Integrating Gender into Planning, Management and Implementation of Rural Energy Technologies:
The Perspectives of Women in Nepal

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ABSTRACT

Women in rural Nepal are heavily involved in management of energy resources particularly biomass, which constitute the main form of rural energy as is the case in most developing countries. Women's most time consuming activities in rural areas of Nepal are cooking, collecting firewood, and processing grain, all of which are directly associated with the rural energy system. Despite women's strategic interests in improved rural energy in Nepal, energy planners (normally male) rarely consider women's roles, needs, and priorities when planning any interventions on rural energy.

This study targeted at rural women in the mid hill region of Nepal, has examined the socio-economic implications of alternative energy technologies (AETs) especially in terms of saving women's labor and time and increasing opportunities for them to participate in social and economic activities. The analysis indicates that there is a positive implication of AETs on women's workload especially with access to the micro hydro mills available in the villages. In general, women have been able to save their labor and time in collecting firewood, and milling activities, although this is not always apparent due to women using the saved time for other household chores. However, AETs were rarely used for promoting end use activities (such as, energy based small cottage industries) in order to enhance women's socio-economic status. In addition, AETs had rather limited coverage and were not able to fulfill the energy demands of all rural households. There were also limitations in the adoption of such technologies mainly due to financial, technical, and social problems. For instance, the solar photovoltaic system and biogas plants were still costly for the poorest households even with subsidies. Consequently, socio-economic gaps within small communities widened and became highly visible with access to such technologies.

Women's participation was mainly in terms of their involvement in community organizations (COs) and representation in Village Energy Committees (VECs) rather than their active participation in planning and decision-making processes with regard to AETs. Nevertheless, women were actively involved in providing labor in construction work relating to AETs, and creating and mobilizing saving funds as a means to be involved in small income generating activities associated with AETs.

This study ultimately suggests a framework for increasing women's participation in rural energy plans and programs at local and national level, and develops policy measures to enable integration of gender into energy planning and policies. This would help to address practical and strategic gender needs in terms of fulfilling basic energy needs managed by women, and providing them with opportunities to be involved in some social and economic activities, which lead towards the self-enhancement of women.

***Key words*: Rural energy planning, practical and strategic gender needs, participation and empowerment.**

In memory of my grandmother "AMA"
Who always wanted to see me succeed,
You would be thrilled to see me now,
But, your spirit will continue in me forever!!

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Some of the research findings have been presented in three conferences and have benefited from the comments received. A paper on "Gendered Implications of Rural Energy Technologies: A Case Study of Nepal" was presented in 15^{th} NZASIA International Conference on *Asia: Images, Ideas, Identities*, 21-24 November 2003 held at New Zealand Asia Institute, the University of Auckland. Similarly a paper on "Rural Energy Technologies: Towards the Empowerment of Women, A Case Study of Kavre District Nepal" was presented in the 2^{nd} Biennial Conference of DEVNET, on *Contesting Development: Pathways to Better Practice*, 6^{th} -8^{th} December 2002 held at Massey University, New Zealand. Another paper on "Gender and Rural Energy Technologies: The Perspectives of Nepalese Women" was presented in an International Conference on: *Environment, Energy, Technology, Development and Society's Response*, 1-3^{rd} Dec. 2001 held at Banaras Hindu University, India.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
ADB/N	Agricultural Development Bank/Nepal
AEPC	Alternative Energy Promotion Center
AET	Alternative Energy Technology
AIT	Asian Institute of Technology, Bangkok
BSP	Biogas Support Program
CADC	Community Awareness Development Center
CBO	Community Based Organization
CEPRAD	Center for Environment and Agricultural Policy Research
CES	Center for Energy Studies
CO	Community Organization
CRT	Center for Rural Technology
DCS	Development and Consulting Services
DDC	District Development Committee
DEC	District Energy Committee
DANIDA	Danish International Development Agency
ESAP	Energy Sector Assistance Program
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
GAM	Gender Analysis Matrix
GAF	Gender Analysis Framework
GGC	Gobar Gas Company
GO	Government Organization
HH	Household
HMG/N	His Majesty Government of Nepal
ICS	Improved Cooking Stoves
INGO	International Non-Government Organization
ITDG	Intermediate Technology Development Group

ICIMOD	International Center for Integrated Mountain Development
LPG	Liquid Petroleum Gas
MOST	Ministry of Science and Technology
MOF	Ministry of Finance
NEA	Nepal Electricity Authority
NGO	Non-Government Organization
NPC	National Planning Commission
NRA	National Research Associates
PEP	Perspective Energy Plan
PPM	Project Planning Matrix
PRA	Participatory Rural Appraisal
REDP	Rural Energy Development Program
REPPON	Renewable Energy Perspective Plan of Nepal
RONAST	Royal Nepal Academy of Science and Technology
RRA	Rapid Rural Appraisal
SFDP	Small Farmers Development Program
SEI	Stockholm Environment Institute
SPSS	Statistical Package of Social Science
SPV	Solar Photovoltaic
SNV/N	Netherlands Development Organization of Nepal
UNDP	United Nation Development Program
UNICEF	United Nation's Children's Fund
VDC	Village Development Committee
VEC	Village Energy Committee
WECS	Water and Energy Commission Secretariat
WEC	World Energy Council
WHO	World Health Organization

Chapter One
Introduction

> If energy has a close relationship with poverty, it has an even closer and special relationship with the status of poor women because it is them who feel most acutely the scarcity of energy for a host of day-to-day energy needs.
>
> (Ramani, 2002: 8)

Rural energy has been an emerging issue throughout the third world, since the majority of the population living in rural areas depends on biomass resources for fulfilling household energy requirements. High use of biomass resources is not only a threat to forest environments but also a threat to household well-being due to an increase in human drudgery, especially for women. Use of biomass requires maximum use of women's time and energy, and causes high indoor air pollution, which affects children's and women's health especially as they spend more time indoors around stoves than men.

