air pollution	<ul style="list-style-type: none">) Caron monoxide (reduce the motor nerves skill and decrease the oxygenation capacity of Lung and transport capacity of blood vessel)) Air particles (chronic affection on Lung or Lung cancer)
	Nuclear Accident	<ul style="list-style-type: none">) Chernobyl accidents, due to these thousands of people are suffering radio-active hazardous till now.
	Land Degradation	<ul style="list-style-type: none">) Deforestation -Land slide, land erosion, water erosion) Decreases on agro-production
S O C I A L & E C O N O M I C A L	Energy Demand Rate	<ul style="list-style-type: none">) The global energy demand will increase 50% more up to 2020.) The crisis will be happen on energy production, it may effect the capital transition
	Irregular distribution of energy	<ul style="list-style-type: none">) Petroleum 60% on Arabian Countries) Gas 40% on USSR 40% on UAE
	Drudgery	<ul style="list-style-type: none">) Risk over energy transportation and carrying cost.) Energy collection from far distance.) Transportation of goods and water, terrible for grinding of seed.) Due to scarcity of suitable energy sources it may effects on industry and income generating functions.

Source: - Indian Enviromental-1982, preparatory Document 48/8, conference on the Human Environment, Stockholm, 1972

The indication of the energy demand on the present world not merely forecast the energy crisis but also its environmental and ecological impacts on upcoming new world. The present world suffering from the global warming and air pollution due to result of this the depletion of Ozone layer raising sea level is holding. The chlorofluorocarbons persist in the atmosphere a long time and deplete the stratospheric ozone layer, leading to increased ultraviolet radiation on earth's surface. This all reflect the terrible condition may arisen on future world. The radioactive hazardous are activated not present world too. The present table on below simply trace out the unhealthy atmosphere due to cause of pollution.

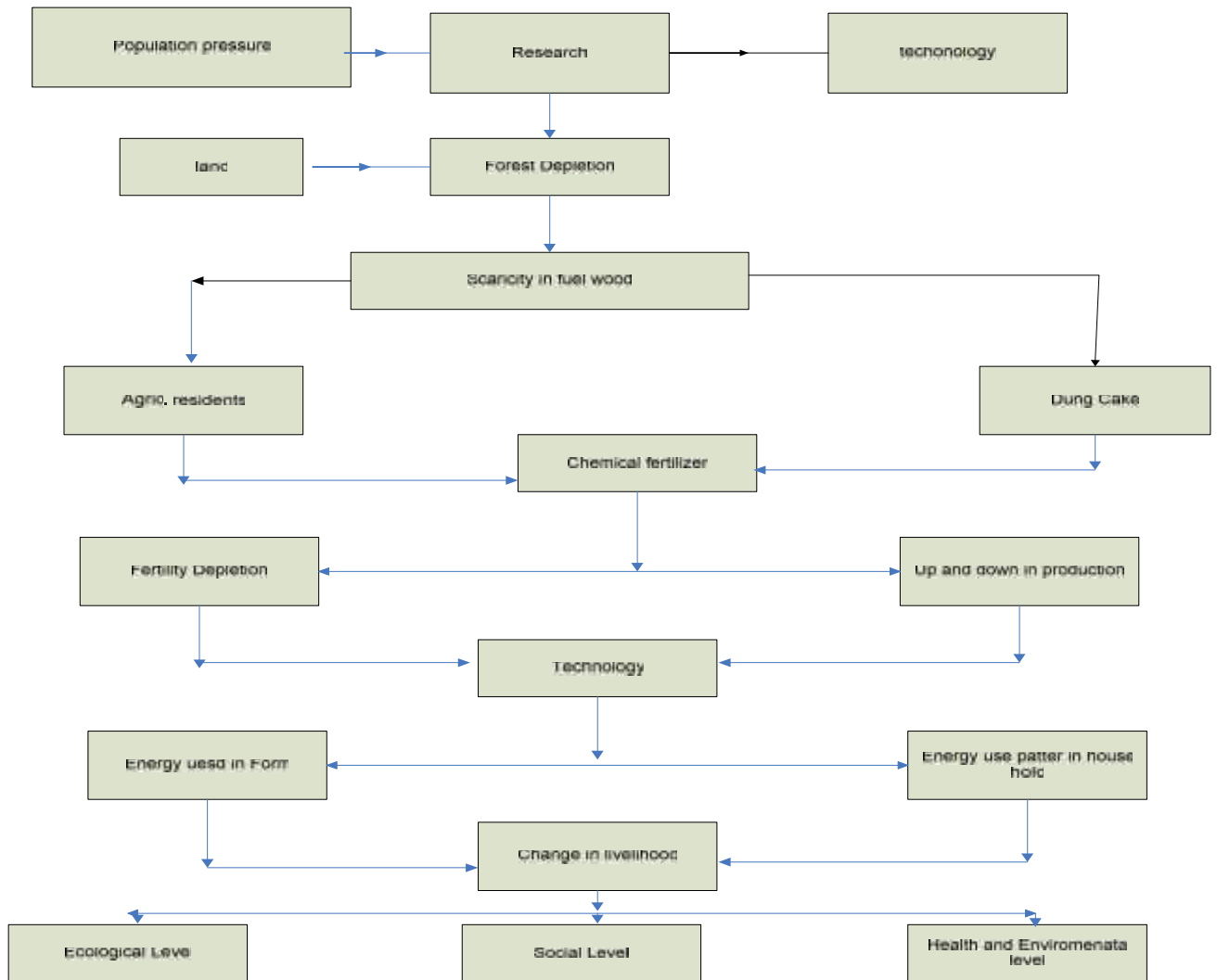
Table 2.8: - Selected Atmospheric Pollution

Pollution	Principle Human Sources	Effects	Remarks
Carbon dioxide	Fuel combustion for heating, transport, energy production	No direct effect on peoples. Over time, may lead to increase in earth's temperature.	Normal constitute of atmosphere. Essential to plant life
Carbon monoxide	Incomplete fuel combustion(as in motor vehicles)	Deprives tissues of oxygen. People with cardio-respiratory diseases more sensitive's.	Contribution of natural sources small. Tobacco smoking is more damaging to the humans than exposure to traffic.
Sulphur dioxide	Burning of Sulphur containing fuels like coal and oil.	Combining with smoke, increase the risk and effects of respiratory diseases. Causes suffocation, irritation of throat and eyes. Combining with the atmospheric water vapor to produce acid rain. Reduce crop yields. Leads acidification of lakes and soils. Corrodes buildings.	
Suspended particular matter	Smoke from domestic, industries and vehicular sources.	Possible toxic effects depend on specific compositions. Aggravates effects of Sulphur dioxide. Reduce sunlight and visibility. Increases corrosion.	Chemically, a most diverse group of substances. Natural source of include dust storms, volcanic eruptions and sea array.
Oxide of nitrogen	Fuel combustion in motor vehicles and furnaces. Forest fires.	Possible increase in actual respiratory infection and bronchitis morbidity in children. Produce brown haze in city air. Cause corrosion.	Nitrogen oxide and nitrogen dioxide are two components.
Volatile hydrocarbon	Partial combustion of carbonaceous fuels, industrial processes, disposal of solid wastes.	React with other pollutants to produce eye irritants (acrolein, aldehydes). Ethylene is harmful to plants. Aerosol particles reduce visibility. May produce unpleasant odors.	
Oxidants and Ozone	Emission from motor vehicles. Photo chemical reaction of nitrogen oxides and reactive hydrocarbon.	Cause eye irritation and impaired pulmonary function in diseased persons. Corrode materials and visibility.	Mainly derived products of atmospheric reactions between other pollutants. Ozone is a natural and

		Ozone is one of the most damaging pollutants of plants.	essential constitution of the upper atmosphere.
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Source: - Indian Environmental-1982, preparatory Document 48/8, conference on the Human Environment, Stockholm, 1972

Table 2.7: - Cultural Ecological Model:-



Source: - international economic department (IEC), World Bank

The amount of energy radiation from the sun is unimaginable large. Solar radiation is absorbed in the atmosphere and at the earth surface at a rate of around 10^{17} w. The global rate of energy consumption is around 10^{13} w, so the sun provides 10,000 times more than energy then the world consumption.

In 1963's, the direct conversion of solar radiation into electricity through photovoltaic (PV) device was understood only by a handful of scientists. By the late 1960's

PV energy conservation was still a little known technology, but had established an important market in U.S. space program. PV was ideal as sunlight consistency available on space.