This is an important issue in Nepal, since more than 80 percent of the rural population relies on biomass for fulfilling their household energy demands. Women are primarily responsible for managing household energy requirements. For instance, in rural Nepal, women spend most of their time in collecting firewood, processing grain and cooking. Yet, any intervention in rural energy is primarily aimed at saving the use of firewood and increasing economic growth through rural electrification rather than at reducing human drudgery, especially that of women. This research sets out to study the implications of alternative energy technologies from a gender perspective in order to examine if such technologies have been helpful in saving women's time and labor and to recommend policy measures aimed at how to integrate gender into planning of rural energy technologies.

This first chapter provides some background introducing research problems, research objectives and questions, scope and limitations of the study and structure of thesis.

Background of the Study

The increasing demand for fuel and firewood as an energy resource in rural areas has affected the forest resources, threatening the beauty of the environment, contributing to atmospheric warming, flooding, desertification, and the drying up of water resources. Since the main source of rural energy is biomass fuels (firewood, agricultural residue, and animal dung), energy use has both environmental and development implications. Improved use of biomass resources will be essential for preserving the natural resource base on which agricultural productivity largely depends (Thapa, 1994). At the same time, saving human energy in managing energy resources, and improving health conditions by reducing domestic air pollution are prerequisites to increase the productive and reproductive capacities of women (Cecelski, 1995; Kartha and Larson, 2000; Reddy, Williams and Johanson, 1997). Higher quantities and qualities of energy are equally necessary for increasing living standards in the face of a rising population and for providing energy for economic development (FAO, 2000; World Bank, 1998a).

Rural energy is a central area, where women's roles and responsibilities regarding rural energy should not be underestimated, since they are directly involved in the consumption and management of energy resources. In fact, women become excellent managers of energy resources in order to survive (Batliwala and Reddy, 2003). This is because 'they pay an immediate price in terms of labor, if not money, if they are wasteful in energy use' (Batliwala, et al, 2003: 40). For instance, the growing scarcity of firewood and other biomass resources add hours to a woman's workday (WECS,1995a: 2). Women, being the primary managers of household energy in the rural areas, are worst effected in situations of fuel insufficiency and are the most impacted upon by rural energy programs (Neudoerffer, Malhotra, and Ramana, 2001: 373).

Since the interests and needs of men and women vary based on the different social construction, development projects have different implications for and impacts on men and women (Østergarrd, 1992; Skutsch, 1996). For instance, a water supply in a village fulfills women's demands for basic household water needs (such as for drinking, cleaning, and washing), while for village men, it may be for irrigating the farm. Hence, the projects that are designed for the benefit of a certain community must consider the different roles, interests, and needs of men and women, so as to ensure they address the interests of different groups, which contributes to long-term sustainability of the projects.

While considering the needs of men and women differently in planning any projects, it is worthwhile to consider their practical and strategic gender needs as defined by Molyneux (1985). Practical gender needs are the needs women identify in their socially accepted roles in society. They are practical in nature and often are concerned with inadequacies in living conditions such as water provision, health care, and employment (Molyneux, 1985:232). Strategic gender needs are the needs women identify because of their subordinate position to men in their society. They vary according to particular contexts. Meeting strategic gender needs helps women to achieve greater equality. It also changes existing roles and therefore challenges women's subordinate position (Molyneux, 1985:233). It is always reasonable to have a gendered approach in planning projects in order to ensure the full benefit of projects to both men and women and their families, and in order to draw on the expertise of both women and men.

The growing energy scarcity around the third world invites sustainable planning of energy resources, where women have an enormous role to contribute in terms of using their indigenous knowledge and skill in managing resources efficiently. Rural energy planning needs to address both practical and strategic gender needs recognizing the women's role in meeting basic household energy requirements and in meeting their economic needs. Apart from fulfilling daily energy requirements at the household level, rural women have a deep interest in having more time for social and economic activities and to have access to local employment opportunities, which fall under their strategic needs.

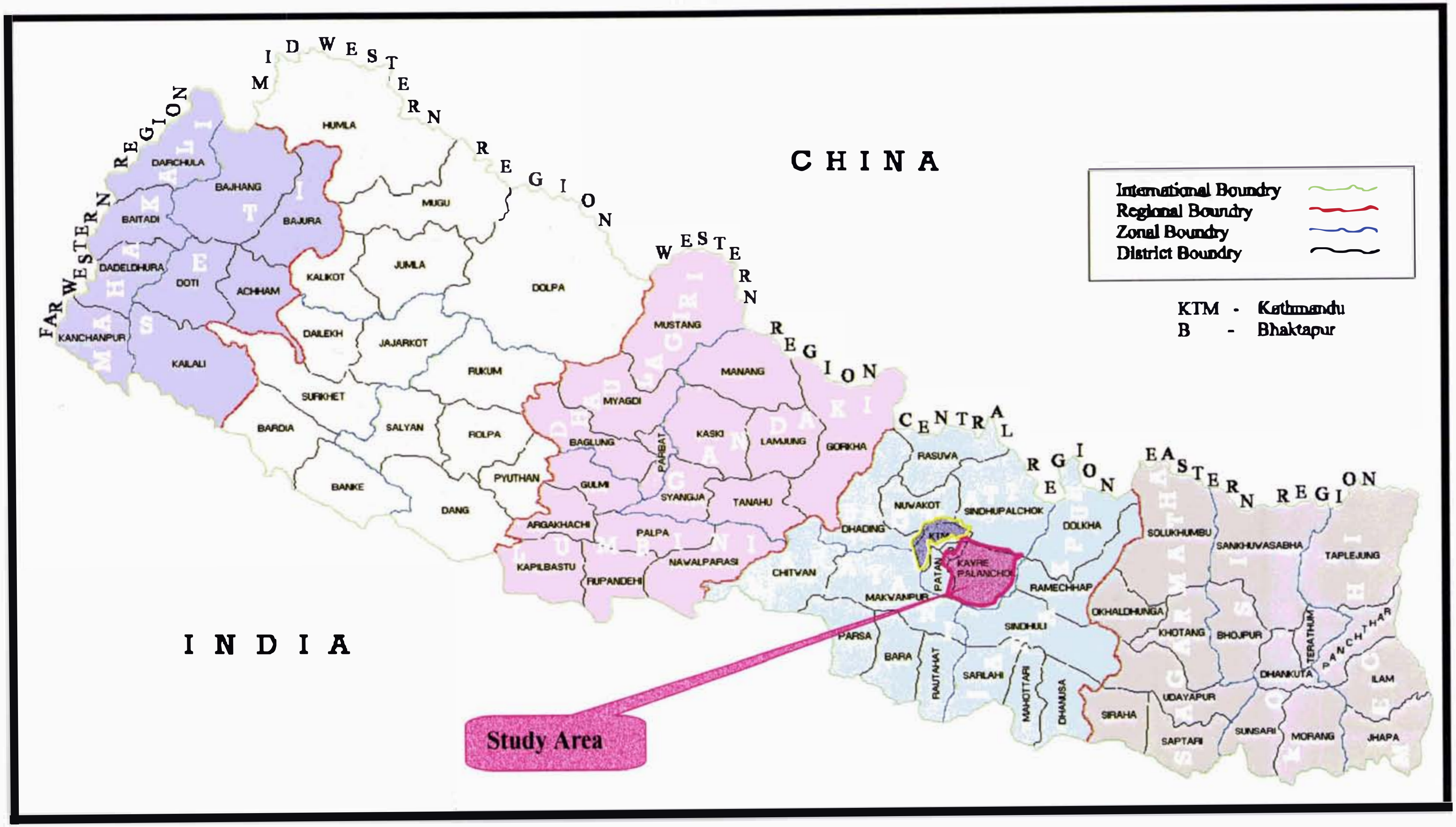
A gendered approach to rural energy planning is thus justified on the following four grounds. (a) energy needs at the household level are directly related to women's productive roles and responsibilities, (b) rural energy has an impact on women's health and drudgery, (c) rural energy projects have potential for increasing women's time to pursue social and economic activities and increasing employment opportunities for rural women, and, d) roles for women in management of energy projects can lead to a rise in their status. These factors can ultimately contribute to the sustainability of rural energy projects while simultaneously empowering rural women.

The Nepal Context

Nepal has a population of approximately 23 million with the majority of the population residing in the rural areas of the country occupying the terai (low land) and mid hill regions. The mountain region is sparsely populated and provides livelihood to 7.8 percent of the population. The terai and hill comprise 23 and 42 percent of the land area and provides livelihood to 47 and 46 percent of the population respectively (CBS, 1999). The hill region is located in the middle of mountain and terai regions. My research is located in the Kavre district, one of the mid hill region of Nepal (See Figure 1.1).

Women comprise of more than half of the population of Nepal, but lag behind in every socioeconomic, legal, and political sphere of life. Some of the general features that characterize the position of women in Nepal are; low literacy rate and limited access to education, low status in society, little time to be involved in income generating activities, and low access to productive resources (Acharya, 2001; Bhattachan, 2001). This is particularly the case for rural women.

Figure 1.1: Map of Nepal



Source: ncthakur.itgo.com

Nepal is a multi-cultural and multi-ethnic society and comprises of a range of castes and ethnicities[1]. Gender based differences are very common among all ethnic groups, however, the degree of disparity varies. Coinciding with the large geographic variation of the country, there exist considerable differences in traditions and the culture of the different ethnic communities on women's mobility, marriage options, and access to resources and social status (ADB, 1999). For instance, high caste Hindu *Brahmin/Chhetri* women face greater discrimination than Mongolian (*Gurung, Magar, Tamang, and Rai*) and low caste groups (*Damai, Kami, Sarki, and Tharu)* (Cameron, 1998; Sainju, 1996; Sattaur, 1996). Among high class families, women's mobility is very low and they have low access to decision making processes in household and community activities (Bhattachan, 2001). The low caste women are more involved in productive activities, and work as wage laborers on other's farms unlike the higher caste women who are more restricted to household activities. Thus while high caste women are protected within the patriarchic boundary, this is not the case with the low caste women (Bista, 1991; Cameron, 1998).

Irrespective of ethnic background, women perform almost all household chores including energy management such as cooking, and collecting firewood and water. However, the Buddhist women belonging to *Tamang/Rai*, and *Gurung/Magar*, may enjoy greater freedom in management and development of water and energy resources as compared to *Brahmin/Chhetri* women due to their higher degree of independence (Earth Consult, 1995).

Rural Energy Needs and Forms in Nepal

Nepal has very low per capita energy consumption as compared to other developing countries. In the year 1992/93, the per capita energy consumption was amounted to 14 Gijajoule (GJ) as compared to 43.2 GJ in China and 14.6 GJ in India (Rijal, 1999a).

[1] Caste and ethnicity are used interchangeably in this text, since people of different castes have different ethnic origins. For instance, Brahmin/Chhetri belongs to Indo Aryan group, while Gurung/ Magar and Tamang/Rai also known as "Matwali" (liquor drinking group) belong to the Tibeto Burman group and the low caste group (Kami, Sarki, and Damai) represent the ethnic minority.

Traditional energy forms predominate in the energy sector in Nepal. The use of traditional fuels (primarily firewood) in Nepal ranges between 70 and 95 percent, while in China it is less than 25 percent and in Bangladesh, India and Pakistan it lies between 50 and 60 percent (Rijal, 1998a:1). In the year 1998/99, traditional biomass resources met 88 percent of the total energy consumption (260milion GJ) in Nepal, among which firewood had a major share (Table 1.1). The rest come from commercial sources such as petroleum products, coal and electricity (CES, 2000). Electricity shares only 1 percent of the total energy consumption.

Table 1.1: Rural Energy Situation in Nepal

Types of Fuel Used	% of Energy Consumed
Firewood	78 %
Agricultural by Product	4 %
Animal Waste	6 %
Total Biomass used	**88 %**
Electricity	1 %
Petroleum	9 %
Coal	2 %
Total	**100 %**

Source, CES: 2000

The basic energy requirements of rural households include energy needs for cooking, lighting, and space heating. Cooking and space heating are known as major components of household energy needs and are mainly met by traditional fuel (Rijal, 1998a). Kerosene is the only source of lighting in most of rural areas that have no access to electricity. Other energy needs at the household level are for processing agricultural produce, and for irrigating farmland.

The indigenous energy technologies such as *janto*, (a stone block to grind the grains) *dhiki* (Wooden block for rice husking), and *pani ghatta* (power created from water using the local turbine) are popularly used in rural areas for grinding grain and processing other food products. These traditional energy technologies are popularly used in Nepal. Considerable human energy is required to use the *janto* and *dhiki* and this is mainly the responsibility of women. *pani ghatta* is operated through the water force and this kind of technology is mainly designed and operated by men.