Now a day the application of PV- Systems have been wide spread and there has been particular interest among donor institution and manufacture to apply PV systems to provide basic human needs (: lightening and water pumping) in village and rural area of developing countries.

As there are two billion people are in the world who do not have to access to electricity, and giving important role electricity can play in improving living conditions and facilitating economic development, solar PV is a good choice that need careful consideration in an economic biased manner for rural electrification.

2.5 Photovoltaic Theory:-

Solar PV cells are semi-conductors devices which absorb solar energy and converted it in to electrical energy. It was 1st observed on 1839 by Edmond Becquerel. The 1st selenium PV cell was produce in 1883. By 1905, it was known that the number of energy level of electron's emitted by a photosensitive substance varied with the intensity and wavelength of light shining on it.

P-n- Junction: -

Junction diode is formed by placing a p-type crystal in contact with n- type crystal and subjected to high pressure so that it becomes a single piece. The assembly so obtained is called p-n- junction diode. In addition to these majority charge-carriers, there is few minority charge carrier in each region. The p- region contains a few electrons where as n- region containing few holes. Here the p-type region has (positive) holes as a majority charge carriers and n-type region has (negative) electrons as majority charge carriers.

Holes:-

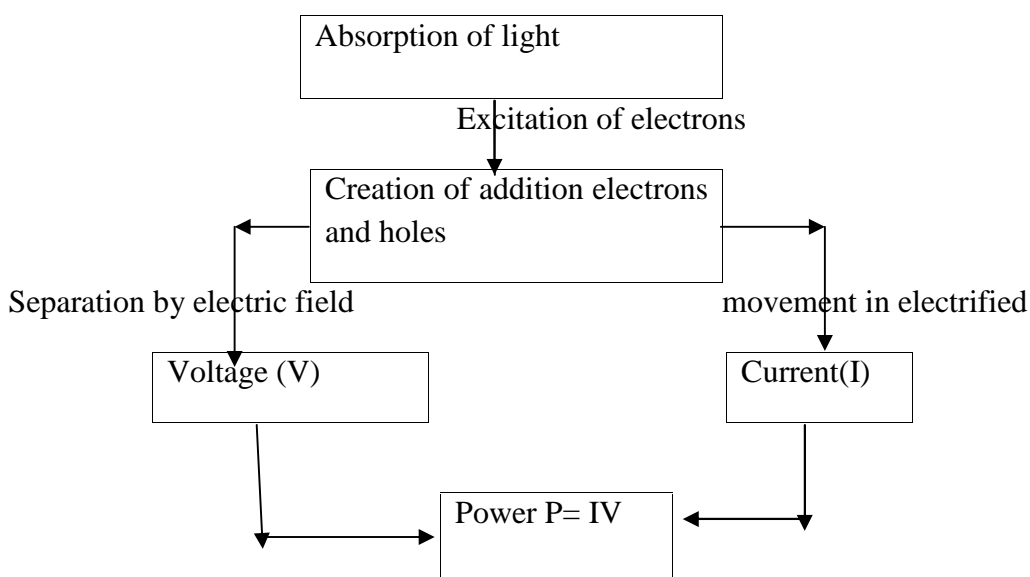
The departure of the electron creates a vacancy valance orbit called holes. It happens when the ambient temperature is above the absolute zero (-273°c), the heat energy in this air cause the atom in a silicon crystal to vibrate this may result occasionally dislodge an electron from the valance orbit.

Energy Gaps:-

In silicon atom, the distance between the valance band and the conduction band is called the energy gap. Where the valance band refer to the amount of energy required to pinch off valance electron from orbit and conduction band refer to the free electron go to next- higher energy band. The relativity few semiconductors found to be close to the optimum energy gap are: -

-) Crystalline silicon
-) Gallium arsenide
-) Cadmium telluride
-) Copper indium diselenide
-) Amorphous silicon

In PV Process:-



Types of PV cell

Among several types of cells available now these fall in to two general categories namely crystalline and thin-film.

Crystalline silicon cell are the most widely available solar cells. These were initially manufacture from the wafers cut from single crystals but now they are been fabricated from cheaper poly crystalline silicon materials. The most common method for growing crystals the 'Czocharalski- method ' involves the control cool of molten silicon in to a cylindrical ingot or (bowel) while is the single crystal typically 1m long and 15cm in a diameter. The ingot is than sawed into thin wafers which are subjected to necessary chemical, thermal and deposition treatment in order to from a p-n- junction with front and back metal contact.

A still cheaper, but less efficient, silicon cell is made using a film of amorphous (non-crystalline) silicon, the type use in consumer products such as watches and calculators.

2.6 The Solar Resources:-

The electrical output of the PV device is depending on the solar radiation it receives. Outside the earth atmosphere, on the normal surface normal to solar beam, the power density is 1365 w/m^2 . Whereas, the typical solar spectrum on the earth surface during a clear day, total irradians (areas under the curve) is 1000w/m^2 . The amount of solar radiation depends up on in travel distance, quantities of dust, water vapor, ozone, CO_2 , and other components. The diffuse irradiation plus the direct radiation from sun are together termed as total irradiation. This total irradiation on horizontal surface called the global radiance. The different sunlight may vary from 20% clear day to 100% in heavily over cast condition.

The more importance than the instantaneous solar irradiation at a side, is the total solar energy reactive in a day over a specific area, it called daily solar irradiation.

2.7 Application of solar System

I. Stand -Aune systems

Components of PV system

-) An array of PV module
-) Power conditioning equipments
-) Cabling with electrical protection equipment
-) Load

Array of PV

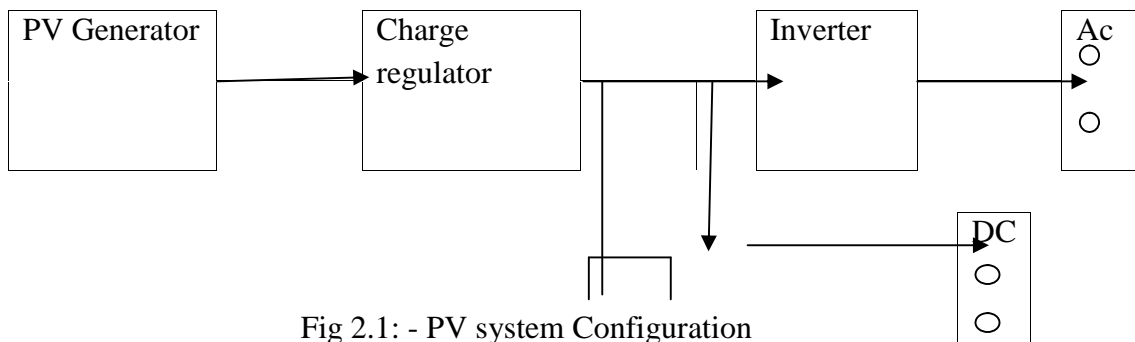


Fig 2.1: - PV system Configuration

A. Power conditioning unit

- i. Batteries: - Batteries are required when the application requires an electric supply at times when no electricity beings produced by the module. PV batteries must have the abilities to be repeatedly charged and discharge without damage.
- ii. Charge regulator: - It used to particularly in lead acid batteries. They prevent potential damage in the battery due to overcharging.

- iii. Maximum power point tracker: - In electric device usually incorporate in to large PV system. Which automatically adjust module voltage and current to keep the system operating at the maximum power point of I- V curve?
- iv. Inverter: - A solid state electronic component which convert electricity from DC to AC for load that require for AC load.
- v. Cabling: - Along with electrical overload protective equipment an essential part of PV system and should be specified to last for at least the life time of PV modules.
- vi. Load: - the electrical equipments which are operate through electric sucks such as light, iron, radio, television, etc.

The most common end user equipment which operates with a standalone PV power supply can be categories as follows-

-) Refrigerators systems
-) Lightening system
-) Battery charging system
-) Pumping systems
-) Domestic home system
-) Other systems(industry, agricultural, navigational and consumer products)

a) Water pumping system: - Initiated on 1970, for application in the Sahal region of West Africa. It can be used to pump from bore holes wells and rivers, the most common application being village water supplies, irrigation and livestock watering.

A PV pumping consists of PV array connected in to an electrical motor deriving centrifugal, reciprocating or diaphragm pump via a power conditioning unit (usually an inverter and a maximum power point tracker). There is no need for batteries because the pump water is used as energy storage.

Depending up on the application and local condition, the 5- general configurations used for pumping system with PV array are-

-) Submerge centrifugal motor pump set
-) Surface-mounted motor with submerged pump
-) Reciprocating positive displacement pump or jack pump
-) Floating motor pump sets
-) Surface section pumps

b) Refrigeration System: - the WHO introduce the immunization programmers' with the use of PV powered refrigerator during 1980's in order to maintain vaccines within their required temperature ranger 0 to 8 degree centigrade.

The most common application of PV power refrigerators are:-

-) Refrigeration of human vaccines for immunization programs.

-) Refrigeration of human blood, live-stock vaccines, domestic refrigerators for remote building.
-) Agricultural cold store (few commercial product)
-) Ice productions (few commercial product)

c) Lightening system: - in 1970's, small lightening system is 1st widespread application ion PV in developing countries. In term of number of installation, lighting is the presently the biggest application of PV wit 10's to 1000's of units installed worldwide and the number is still increasing. They are mainly used to provide lightening for domestic or community building, such as school or heath centers in remote areas. PV lightening is also being increasingly used for security, street and tunnel lightening.

When compare with the traditional lighting equipments currently used by many millions in the rural areas of the developing countries, namely candle of kerosene lamp, PV lighting systems are efficient and provides good quality light with no pollution. They also present no fire risk and do not need constant attention or replacement to their fuel supply.

d) Battery charging system: - The huge demand for small quantities of electricity to small torches, radio, TV, and light on developing countries. This is apparent from the continuous transport of batteries from rural area to network (grid). Connected town the numerous shops offering a battery charging services and vast quantities of small "through-away" prime cells brought by rural peoples.

PV battery charging systems, charging either small rechargeable cells (e.g.-nickel cadmium battery) or slandered lead-acid automotive batteries, can provide an efficient and cost-effective alternative to the extraordinary wasteful procedures followed at present; several thousand are now use in worldwide.

e) Domestic home system: - Remote Area Power Supply (RAPS) / Solar Home System (SOS) are domestic home system which can be as small as a lightening system or large enough to power all the requirements of a grid- connected home. During 1980's the introduction of solid -state technology and energy efficient lamp lead to most cost-effective domestic PV- system and several tens of thousands have now been installed in remote area of developed and developing countries.

A typical system consists of a PV array with batteries, charge regular and various 12to 24v DC appliances for

-) Light
-) Television, radio and video-recorders
-) Fans and ventilation system
-) Evaporative coolers
-) Refrigerators
-) Circulation pump for solar water heating system &
-) Computer

e) Other Application for the PV

Industrial system	Agricultural system
Cathode protection Data acquisition (achievement) Ventilation Air-condition	Electrified fencing Livestock tracking system Drying system (Ventilation fan) Food processing grain grinding, maize shelling) Milk cooling Water tank ice preserve
Navigation lights	Consumer product
Street light Coastal light and buoys boat light Trivial avoidance lights (for air-craft) Hazard and directions beacons Railway crossing light	Battery charge for torches Watch, clocks Toys Radio, door bells Car, ventilation
Telecommunication System	Miscellaneous
Rural and emergency phones Transceivers Rural radio/ television Board casting system (i.e. mosque)	Water treatment Desalination plants Space heating or water heating/ Heat pump

2.7 Economic Overview: -

The economics of PV system are rather different to those of other small power system in that: -

-) The capital cost of equipment is high
-) There are no fuel cost
-) Maintenance cost are low
-) Reliability is high so replacement cost are low
-) The output of this system is depending on this location.

2.7.1 Cost Benefits: -

Among the various benefits the social and environmental benefit should be taken account. These might include lives that have been saved by providing more refrigerated

vaccines fewer illnesses due to the fresh water supply, better eyesight because of more effective lighting, less environmental waste by encouraging rechargeable batteries and so on.

This is the improvement in cost and performance associated with increased production that has been given raise to expectations that large markets will developed as cost fall (or conversely that cost will fall as large market are developed) most past forecasts on the PV market and modulo cost have now been proved to have been significantly optimistic as a reduce of cost reduction goal falling to be raised and the market proving to be less sensitive to price than expectation.

Solar PV power: - The economics of PV system

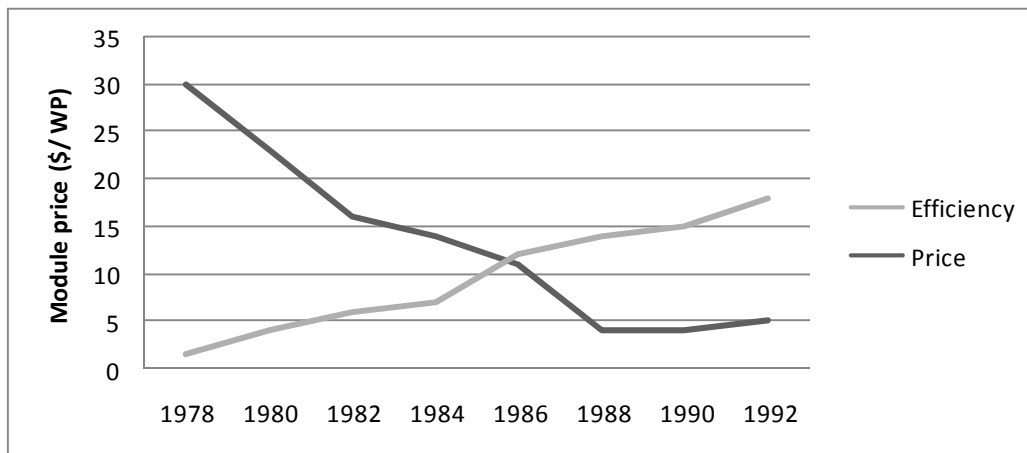


Fig 2.2: - price and efficiency of crystalline PV modules (wp- Watt Peak)

2.8 Terminology:-

-) The life cycle cost – the sum if all costs of the system over its life times, expressed in present money.
-) Payback period- the time is taken the total cost to be paid for by the monetary profit and other benefits of the system.
-) Rate of return – the magnitude of profit and benefit expressed as a % of annual return of the initial investments.
-) Units – PV modules are related in units of peak watts, which is their performance in peak sunshine of $1000\text{w}/\text{m}^2$. Hence a modulo related to a 50 wp (peak watt) will generate 50watt electricity in brightest sunshine.

2.9 Cost Structure of PV System: -

-) The cost of PV system fall in to three broad categories
-) PV modulo
-) Component required to physical area of the PV- array and
-) Component related to power output of the PV array

Casualties of PV modules are so expensive

Raw silicon it selves is relatively so expensive, costing about \$10 per Kg for low grade stock and accounting for \$0.3 to 0.4 per wp of total modulo cost. The manufacture of PV modulo using crystalline silicon occurs in five stages-

-) Casting the raw materials in to silicon ingots.
-) Silicon ingot into wafers.
-) Fabricating cells from the wafers.
-) Encapsulating the cells beneath weather resistant material.
-) Assembling the frame of module and testing its performance.

Solar crystalline module production cost (in U.S. \$ / wp)	
Silicon wafer	2.23
Other material	1.14
Direct Labour	0.51
Overhead	0.55
Total cost	4.43
Crystalline module production cost (average from 5PV manufactures) in &/wp	
Silicon feedstock	0.32
Crystalline	0.62
Wafering	0.63
Cell fabrication	0.83
Module fabrication	1.04
Total cost	3.44

Thin Film Modules

Average thin film module production cost (5% efficiency) in U.S. \$/wp	
Plate	0.58
Module	1.04
Labour/ overhead	0.81
Total cost	2.43

2.10 Balance of System (BOS) Components

Typical BOS cost in the range of \$4 to 6 / wp as much again as the modules themselves. The majority of this costs can be contributed to-

-) Power conditioning units and inverter
-) Wiring and power cables
-) Support structure

-) Load equipments
But also includes
-) Land rent (or purchase) and site programs
-) System designs
-) Installation
-) Overhead and indirect cost
-) Operations

2.11 Prospective of Cost reduction: -

PV module constitute 50 – 60 % of the cost of PV power supply system, hence on most work on cost reduction system has focus on the modules themselves. It is important to note however that if efficiency of the load equipment is increased, the size power of the corresponding reduce the cost of the PV array is correspondingly reduced. The cost of the module per weak watt can be reducing both by reducing the cost of its manufacture and by increasing the efficiency of energy consumption.