In rural areas of Nepal, energy needs at the household level are directly related to women's workload and their time. For instance, women in rural mountain areas often still spend five to six hours in collecting firewood and two to four hours in processing grains (Author's personal observation). The women's metabolic energy is often made invisible and almost forgotten by the rural energy planners (Cecelski, 1995). For instance, water mills for grinding grain fall under the energy sector, whereas women doing the same task with other indigenous technologies do not. Ignoring human energy disadvantages women in particular, since women provide significant amounts of labor and time in managing household energy systems (Cecelski, 1995; Clancy, 1997).

Energy must be viewed as a means for fulfilling the social and economic objectives of the rural population in Nepal. Rijal (1999a) points out that, the development of energy is essential for four distinct reasons. First, the minimum level of energy required to meet the basic needs of the communities, such as cooking and space heating, must be fulfilled. Second, the provision of energy is essential to meet the social objective of alleviating human drudgery[2] (particularly that of women, children, and the economically poorer section of the population) Third, energy is also required to sustain and support economic activities (newly emerging or traditional ones). Finally, the development of energy supply infrastructure should be conceived in such a way that it plays a leading role in increasing the productivity of hill and mountain areas, thereby increasing the economic efficiency of resource use (1999a:20).

There are renewable energy technologies that offer significant potential in terms of reducing women's drudgery and improving health conditions, allowing women to have

[2] Women's drudgery refers to their heavy workload and hard time for collecting firewood and for food processing.

enough time to be involved in income generating and social and community development activities as well as providing local employment opportunities to rural women. For example, biogas (ADB/N, SNV-Nepal, and GGC, 1994), micro-hydro, and solar photovoltaic, have been found to have a positive effect on women's daily workload, their living conditions, and economic empowerment (East Consult, 1994: 28).

Energy forms that are not conventionally used or new and renewable forms are considered alternative energy in Nepal. They primarily include micro-hydropower, biogas, solar energy, and improved cooking stoves (Amatya and Shrestha, 1998a). By saying rural energy technologies, I include both alternative (renewable) energy technologies (AETs) and the traditional indigenous energy technologies since they are both intended to fulfill the energy demands of rural areas.

Statement of the Problem and Rationale

> Biomass is the primary fuel used and will continue to be so for the foreseeable future. The major source of energy in rural areas is human labor used for both survival activities and production. This dependence on biomass and human energy is an important factor in rural poverty and it is not measured either in national accounts or in energy balances (Cecelski, 2002: 13).

Biomass fuels are heavily used in rural areas, where there is poor access to commercial fuels. A substantial proportion of agricultural residue and animal dung is diverted from the farm to the fireplace. The low level of efficiency of these fuels, which are a health hazard, particularly for women who are the producers, managers, and users of energy at the household level, worsens this situation (Rijal, 1999a:23). 'It is well known that women usually bear the burden of providing biomass fuels for daily domestic use while less well known is the extent to which human energy is an essential element in the household economy' (Batliwala and Reddy, 1996: 1).

Energy is considered highly technical, large-scale, and capital intensive, which would require professional skill and thus is regarded as falling under the control of men (Cecelski, 1992). Meanwhile, the basic energy requirements mainly managed by women, either for subsistence, or small-scale activities, are ignored. The planners and policy makers discount women's capacity and their indigenous knowledge in efficient use and management of energy resources (Cecelski, 1995; Skutsch, 1998). Acceptance of energy saving technologies is often taken as granted, while ignoring socio-cultural factors including women's needs and priorities (Skutsch, 1995). For instance, a common assumption is that women easily adopt improved stoves because it saves the use of firewood. However, women have many other criteria (such as easy to use) to assess the utility of stoves apart from the fuel economy (1995: 3).

There is a dilemma in the use of alternative energy technologies (AETs) versus traditional technologies among rural communities. The traditional energy technologies have not been able to meet the growing energy demands in rural areas. They neither help to reduce women's drudgery nor help to improve women's health. In addition, AETs have not always been attractive to the rural people because of the negligence of energy planners to address socio-cultural issues. The technologies so far disseminated and distributed to the rural communities are based on the interest of the donors, the government and the NGOs. They have undermined the capacities of local institutions, which could be significantly mobilized for ensuring their adaptability, ownership and thereby the sustainability of such technologies within the community (Banskota and Rijal, 1996). Hence, rural energy projects have been less successful in enhancing the socio-economic status of rural population especially of women in absence of appropriate planning practices.

Though policies on women's development in Nepal have linkages with energy issues, they do not specifically address energy concerns. For instance, there is no mention on whether and how women's active participation will increase in the planning and implementing of renewable energy development programs (Delucia and CRT, 1997). At the same time, the alleviation of human drudgery and deteriorating health conditions, particularly among women and children, as well as decreasing soil fertility, have never been considered seriously by energy planners in Nepal.

It seems that the role of women as users of energy and their relationship with energy related sectors have yet to be well understood by policymakers (who are usually male). Policies seem to have been formulated on the premise that development is a gender-neutral process, and that both men and women participate and benefit equally from development. This assumption is a distortion of the real situation considering that women lag behind men in the socio-economic, legal, and political spheres of life. Until women's practical and strategic needs are recognized, addressed and internalized within policies, and gender-based programs planned and implemented, rural energy programs are likely to remain ineffective and unsustainable (Amatya and Shrestha, 1998a:106).

Past research has little focus on women's current state of knowledge regarding energy technologies, the impact of shifting energy from traditional to alternative technologies on both rural women's incomes and livelihood and their roles as active participants in the development and implementation of AETs. Reduction of women's drudgery has been a major focus of women's concerns, while there is a little attention of policy makers in saving women's time and labor in household production activities (Cecelski, 1995).

A macro-level study is required to understand the role of gender in the planning, management and implementation of rural energy technologies, which could be used as a reference document for policy makers. Meanwhile, micro-level research is also needed to have in-depth understanding of local women's indigenous knowledge and skills, their current level of participation, problems and potentials of women, and positive and negative implications of AETs on both men and women.