Four basic strategic are being pursued for reducing the cost of PV module: -

- Increasing the efficiency of PV cells
- Improving existing production technology for crystalline silicon module
- Developing mass production method for manufacturing thin-film modules
- Researching entirely new production concept.

Chapter 3

Methodology

A set of methods employed to accomplish the research objectives thus the research methodology has been discussed in this section. More specifically, it contains study area, source and nature of data, research design, size and section of samples, data collection instruments, methods of data analysis and interpretations. Relevant information on the basic of proposed objectives has been collected using a combination of tools and techniques.

3.1 Rationale of the Section of Study Area

This research work has been done in ward no. 1 of Malayngkot VDC of Syangja district. The VDC is situated in eastern-northern part of the Syangja; on average 60km far from the district head quarter, Putalibazaar, western region of Nepal. Purposively the area was selected for the research topic “*A Study on Application of SPVS*”. The researcher is familiar to that area that would be easier to acquire reliable data and, being a student, would be suitable from time and financial aspect.

Ward no. 1 is the main centre area among wards of the Malayng-kot VDC and people are more educated and aware than other ward in comparisons. Most of the house hold has their monthly income sources e.g. services, business and other income generating functions at their own places few of them are working aboard. Some local NGO’s are also functioning at their own places. But still satisfactory result could not achieved in many common development campaign. People are facing same major challenges as in Nepal, i.e. energy problem. This also was stressing a major challenge for the development worker of this area. So the above justifications were the main reasons for selecting the study area.

3.2 Source and Nature of Data

The study was primarily based on primary data collection from fieldwork. Secondary data are collected from various published as well as unpublished report and relevant sources like District Development Committee, Central Bureau of Statistic, and other relevant offices. The combination of primary and secondary data helps to provide a clear picture of objectives of this study. The local people are the main sources for the primary data. Key informants from the study area and others knowledgeable persons have met for more information. Local development workers social workers as well as the staff of the local NGO’s have also been consulted for required information. Data from other sources including the extensive literature review of past works and published materials are considered with due attention. To accomplish the study, preference has been given to both quantities as well as quantities data.

3.3 Research Design

The main objective of present research is to identify the energy problem and identify the solution through solar system. So an exploratory as well as descriptive research design has been employed. The analysis of the study has been presented descriptively. With the hope this design, socioeconomic condition of respondents, situation of energy consumption, resources potentiality and challenges of for utilization of solar PV system has been descriptive and analytic. In the area of Malayang-kot VDC-1, observation, detailed household surveys and interview with the local people, informal chat with the key information and development works has been conducted.

3.4 Sampling Procedure

Sample plays a have significant role in any research. It is understood as the section of some part of aggregate or in totally on the basis of which a judgment or inference about the aggregate or totality is same (Kothri, 1994:112). Samples were taken in the following way for conducting the research work.

- 30 households have been selected randomly for the interview out of the total households of Malayang-kot VDC-1. All the house hold members, education, age and occupational situation were asked but in other respects, only informants of the households were asked.
- Key informants, development workers, social workers, and other knowledgeable personalities were contacted for informal discussion. The key information was collected with the queries of more or less similar to household questionnaire so as to regulate the information generated from household survey.
- Verified the data collected from the different persons and found matching as integrated.

3.5 Data Collection Procedure

The present study is based up on the household surveys, local group discussions and observation the key informants visits.

3.5.1 Primary Data Collection Procedure:-

To obtain the data reliability and minimize the biasness primary data was collected with the help of household survey, Focus group discussion, observation methods and key information system was also applied to obtain real situation

Household Survey:-

Data like socio-economic information such as sex, education; attitude towards combine efforts in common problems has been collected from the house-hold surveys. One key person has from each household has been asked for the required information. The bases

of the selecting respondents are as follows: Head of household, Senior in age, permanent residents, easier to respond more easily etc.

Focus Group Discussions

The kind of problems and challenges could not be successfully measurable by using single methods. Thus, the data on problems have been considered from the focus group discussion with the local people. The discussions were focused on following aspect.

- Types of energy resource viable for local area.
- Level of energy demand and people respond on available sources.
- Knowledge on utilization of energy as a income generating and human empowering function.
- So the following questions have been solved from the group discussion;
- Who need energy?
- Why energy is needed?
- Is it essential to increase the quality of life?

Observation

Observation is the most important instrument of data collection during the field work. In a social research, this method also plays vital roles. During the field work, observation has been conducted in the study area of Malayang-kot VDC-1 concerning with the research objective. Close observation with the local peoples energy utilization, peoples responsibility to protect energy sources, home sanitation, people feeling on consuming of high energy through solar system and their attitude towards another form of energy sources such as hydro- electricity provide by NEA or Butwal Power Company were closely observed.

Key Informant survey

Key informants are the key for getting valuable information about the real situation for the energy accessibility. A researcher can get more and more information with the help of key informants. Realizing that fact, key information survey has also been conducted. Following typical key informants are considered to add the necessary and sufficient condition of study that was:-

- Development workers of the development organization, who at least has resided since 3 years.
- VDC secretary/VDC chairperson.
- Local teachers. &Leading persons of the village

3.5.2 Secondary Data Collection:-

Researcher aim can not full fill from the data collected from the primary, thus to obtain the valuable data for the research purpose researcher consult different published or unpublished data had also been taken account.

3.6 Methods of Data Analysis and Interpretation

The data collected from the field and the other sources have been descriptively analyzed. The study is based on the quantitative and qualitative data generated through field visit, such as key informant interviews, household surveys, focus group discussions and observation. There after data has been comprehensively scrutinized for its relevancy. Simple statistical tools such as numbers and percentage have been applied for the analysis of gathered data. Raw data has been edited 1st in contrast with the secondary data. By comparisons, data error has been eliminated. At last, the data has been code and classified into descriptive and numerical characters and after computing the qualitative and quantitative data, meaningful conclusion have been derived. Thus interpretation has been furnished in the textual form.

Chapter 4

General Information of the Study Area

4.1 Malayngkot VDC

The Syangja district described as one of well educated district among 75 district here researcher would like to give some key information about Malayngkot VDCs information as comparison to Syangja district.

Table 4.1: Overall View of Malayankot VDC on Compare to Syangja District

Indicators	Rank	Data value for District	Data value for Malyangkot VDC
Overall composition	9		
Access to improve source of drinking water (percentage)	37	81.9	90
Access to toilet facility (percentage)	15	61.7	50
Proportion of household having electricity facility (percentage)	10	53.7	10
Proportion of household using solid fuel for cooking (percentage)	16	72.2	80
Proportion of household having radio facility (percentage)	5	74.1	75
Telephone lines per thousand populations (number)	39	1.62	4
Road Density (length/ sq. km. area)	25	0.18079	0.0
Singulated mean age at marriage female (Years)	23	20.1	22
Child dependency ratio (percentage)	57	80.3	85
Incident of diarrhea per 1000 children<5 years	27	152	100
Proportions of mal nutrition children under 3 years (1000)	18	12	10
Reported death per 1000	31	4.92	5
Primary school net enrollment ratio (percentage)	18	93.4	95
Ratio to girls to boy in primary education (percentage)	7	98.5	99
Student teacher ratio in secondary education (percentage)	38	27.4	25
Literacy rate of population 15-24 years (percentage)	1	91.3	97
Ratio of Literality female to literate male 15-24 years (percentage)	4	92.3	93
Share of women in wage employment in non-agro sectors (percentage)	14	18.9	25
Employments of populations of working age ratio (percentage)	36	72	65
Proportions of children's 10-14 who are working (percentage)	11	5.8	10
Proportion of urban populations (percentage)	16	15.8	8
Percentage of share of women in non agro occupations	1	33.4	5
Per capita development Budget Expenditure (in rupees)	55	582	-
Per capita regular Budget Expenditure (in rupees)	42	983	-
Forest User Household (percentage)	32	54.46	100
Health Institution Density (per 1000)	18	3.54	-
Irrigated Area (percentage)	40	14.3	-
Farm Size (Ha/house)	58	0.46	-
Contraceptive Prevalence Rate (percentage)	46	27.37	-
Per capita food production (kilo Calories)	25	3640	2500
Educationally dis-advantaged Population (percentage)	4	0.01	0.0
Marginal Farm Households (percentage)	59	46.81	25

Source: - District profile of Nepal – 2007/2008 & VDC of Malyankot, 2008.

The above table forecast the more or less information about the study area and the Syangja district.

Table 4.2: - Topographic Distribution of land in VDC of Malyankot

(Area in Ha.)

Physical Condition	Agricultural		Pasture	Forest	Others	Total
	Cultivated	Non-cultivated				
Mid-mountain	598.7	354	163	503	27	1645

Source: - VDC of Malyankot, 2008

Table 4.3: -Demographic Trends of Malyankot VDC in a General Record

Particulars	2001 Census	Present Projection
Total population	5969	6303
Male	2651	2799
Female	3318	3503
Sex ratio	80	80
Total households	1154	1284
Average household Size	5.17	4
Literacy Rate in %		55.5
Population Density per Sq. Km.	270	285

Source of data: - Malyankot VDC, 2008

4.2 Climatic Record of Syangja District

Latitude: - 28°06'N Longitude: - 83°53'E (elevation: 0868) (2005)

Maximum Temperature 31.6°C Minimum Temperature 6°C

Rain fall (average in a year) 187.47 mm

Average Annual Relative Humidity: - Maximum 98.7 and minimum 8.45

4.3 Infrastructure and social services of Study Area (Malyankot VDC)

Though few of private and governmental office are providing to services to local people but these are insufficient because of lack of road and communication, even though the official person claim themselves are providing better services but limited class room with unsafe building of school and secretion of medicine and agro requirements on school and agro sub centre reflects the poor services.

Some remarkable social development and updated infrastructure situation of the VDC is mentioned as follows in table.

Table 4.4: - Infrastructures of the Malyankot VDC

S.N.	Descriptions	Quantity
1	Primary Schools	2
2	Secondary School	1
3	Agricultural sub center	1
4	Veterinary Service	1
5	Sub health post	1
6	Non- governmental pitch road	-
7	Micro-hydro plant	-
8	Suspension Bridge	1
9	Non-governmental Organization	5
10	Library	1

Source: - VDC Office, 2008

The religious and ethnical distribution of population in Malyankot VDC is not much diverse though Brahmin and Chhetry may count the dominant over Magar and Gurung. Beside the Brahmin, Chhetry, Magar, Gurung, there are also significantly present of Damahi, Sarki, Sunar, Newar and Thakuri too.

The demographical study of Malyankot VDC shows the majority of Hindus Vedic traditions of VDC but we may find Buddhist as a minority present, though researcher found the there is no any religious and ethnical segregation between people to people in a theoretical view.

Table 4.5: - Educational Status of the VDC People

Level	No. of Population		Total	Percentage
	Male	Female		
Illiterate	982	1,822	2,804	44.5
Under SLC	1365	735	2099	33.3
SLC	500	200	700	11.1
Under Graduate	200	125	325	5.15
Graduate	150	100	250	4
Post Graduate	50	15	125	2
Total	2,799	3,503	6,303	100

Source: - VDC office, 2008.

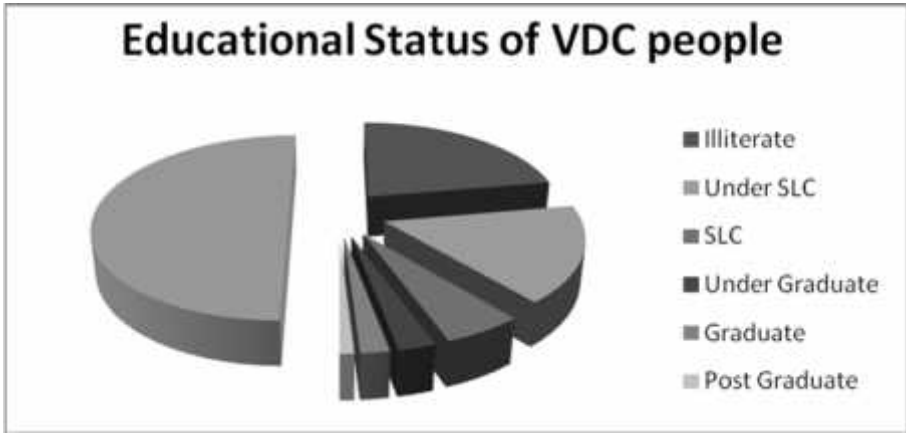


Fig 4.1: - Educational Status of the VDC People

The educational scenario of local resident on Malyankot VDC reflect through the data obtained from VDC record that the 55.5% people are literate means this VDC is ongoing towards the progressive on education. Most of school age children are getting education on their VDC as well few of students are taking education outside of VDC this also indicates the people’s realization the signification role of education on human progress that wise we may quite hope full for the social reform and human development on this VDC within a few years.

Chapter – 5

INTERPRETATION AND ANALYSIS OF DATA

This chapter is based on analysis and data generation through questionnaire, observations, discussion and personal study of the consumers were done. The data taken from field visit are presented in tabular forms and they are analyzed in different point of view in order to find the objectivity of project work. Since all field visits were done on rural area thus the study and interpretation all are in rural based.

5.1 Structure of Sampled Population

Here the structure of population means the spatial distribution of population on study area through which researcher may obtain the actual distribution of population accordingly to cast, age, education, profession, economic conditions, ethnicity, family size, and etc.

The study mainly focused on the solar home system because most of Nepalese women's are spending their most of time to collect fire wood. Similarly most of rural women's are also suffering from chronic effect on their lung even though they are not smoking and rural environment is also healthy. On the name of energy collection and suffering such chronic diseases the economic status of rural life also lay down, that wise to enhance the rural economic, researcher realized without overcoming the issue of energy problem and application methods of energy the rural economic development could not be achieved.

While study on field, researcher equally given the emphasis on women, low income family, local indigenous people including both literature and ill-literature. No one can imagine the goal of development could be success without education there for to provide better education for our children light is also play vital role. Consequently the prosperity of the country and community will be easier to achieve. Realizing this importance of education among the rural people of Nepal, researcher collected the information regarding the education status of the study population which is expressed as follows.

5.2 Respondents by Caste/ Ethnicity

Caste segregation system on Vedic society is considered one of major headache situation. Brahmin ,Cheetry, Baishya and Chuddra s' are considered as the major composition of Vedic cultural. With in there four segregation Brahmin are considered as a Head of the society, Cheetry take the position beyond the Brahmin but they have on position of Shoulder (arm) of the society, the function of Baiyshe defined as the merchants

and farmers similarly Chuddra on cast system take as a lower cast on society, because of this the development of Chuddra on Vedic society is in the poorest condition.

Table 5.1: - Caste Distribution of Study Area

S.N.	Cast	Nos. of household	Percentage
1	Brahmin	8	30.77
2	Chetry	6	23.08
3	Baishya	9	34.61
4	Chuddra	3	11.54
Total		26	100.00

Source: - Field study, 2008

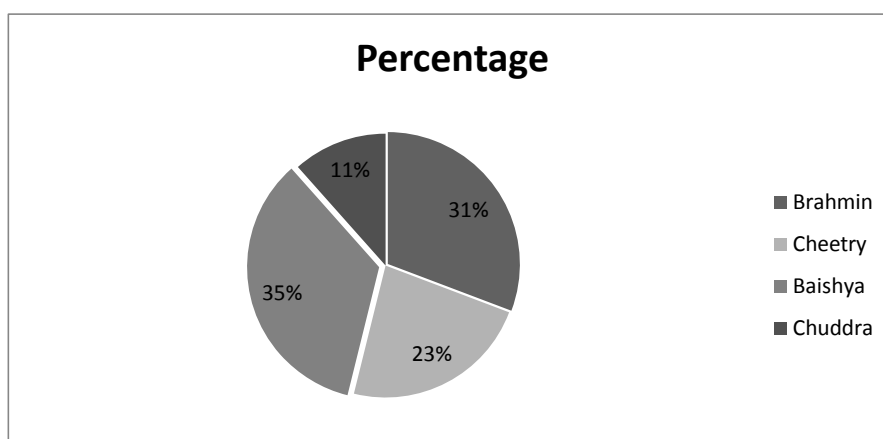


Fig5.1: - Caste Distribution of Study Area

It can be seen from above table the population of Brahmin are nearly about 31% where as Chetry in 23%, Similarly Baishya are not in a minimum position they are also about 35% and rest of 11.5% are Chudra. This indicates that all four different types of cast are accounting as respondents on study area.