Research Objectives

The main goal of this research study will be to understand the socioeconomic implications of energy technologies from a gender perspective. Ideally, this will provide impetus for gender to be integrated more carefully into energy planning and policies so as to ensure wide ranging benefits for women and their communities based upon the successful operation of energy technologies in the rural hills of Nepal.

The specific objectives are as follows:

a) To identify and analyze the problems and potentials for women in regard to rural energy resources and technologies,

b) To analyze gender roles in sustainable use of energy resources and the development of alternative energy technologies,

c) To compare the socio-economic implications of the traditional and alternative energy technologies from a gender perspective,

d) To develop an institutional framework viewing the women as basic users and managers of household energy technologies, so as to involve them in the planning, management and implementation of rural energy technologies,

e) To develop the appropriate policy measures which consider the primary role of gender so as to provide information to the policy makers and planners of the country for efficient and sustainable use of energy technologies.

Research Questions

Based on the above research objectives, the following questions have been formulated.

a) What are the problems and potentials of women regarding rural energy resources and technologies?

b) What are the gender roles in managing household energy resources and how could women's indigenous skill and knowledge be better integrated, into rural energy planning?

c) Do alternative energy technologies have positive impacts on socioeconomic aspects of rural communities, particularly in terms of reducing rural women's work burden and saving their time for productive work and social activities and increasing employment opportunities?

d) What kind of institutional framework and policy measures are required for the proper integration of gender into the planning, management and implementation of rural energy technologies?

Scope and Limitations of the Study

This study, being of an exploratory nature, has good potential to investigate the relationship between gender and alternative energy in Nepal, with wider implications for other third world countries. The intended research aims to develop an institutional framework and the appropriate policy measures for integrating gender into the planning and management of rural energy technologies. This could provide a basis for the planners and policy makers of the country to develop gender sensitive rural energy plans and policies.

Due to the existing insurgency problems around the country, I had to reduce the sample size, which might be less representative as compared to a more extensive sample survey. I also found a few methodological constraints to the application of some tools due to the time limitations. I had to be very flexible in using different research tools such as activity profiles and social mapping. Nevertheless, careful consideration was given to ensure the reliability of this empirical research.

Structure of the Thesis

Having discussed fundamental issues relevant to gender and rural energy, and having outlined the statement of the problem, the rationale of the study, research objectives, questions, and research area in the preceding sections, this section shows how the rest of the thesis is organized.

Chapters Two and Three provide a review of the literature on theoretical perspectives on gender and development and energy and sustainable development overview of rural energy technologies that serves as a contextual basis for further analysis. Chapter Two begins with a historical review of the concept of gender, theoretical debates on gender and rural energy issues. Chapter Three reviews the concept of sustainable development in relation to energy, rural energy issues facing developing countries highlighting the need for an integrated approach for rural energy, and finishing with a description of traditional and alternative energy technologies in Nepal.

Chapter Four develops the conceptual model of my study based on the theoretical ideas explained earlier. This chapter also elaborates on the concepts of participation and empowerment, which provided a basis for developing participatory approaches to rural energy planning. A participatory planning model is developed as an ideal model and its application is reflected in subsequent chapters.

Chapter Five describes the methods and techniques of the study. This chapter introduces the research sites and covers the mechanics of research methods as well as the experience of the application of these methods in the field. In the first part, the research designs and methods are presented in line with triangulation approach with explanations of the descriptive survey and case studies, and techniques of data collection and analysis. In the second part, fieldwork experiences are reflected upon sharing the practical application of research methodologies in the fieldwork.

Chapter Six reviews the present scenario of rural energy planning and policies in Nepal highlighting policy issues and challenges and elaborating the roles and relations of different energy institutions.

Chapter Seven presents four case studies focusing on four different technologies, namely micro-hydro plants, biogas plants, improved cooking stoves and solar photovoltaic systems. Village Development Committees (VDCs) where case studies are derived from are introduced separately. The analysis of case studies is conducted using different methods of participatory research indicating the positive and negative implications of rural energy technologies on gender, preferences between traditional and alternative energy technologies, and practical issues relating to the implementation of rural energy programs.

Chapter Eight describes further gender implications of rural energy technologies mainly based on survey findings. The socio-economic characteristics of sample households are described before detailed analysis of gender and household energy systems and the relationship between alternative energy technologies and empowerment of women takes place.

Chapter Nine concludes the thesis. This chapter begins with a summary of key findings and highlights them in terms of the research objectives. Suggestions for appropriate institutional frameworks and policy recommendations are made to integrate gender into the planning and implementation of rural energy technologies. The implications of this study are then drawn, and future research initiatives are suggested.

Chapter Two
Gender Development and Rural Energy

> Women are not a special interest group in renewable energy, they are the mainstream users and often producers of energy.
>
> Cecelski (2000: 36)

As one of the major aims of my research is to examine the gender implications of rural energy technologies applied in the rural hills of Nepal, it is necessary to review the gender and development (GAD) literature. Deriving from this literature, a GAD approach can be used to analyze the appropriateness and the sustainability of rural energy technologies. Development in general can not be achieved, unless it reaches every corner of society and in particular the most disadvantaged groups such as women. Unless women can participate actively in any development process, any accomplishments are likely to be incomplete and development will remain unsustainable. Since the GAD approach points out inequalities between men and women in most societies and the situation of subordination that most women face, development projects adopting a GAD approach will aim to provide fair/equitable benefits to both men and women and to be sustainable in the long run (Rowlands, 1997: 6).

GAD theory occupies a major part of my research, since my research methodology will be based on a gender analysis framework (GAF) and the research objectives will be analyzed from a gender perspective. Similarly, in my later chapters, a policy framework will be developed concerning how to integrate gender into planning, and implementation of rural energy technologies.

This chapter elaborates on a transformation of approach from Women in Development (WID) to GAD, gender as a concept, gender interests and needs, gender perspectives in development planning and then relates these ideas on gender to the literature on technology and rural energy issues.

WID Versus GAD

This section begins by highlighting the contributions of key authors who have drawn attention to the need to consider third world women's involvement in the development process.