Even though the segregation system makes Brahmin in the position of higher rank but for the prosperity of technological utilization Baishya becomes the 1st position, it is because most of indigenous people of Nepal working on British Army and Singapore Police similarly they are also involve on remittance activities on working foreign country.

5.3 Educational Distribution of Respondent

Each and every respondent have variety in educational status. So, family education in any house-hold holds the key information of the awareness towards life supporting factors. We could hear a proverb in some uneducated families that “what is the role of

education we should hard work for food”. But in case of educated family the using of new-technology always takes 1st credit, so far as energy consumption educated family wants pursuit their life on technological way which makes their life cozy and confirmative.

Table 5.2: - Distribution of Respondent by Educational Status.

Education	No. of population				Total (Male+Female)	Percentage
	Male	Percentage	Female	Percentage		
Ill-literature	8	42.1	4	57.14	12	46.15
Under SLC	6	31.35	2	28.57	8	30.76
Under Graduate	3	15.8	1	14.28	4	15.40
Graduated	1	5.26	-		1	3.9
Post Graduate	1	5.26	-		1	3.9
Total	19	100	7	100	26	100.00

Source: - Field study, 2008

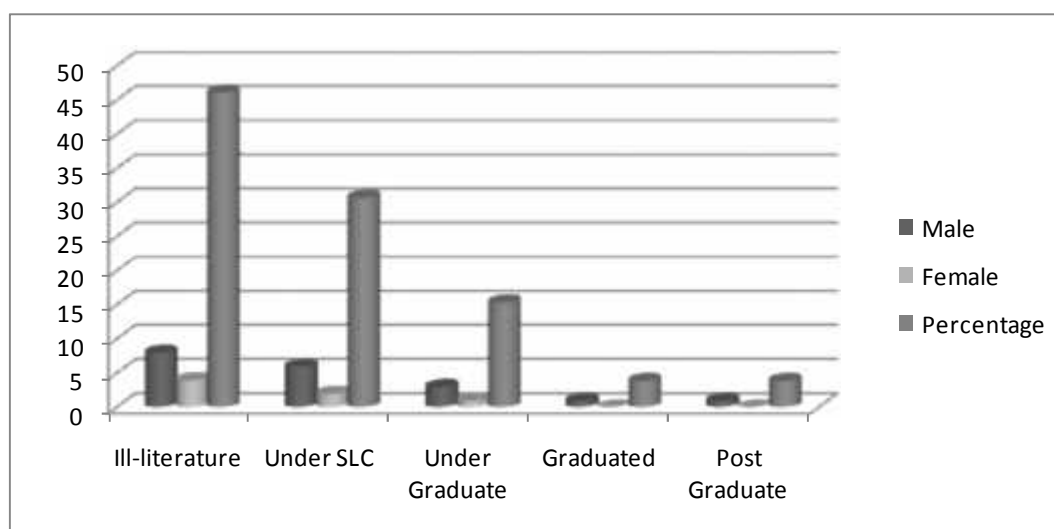


Fig 5.2: - Distribution of Study Population by Educational Status

It can be seen from above table that the female educational status is relatively lower than that of male. Out of 26 respondents only 14 are literate but population of educated female respondents is only 3. There were no female respondents having graduated and post- graduate education. The researcher found 46.15 % of population is ill-literature among of them 33.33 female are present while only 27% women carry the total respondent under study. Beside this 30.76 respondents are simple literature it means they are under

SLC. But some hope full and significant results based on there are 23.2% of populations are SLC passed and among of them 11.54% population is carried-out by female population.

5.4 Family Size of Sample Population

The researcher considered the sample population under the field study where all respondents equally take participated under studied period. On that time they filled up the family size as required to researcher. The rate of energy consumption depends up the equipments used by household. We simply argue on the fact that those persons who have high economic can use more energy rather than poor person but sometimes the family sizes also affect the energy patter of utilization. We simply take an example that if a house contains large family size, in that kitchen s/he must cook more food, there may have numbers of school students in this way the rate of energy consumption must increase.

Table 5.3: - Distribution of Household by Family Size

Family size in Number	No. of House Holds	Percentage
1 – 4 members	2	7.7
5- 7 members	13	50
8 – 10 members	9	34.6
10 + Members	2	7.7
Total	26	100.00

Source: - Field survey, 2008

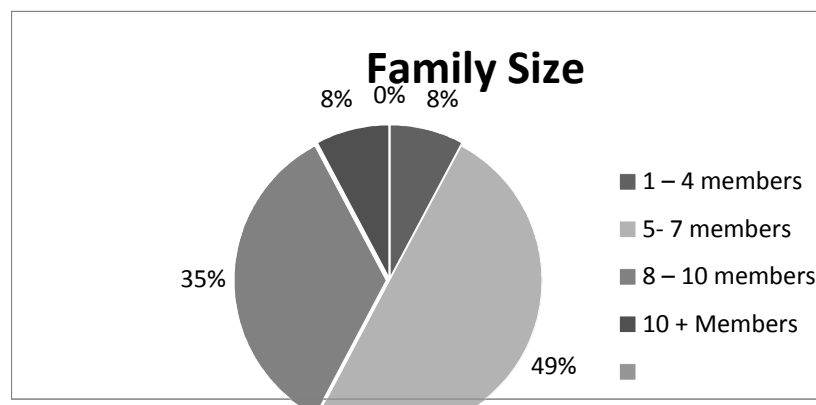


Fig 5.3: - Family Size of Respondent in form of Chat

5.5 Occupation of the Respondent

Occupation play a vital role in the technology installation and the informal utilization of any new trends of technology depends up on the occupation. In a general view is found that, those persons who are in the Singapore police and British Army are mostly preferring the installation of Solar Home Photovoltaic Sistem.those persons who involving on service or trasde are more o\inclined to education than other occupation class because they are well knewn the importasnt of education and are more aware as well. The followig table indicates the number of house holds by occupation.

Table 5.4: - Distribution of House-holds by Occupation

Occupation	No. of HHs	Percentage
Only Agriculture	15	57.7
Agriculture and Service	6	23.1
Business	2	7.7
Service	3	11.5
Total	26	100.00

Source: - Field Survey; 2008

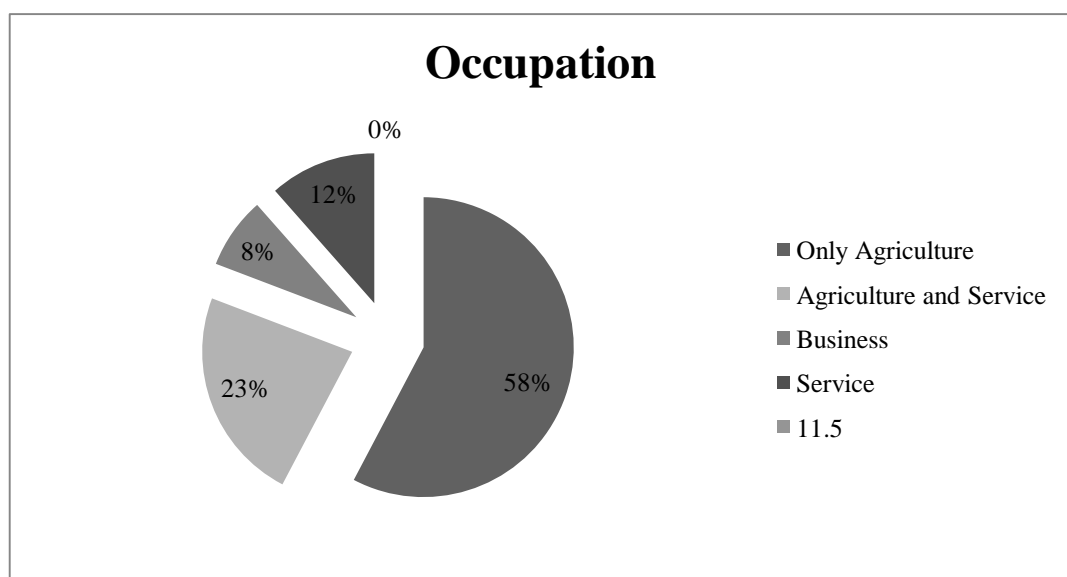


Fig 5.4: - Occupational Status of the respondents

From the field survey it is found that there is a majority of farmer, 57.7% of respondents are involving on agricultural activities, on other aspect there are 23.1 5 of population involving on both agriculture and service, the most power full and strong identification of income generating activities holding on our society is business there are

7.7% respondents are engaging on this sectors. There the researcher found that 11.5% service holders who are in private and public enterprises. Most of service holders are in the field of teacher and Nepal Army.