In 1970, Ester Boserup published a book based on her research titled *Women's Role in Economic Development*, which concluded that women were the major contributors, particularly in agriculture in many third world countries. However, that contribution was not reflected in national statistics. She also emphasized that women's traditional productive functions were disappearing as a result of modernization. For instance, the mechanization in agriculture often reduced the need for women's labor, which otherwise, would have been required for weeding, and transplanting. She further argued that women are less frequently employed in the modern sector because of their low or formal education and training.

While, women are not inferior to men in any field, they are often taught that they are inferior from childhood. This is the reason women themselves sometimes prefer to be employed in 'feminine professions' like teaching where they feel more secure (Boserup, 1970: 215). In addition, the heavy household responsibilities of women obviously constrain their capacity to undertake modern wage sector employment. Women are normally trained in low-income activities like crafts and subsistence production. This could be attributed to the fear of men for competing with more women in the modern sector, and also due to men's preference for women to work within the household periphery. Boserup (1970: 221), Moser (1989) and Brohman (1996) note that women are rarely provided with vocational training in agriculture, rather in domestic activities like cooking, child-care and hygiene. No doubt, these skills are important for women for efficient household management but their training should not be limited to these qualities as this can place barriers in the way of their participation in a wide range of fulfilling activities from income generation ventures to professional careers.

Similar to the views of Boserup, Tinker (1976:22) whose experience are based on development projects, argued that development planners were unable to deal with the fact that women must perform dual roles (productive and reproductive) in society whereas men commonly focus only on productive roles. She also noted that development had an adverse impact on women because of three types of planning errors; a) failure to acknowledge and utilize women's productive role, b) reinforced values, which restrict women to the household engaged in child bearing and child rearing activities, c) inappropriate application of western values regarding women's work. The inequalities between men and women expanded as a result of imposition of capitalist development models on much of the third world. Such ideas challenged the assumption that gender equality could be achieved through modernization. To sum up the views of both writers, modernization and economic development are not proportionately related to gender equality.

The period 1976-1985 was declared the 'UN Decade for Women', following the International Women's Year in 1975. Women in Development (WID) came into existence around this time as a strategy to influence policy makers, researchers, and international development agencies in order to integrate women into global processes of economic, political and social growth and change. As illustrated by the pioneering work of Boserup (1970), the WID framework offers a blend of modernization theory and liberal feminism. It assumed that Third World Women can be liberated through integration into modern sectors of developing economies. Like liberal feminists in the North, the WID framework has linked women's advancement with improved access to all aspects of educational and employment structures (Rowlands, 1997). The WID approach promotes women-specific projects as well as projects aimed at incorporating women more fully into mainstream development. However, the qualitative aspects of their integration as well as sustainability of such integration were overlooked (Steady, 1995: 20).

The WID approach provoked a lot of research, which showed that women had achieved less than men from development efforts. The WID approach did not question why this occurred and continued to focus only on how women could be better integrated into ongoing development initiatives. Some projects and programs were welfare oriented focusing on food and distribution, nutrition, and childcare training to support women in their role as mothers. The welfare approach the earliest policy approach is still popular in the third world and is based on three assumptions:

> First, women are passive recipients of development, rather than active participants, secondly, that motherhood is the most important role for women in society, and, thirdly the child rearing is the most effective role of women in all aspects of economic development (Moser, 1993: 59).

Thus the welfare approach centers women in reproduction while another WID approach, equity was based on production. The equity approach recognizes that women are active participants in the development process, who through both their productive and reproductive roles provide a critical contribution to economic growth (Moser, 1993: 62). After the 1970s, an anti-poverty approach also evolved, under which economic inequality between women and men is linked not to subordination but to poverty (1993:66). Efficiency has since become the predominant WID approach, under which efficiency is seen as increasing with women's economic contribution (1993: 71).

Women in Development activities were exclusively focused on women's one or other of women's roles ignoring how roles were articulated and neglecting social and power relations between men and women (INSTRAW 1995: 17). In brief, the WID approach is based on assumptions that gender relations will change naturally as women gain more economic power. Generally, amongst the poorest of poor, this was far from true and such projects tend to increase rather than to alleviate poverty. Welfare and anti-poverty schemes are necessary preconditions for equity in many cases, but these only enhance women's *condition* as opposed to *position*. This is the reason women in the world still lag behind in most spheres of life (Young, 1997).

During the 1970s, issues regarding the integral involvement of women in national development processes slowly moved on to the agendas of national and international development agencies. By 1980, many countries and international agencies had explicitly incorporated women's issues into their development plans and had set up special bureaus, offices, or even ministries as the organizational focal point of these new concerns (Steady, 1995:15).

The new Gender and Development (GAD) approach emerged in the late 1980s as an alternative to WID in response to the limited success of WID. Contrary to the WID approach, in which women were viewed as passive recipients of assistance, or as resources whose labor should be harnessed to meet development needs identified by outsiders, the GAD approach views women as active participants in development. According to Kate Young (1997), the GAD approach starts from a holistic perspective, looking at the totality of social organization, economic and political life in order to understand the shaping of particular aspects of society. The GAD approach critically examines and analyses the underlying assumptions of current social, economic and political structures and questions the steps being taken to meet fundamental goals such as ensuring equity and equality for women in development, that were far from being achieved (ICIMOD, 1999).

GAD is an approach concerned not simply with women's roles, but with the dynamics and structure of gender relations (Moser, 1993:3). Gender relations are seen as central to social processes and social organization (though not as their only important feature) and therefore to development, which is defined as a 'complex process involving social, economic, political and cultural betterment of individuals and of society itself'(Young,1988:6). The GAD approach does not completely replace the WID approach. It views inequality between men and women as structural, derived from socio cultural norms that serve as organizing principles of society. The GAD approach seeks to replace the piecemeal method of integrating women in development 'by measures to change the structural relations between men and women that are socially determined and keep women in a position subordinate to men' (Steady, 1995: 20).

In the GAD approach, welfare or basic needs are built into programs as elements of a wider consciousness-raising, and meeting welfare needs is a means to an end and not an end itself. Gender relations are very dynamic, not determined by a uniform pace or direction but having a permanent influence on men and women. Rather than focusing on women in isolation, GAD argues that it is important to understand the distinct culturally and socially defined roles and tasks that, women and men assume both within the family and household system and in the community (Cecelski, 1995:562).