5.6 Annual Income and Source of Income

Prosperity of the house-hold depends upon the source of income and its extent. Higher the income better will be the household status. The annual income of most Nepalese people based on the agro product. The economic based upon the agro product which can't be considered as the sustainable because Nepalese agriculture based upon the monsoon movement. If the monsoon occurs in a time, the annual crop production of Nepal also good otherwise loose. The power purchasing capacity also depends up the income of family. The efficacy of the Solar PV system is based up on the capacity of solar panel and power load system.

Table 5.5: - Source Income Distribution of House-hold

Source	No. of House-holds	Percentage
Service Pension	3	8
Teaching	3	8
Service	3	8
Remittance	5	13.5
Agriculture	26	70.30
Business	2	5.40

Source: - - Field study, 2008

The data presented on above table shows that the majority of house-hold depends up on the agriculture (70.30%) as a main source on annual income, similarly 8% of household depends correspondingly upon service pension, teaching and service as a same way 13.5 5 if house income based on remittance, and more over 5.4% of house source of income is business.

5.7 Income Distribution among Respondents

Although the income distribution of agrarians' society based up the agro-product but in some aspect people profession on different field also a casual factor of public income sources. Here, even most of people live on traditional life style but few of them are deferent way of life, the causal cofactor comes to play here is annual income. The

distributions on annual income of the family not merely stress to pursuit onward technological life but it enforces human being to make cozy and different life style which makes different than their villagers.

Table 5.6: - Distribution of Family Annual Income of Respondents: -

S.N	Annual income in Rs.	No. of Family	Percentage
1	50,000.00	3	11.54
2	50,000.00 - 75,000.00	6	23.08
3	75,000.00 - 1,00,000.00	6	23.08
4	1,00,000.00 - 1,25,000.00	4	15.40
5	More than 1,25,000.00	7	26.90
6	Total	26	100.00

Source: - - Field study, 2008

The above presentation shows that the significant proportion of SHS installed oh that house whose annual income crosses more than Rs. 1, 00,000.00 per annum. There are 11.54% of respondents having solar PV system have annual income about Rs. 50,000.00, similarly 23.04% of population lies correspondingly to the annum income more than Rs. 75,000.00 and 15.40% of population having annum income more than Rs. 1,00,000.00 . There are only 26.90% of population who are considered as the majority income group carrier, are taking benefits from solar home appliance system, those annual income cross over more than Rs. 1,25,000.00.

5.8 Energy Use Trends

People using energy since the origin of human life, this consequence pattern of energy using will hold up to endless generation of human life. The main purpose of energy use is for sustain life. For making life sustain as per as possibility people must pursuit themselves in a technological world. It is impossible to achieve the technological life without getting sufficient amount of energy. On a name of energy consumption no one has authority to disturbed our healthy environment. Human are utilizing the energy to their ever part of life by knowingly or unknowingly. People are using solar energy, wind energy since their evolution on later they know the uses of fire soon and latter they invent other form of energy and its sources too. The present people taking petroleum, gas, coal as major form of energy even though they are not satisfied it environmental impact. Here we have some options for using pattern of energy for rural life.

Table 5.7: - Application of Energy for Home Appliance

Energy Types	Purpose	Source	Duration hour per day	Estimated budget
Solar PV System	For cooking , lightening, Listening radio & watching TV	Sun	5 -hour	15000 to 35000 At a time of plantation than few amount maintaining cost per month.
Petroleum	Travelling and lightening	Nepal Oil Corporation	Some times	Rs 150 per month for lightening.
Wind	To drying Clothes, separation of dust particles from agro-product	Naturally or wind blow	Whenever required	Free of cost
Fire-wood	For cooking, heating home	Jungle and agro-residual	4-hour	RS. 500 per month
Bio-mass	Lightening and cooking	Cow Dung	4 - hour	20,000 to 30,000 At a time of plantation than few amount maintaining cost per month.

Source: - Field study, 2008

Table 5.7: - Distribution of Solar PV System uses Household According to Application

Purpose	No. of Household	Percentage
Lightening	26	50
Listening radio	24	44.44
Watching television	4	7.4
Total	54	100.00

Source: - Field study, 2008

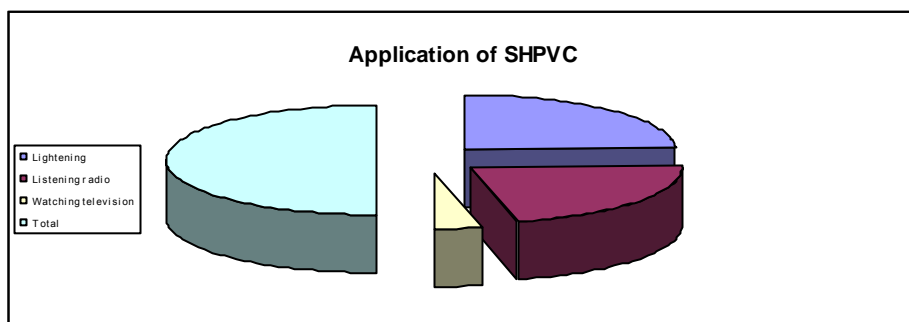


Fig 5.5: - Distribution of Solar PV System

It is concluded from above table which was driven directly from the user's that Malyankot VDC of wade no 1 has great success in energy using pattern. People's slowly realizing the importance of the role of solar energy, they also knew the importance of solar system will increase their life stander among their colleges. People not only use solar energy for light, warming, cloth drying but they are using this for making pickle, Gundruk and taking sun bath during winter season 3 hour per day. The more significant role played by the installation of solar photovoltaic System on Home carried on lighten purpose i.e. about 50% of households similarly, for listening radio people used 44.44 of house hold and rest 704% carry television watching. The utilization of solar energy indicated that people are aware slowly and gradually the importance of solar PV technology.

5.9. Economic Benefit through Solar PV system

Whenever the utilization of technology doesn't give advantage to user it becomes meaning fullness. As per concerning the polar system we must take economic point of view because the all kinds of materials uses on solar system should import from foreign country with paying in terms of U.S.\$.. It takes huge amount of money at the time of installation (minimum cost of installation of a solar PV system carry N.Rs. 20,000.00 which have efficiency to lightening three 20 watt bulb for 7 hours). On the basis of respondent view the economic benefit of solar PV system listen below in term of energy evaluating on monetary view as: -

Table 5.8: - Showing the Annual Economic Shaving by SHS

S.N.	Particular	Annual saving in Rs.
1	Lightening	2,500.00
2	Listening radio	600.00
3	Watching Television	4,800.00

Source: - Field study, 2008

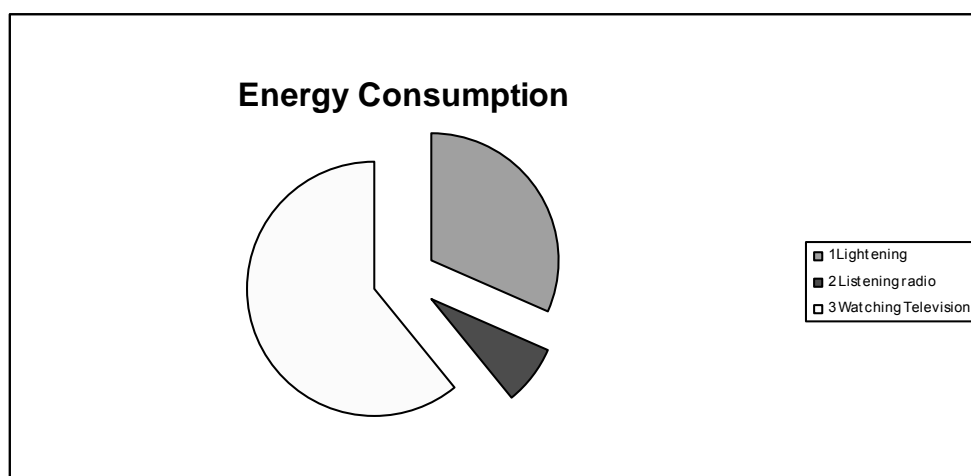


Fig 5.6: - Showing the Annual Economic Shaving by SHS

On analyzing the above table we may come on conclusion that, even the installation charge of the solar PV system is much higher but the annual saving of energy cost per annual consumption makes over comes the overall costing effect of installation. The installation charge to install the Solar Home Photovoltaic System to operate five 25 watt cfl electric bulbs, a color Television, radio and telephone, its take about Rs.35, 000.00 of cost, but one can get success to achieve about 8,000.00 per annual energy facility (cost calculation based upon present market price, 2008, July).