The GAD approach has an emphasis on women's empowerment through greater self-reliance (Moser, 1993: 75). According to Rowlands (1997), the GAD approach makes visible the power relations that exist between men and women in most societies, the situation of subordination that most women face. It raises detailed questions on different aspects of development, which affect women. 'Why is the incidence of women as heads of household apparently increasing? Why is the division of responsibility for domestic and reproductive activity apportioned in a way that makes women's burden so heavy? Why is very little work being done with men towards changing the nature of men's participation and attitudes so that women are more able to become involved?' (Rowlands, 1997: 6).

Looking through a 'gender lens' at the differing impacts of development on women and men, separately and together, will help us to identify and resolve underlying conflicts. The overall goal should be to bring positive changes that catch the opportunities and enhance equitable participation in the sustainable development efforts and equality between women and men (ICIMOD, 1999). Ultimately, this relates to empowerment that has to be ensured in the process of development.

Definition of Gender

Gender is a concept that describes the socially constructed relations between men and women. Common sense may suggest that gender and sex are just two ways of looking at the same division and the female sex automatically belongs to feminine gender.

However, as Oakley (1972:158) argued 'to be a man or a woman, or to be a boy or a girl, is as much a function of dress, gesture, occupation, social network and personality, as it is of possessing a particular set of genitals'. For instance, men wearing women's clothes is much more of an embarrassment than women wearing men's dress (White, 1993:101). Thus, gender is not a question of being man or woman but their socio-cultural identity.

> Gender is socially defined and its manifestations and implications differ across societies and cultures. Gender therefore requires a comparative focus on women and men and can not be analyzed or programmed purely from the perspectives of women (Wiltshire, 1995: 127)

Østergaard (1992: 6) refers to gender as the qualitative and interdependent character of women's and men's position in society. Gender relations are viewed in terms of the relations of power and dominance that structure the life chances of men and women. Thus, gender divisions are not fixed by biology, but constitute an aspect of the wider social division of labor. This in turn, is rooted in the conditions of production and reproduction and reinforced by the cultural, religious and ideological systems prevailing in a society. Therefore, gender relations enable us to distinguish the biological differences between females and males from the culturally, socially, politically or economically determined differences between the roles assigned to or undertaken by women and men respectively (Elson, 1991; INSTRAW, 1995; Østergaard,1992).

The following questions developed by INSTRAW (1995: 10) are interesting to discuss to clarify the concept of gender:

'Is gender related to women only?
Is gender also related to men?
Does gender view all women to be the same?
Does gender divide men and women, or unite them?
Is reversal of roles on the agenda of gender?'

Gender is not a synonym for the word 'women', and neither is it an abbreviation for men and women. It is a concept that attempts to understand the differences between men and women, which are externally influenced. It also tries to examine the conditions that are imposed on the naturally given biological sexes. Therefore, gender has to deal with both sexes in relation to each other (INSTRAW 1995:10).

The focus on gender rather than women was influenced by the ideas of the two writers Oakley (1972), and Rubin (1995). Their main concern was the way problems of women were perceived in terms of their biological differences from men rather than their social relationship between men and women. The focus on gender rather than women critically looks at women in relation to men. Due to the gender differences shaped by ideological, historical, religious, ethnic, economic and cultural determinants, men and women play a different role (Whitehead, 1979).

Gender does not imply that all women are alike. There are differences among women depending on their social and economic surroundings. However, they share experiences, strengths, and obstacles that bind them together as a group. Race, ethnicity, class, caste, nationality, age, and civil standing are other factors that may cause significant differences among males or females, but gender is always present and can not be ignored (INSTRAW,1995).

Gender does not initiate a mass social movement that aims to divide men and women and bring conflicts, which are not in existence. Rather, it brings the issues relating to men and women together that have brought unequal relations. At the same time, it also draws the attention of development workers in order to address the issues with appropriate measures that will help change rather than perpetuate the unequal relations (INSTRAW 1995).

Gender and development does not aim to reverse the roles of men and women by letting men do all the housework and women do only productive activities. Rather it aims to empower women giving them opportunities to engage in a wide range of roles and let them have equal and proportionate benefits like men in order to ensure the sustainable development of the country.

Gender differs from Women in Development in the sense that the latter only deals with women without considering their gendered role in society. WID focuses on welfare, anti-poverty, and efficiency approaches whereas GAD emphasizes equity and empowerment.

To sum up, gender is all about reconciling growth with equitable distribution of benefits and with equality of power relations among and between men and women. On top of everything, gender highlights the interdependence and partnerships between men and women in any field of development. It is a 'concept, a condition, a category and a component' and hence an integral part of development (INSTRAW, 1995: 12).

Identification of Gender Interests and Gender Needs

Molyneux (1985) argues that women may have general interests in common, assuming the compatibility of interests based on biological similarities. In reality, the position of women in society depends on different criteria, such as class, ethnicity, and gender. Thus, we should refer to gender interests and not women's interest, because women do not only deviate from men but are themselves divided in many ways; by class, age, religion, and ethnicity (White, 1993:99). Molyneux (1985) further divides gender interests into 'practical' and 'strategic':

> Gender interests are those that women (or men for that matter) may develop by virtue of their social positioning through gender attributes. Gender interests can be either strategic or practical each being derived in a different way and each involving differing implications for women's subjectivity' (1985:232).

The practical gender interests lie in achieving incremental improvements within existing structures and the strategic interests lie in structural change to improve women's position (White, 93:100). Gender interests therefore initiate with the different position and status of men and women in society and they again form the practical and strategic needs.

Developing these ideas further, Moser (1989: 1803) notes that it is important to distinguish between gender interests and gender needs-both strategic and practical. An 'interest' is defined as prioritized concern whereas 'need' is defined as a means by which that concern may be satisfied. As interest is abstract and need is concrete. For instance, women identifying areas to improve in their standard of living/status are discussing their practical interests, and interventions to address these interests are meeting a practical need. On the other hand, addressing the equity balance in gender relations is a strategic interest and providing the equipping mechanism is a strategic need (Moser, 1989).