Here we conclude from above information that if one may use solar PV system as power consuming and economic generating function it gives significant solution towards economic development.

Table 5.9: - Respondents give their Respond on few objective questions

S.N.	Question	Answer	No.
1	What is the status of sun on your religion?	I take it as our god and pray regularly.	26
2	Do you found any advantage through sun?	It changes my life pattern.	26
3	What is your position in your society after using solar PV system?	Through it I got my social stander higher than before.	26

Source: - Field study, 2008

The researcher also aimed to find out the relation of technology using pattern changes on human social attitude. The researcher found that none of lower cast people want to isolate to take advantage of solar system. All solar PV system makes people feeling given new status on their society. They uniquely said that “since the utilization of Solar Home Photovoltaic system, it makes our life get new respectable position on our society”.

Here peoples give the positive response towards solar system, they also made unique voice on satisfaction of using solar PV system, they collectively said, even if NEA (Nepal Electricity Authority) provides sufficient amounts of energy we never want to isolate to take solar advantage through solar panel. They advice to all those who are not take any advantage please don't be isolate to take technological advantage of solar PV system it makes evolutionary change our life also. They also agree on common problem that government give huge substitution to kerosene which not only burrow our money to foreign country but also harmful effect our environment that's wise it is better to give more and more substitution on solar PV system which makes adverse effect on our daily life and pursued to our healthy environment.

5.10 Problems on Solar Photovoltaic System

Even solar system provides lot of positive attitude for human society through naturally or artificial way, It does not have any environmental Impact, people still do not able to utilize its benefits because of it high cost of installation. The households who are using the solar technological system getting constraints due to non viable of technician on the spot at the time of requirements similarly they do not have simple technological knowledge for solve normal problems associate SPS, Due to this they are paying high cost at a time of acid change and water change. The household using SHS must depend on technician for repair and malignance who is in 25 K.M. a part of their resident, and 2 and half hour journey by vehicle.

Chapter -6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary and Conclusion

Energy is vital for cooking and lightening. However, the rural people can't take equally benefit from the advanced technology. Not only the people of Nepal but also the rulers who are always stay on the policy making always ignoring the issue of development through technological way. The country lacks sufficient technocrats who can play vital role for development, we do not have sufficient amount of road facility for efficient transportation here we derive some example through Mr. Mahabir Singh Pune who give reportable significant result on Madghi District by using solar technology.

The issue of development not only a big issue for developing country but also the one of the major subject to developed world. Yes, here we come on that point, it quite easier to country those who are find the path of development can easterly achieve their goal but those country that are not identify their path till now how can they prolong their way. The primary issue on the present world is energy. The petroleum product of present world facing terrible condition, the price of crude petroleum is \$145 (23rd July 2008) reflect the scarcity of fuel on present world because petroleum, coal and Gas considered a major energy sources. To over-come its effect the alternative energy system must be identify. Solar may become tonic for solving this issue because, the amount of energy radiation from the sun is unimaginable large. Solar radiation is absorbed in the atmosphere and at the earth surface at a rate of around 1017 w. The global rate of energy consumption is around 1013w, so the sun provides 10,000 times more than energy then the world consumption.

The annual consumption rate of fuel increasing day by day but the reservation inside the geo-spherical surface is remain constant a study made by world conservation energy sources, 1998 , provides a kindly information about energy crises through it stamen any one can easily forecast the energy demand. If those people who must engage on economic sector are staying on a queue of 2 or 3 hour simple for energy how can one imaging the economic development of country and human too.

Here the peoples of Malayankot VDC of Syangja district also facing same problems since and now. They slowly are realizing the use of solar energy and its social benefits on their livelihood. Few of household on their initiate taking energy benefits through solar home system and few more have interest about it.

Since, the overall social setting of the community shows says that the cast majority on study area is Brahmin, where about 54% of populations are literate. The average family size of household shows a quite higher than that of normal Nepalese standard i.e. more than 5 members in a family and most of household depends up on agriculture for their

economic progression but the respondent who are involving on other activities rather than agriculture also found about equal numbers.

It is obvious that cooking, lightening, listening- radio, watching television, telephone using etc are becoming the primary needs for present people. On fulfill these households on Malayankot VDC of Syangja district are using solar home system. Respondents do have the feeling of stander higher than previous and it has also help to make positive effect on their social pride through electronic media.

Electricity (energy) play vital role in the economic development of a nation. Availability of electricity assists in over all developments, where as consumptions reflect the overall development of a nation. There for to make electric energy viable it is necessary to convert solar energy into electrical power, which will play an important role in the overall development of the country. And the increasing energy demand on present world conform that the future of petroleum, fire-wood and other non-renewable form of energy source laying down day by day but the solar system have not any dead line for ending.

Urban people are considered major energy consumer of energy supply where as minority population countries' population residents in rural areas. Many agro-industries, cottage industries and irrigations are focused on rural areas. Country's overall development depends up on the rural area; therefore regional development is possible only through the equitable consumption opportunity of electricity in rural urban areas.

We can consider a tonic which can provides the un-fulfillment demands energy for present crisis and future generations too. It is estimated that more than 30,000 standalone Solar home Photovoltaic System (SHPS-1280k wp) has been installed during the period of 1993 to march 2002. About 65% of these system were installed through the governmental subside program.

In near future more and more PV system will be used for various types of Services. There is a plan under consideration to install more solar home systems in area where national grid will not reached at the end of 10th five years plan. These facts indicate that time has come to play special attention for PV power systems for income activities.

The income generating activities may include: -

- Rural telecommunication activities
- Cordless Telephone system
- Photo-copy machines;
- Fax-machines
- Email services
- Mini-battery charging services
- Video Camera Batter Charging
- Television shows
- Repair of Radio Broadcasting Receivers/ Cassette Players
- Replacement of Flashlight Batteries
- Private health Clinic
- Shops along the highways
- Display board along major high-way
- Small scale cottage industries
- PNV power mills
- Water pumping

- Thanka painting
- Increasing in agricultural productions
- Income generation of SHS technology
- Adult education/Evening classes
- PV in agro-processing
- Reverse Migration

With regarding the all of above sub-sequential benefits, the researcher comes to conclude that on utilizing solar PV system on home makes significant positive effect on human development through social and economical prosperity.

6.1 Recommendation

Based on the finding of the study following recommendations are made: -

- a) Awareness programmes on SPVS and its applications be made to the rural people as of information in private and public institutions;
- b) A suitable authority be identified for the dissemination of PV power system and its applications;
- c) Based on regional experiences, possible income generating activity scheme be explored and identified and as of information among prospective entrepreneurs.
- d) Since SPVS provides clean energy and renewable, government must allow free of tax on the solar PV equipment.
- e) Users are facing technicians in case of minute problems; the technicians problems must be solved.
- f) Capacity building in energy management is viewed as a very important factor in promoting energy efficiency in all sectors of economy.
- g) Improving in energy efficiency, apart from many others benefits, would enhance the capacity of developing countries in particular to generate more growth nation product through better utilization of energy resources.

Last but not the least, people and government should play significant roles on achieving the goal of development however the roles differ from one another. For the utilization of solar energy through solar PV system, the main role of the government to make accessibility of the equipment provides sufficient amount of technocrats, making adjustable policy for interested private sectors and making subsidy for SPVS. Through this people will not faced 10-hour load shedding per day for hydro-electricity consumption? As, we know it well, Most of Nepalese people who are utilizing the energy provided by Nepal Electric Authority should faced 4-hour load-shedding per week on on-session and 45-hour of load shedding on obsession. The uses of solar technology not only solve the energy problem but also it provides us CDM (Clean Development Mechanism) too.