Since women's role, interests and needs are not properly represented and integrated into development planning, policy planning often fails to address women's specific needs and interests which often differ from men's needs. Similarly, women's needs also vary widely. They are determined not only by specific socio-economic contexts, but also by the particular class, ethnic and religious structures of individual societies. Hence, they are called gender needs and it is important to distinguish between practical and strategic gender needs as in case of different gender interests (Moser, 1989: 1803). Molyneux (1985) provided comprehensive definitions of practical and strategic gender needs, and clearly distinguished between the two.

> Practical gender needs are the needs women identify in their socially accepted roles in the society. Practical gender needs does not challenge the gender division of labor or women's subordinate position in society, although rising out of them. Practical gender needs are a response to immediate perceived necessity, identified within a specific context. They are practical in nature and often are concerned with inadequacies in living conditions such as water provision, health care and employment (1985:233).

Practical gender needs come up out of the practical gender interests for their survival. The women experience the concrete conditions out of their engendered position within the sexual division of labor. Unlike strategic gender needs, they are formulated directly by women in these positions rather than through external interventions (Moser, 1989:1803). Molyneux (1985) defined strategic gender needs as following:

> Strategic gender needs are the needs women identify because of their subordinate position to men in their society. Strategic gender needs vary according to particular contexts. They relate to gender divisions of labor, power and control and may include such issues as legal rights, domestic violence, equal wages and women's control over their bodies. Meeting strategic gender needs helps women to achieve greater equality. It also changes existing roles and therefore challenges women's subordinate position (1985:233).

Strategic needs could be developed out of practical needs in the long-run. For instance, when women identify their need for having access to basic education is their practical need and when they assert their legal rights and political freedom once educated is their strategic need.

Moser (1993: 38-40) has pointed out that Molyneux's idea of identifying women's needs as either strategic or practical is a useful framework for planning with a gender perspective. Moser (1999) defines practical gender needs as those, which would assist women in their current activities, if they were met. Interventions focusing on practical needs are responses to meet the immediate needs often related to inadequacies in living conditions. Similarly, strategic gender needs are those needs, which, if they were met, would enable women to transform existing imbalances of power between women and men. Meeting strategic needs helps women to achieve greater equality and challenges their subordinate position including their role in society (Moser, 1999: 58).

Kabeer (1994) illustrates the ways in which both strategic and practical needs can be addressed, such as the provision of new economic resources, new analytical skills and awareness, and mobilization around self-defined concerns and priorities. The distinction between strategic and practical needs is useful for ensuring that interventions are aimed at addressing both practical and strategic needs. Wallace (1993) points out that it is important that women themselves define what their own strategic and practical needs are, given their own particular experience and understanding of their situation

Based on the above opinions, it can be concluded that the identification of strategic and practical gender needs is very important for gender analysis. Strategies can be explored once needs whether they are practical or strategic, have been identified preferably by women themselves. Clarification of strategic and practical gender needs serves as a tool for gender planning which in turn, helps to ensure the long-term sustainability of projects. In rural energy planning, rural women have practical gender needs for fulfilling household energy requirements and at the same time, they have strategic needs to have energy for being involved in social and economic activities. For example, once the rural women have good access to rural energy technologies, which satisfies basic household energy consumption. There is then enough time for other activities women wish to participate such as community meetings, adult education programs or small income generating activities. Such forms of involvement allow women to have for example, independent discussions, and income, for which, rural electrification and power is necessary. In addition, the basic household energy needs, whether derived from traditional or alternative sources, is a practical need but once adequately met, it can open up opportunities for women to pursue strategic interests and strategic needs.

What is Gender Analysis?

Gender Analysis involves a systematic effort to document and understand the differing roles, interests and needs of men and women within a specific context. Some key areas to examine in a gender analysis are: the division of labor for both productive and reproductive activities; access to and control over resources, benefits and opportunities, and the social, economic, and environmental factors which influence all of the above. Such an analysis explores and highlights the relationships of men and women in society, and the inequalities in those relationship by asking: who does what?, who has what?, who decides?, who gains? who loses ? (March, Smyth and Mukhopadhaya, 1999: 23).

The concept of gender analysis was initiated from the need to mainstream women's interests and to acknowledge the fact that they could not be treated as a homogenous group based on their different socio-cultural backgrounds. It was also realized that women's needs were better understood when viewed in relation to men's needs and roles, and within the social, cultural, political and economic context (World Bank, 1994).

In all societies, men and women are assigned tasks, activities and responsibilities according to sex. The gender division of labor varies from one society and culture to another, and within each culture, it also changes with external circumstances and over time. Because in most societies gendered power relations are skewed in favor of men, different values are ascribed to men's tasks and women's tasks (Kabeer, 1993). A careful gender analysis is an important factor in all planning since it can provide indicators of gender differentiated impacts on women and men in any given situation.

In gender analysis, quantitative data are disaggregated by gender. This highlights the different roles and learned behavior of men and women based on gender attributes. These vary across culture, class, ethnicity, income, education, and time. Thus, gender analysis does not treat women as a homogenous group. Gender analysis is important in the formulation of sector-specific project planning, monitoring, and evaluation (World Bank, 1994).

Gender analysis or application of a Gender Analysis Framework (GAF) is very helpful in understanding the roles of men and women in a society and the external forces that may affect the project planning. The GAF assesses how the project objectives relate to women's involvement, and anticipates the effect of project on women.

Rural energy projects have a direct impact on women and it is necessary to have the detailed information on women's activities, their access and control over the existing resources, which indicates women's opportunities and constraints for involvement in rural energy projects. Again, various information on gender interests pertaining to different stages of the project cycle is necessary to assess women's needs. This will enable the rural energy planners to understand how women’s needs, and their participation can be integrated into planning management and implementation of rural energy technologies.

Gender Perspectives in Development Planning

There has been very little effort in the past to integrate gender into development planning. This is because development planning was based on an assumption that projects designed for rural communities will have the same impacts on men and women with equal benefits. However, this assumption is misleading and women lag far behind men in accessing project resources and achieving benefits:

> Development planning has failed to recognize fully or systematically women's contribution to the development process or in turn the effect of this process on them. This failure has limited development efforts and effects. Economic growth, project efficiency, and social justice call for a new approach to development that systematically includes women (Overholt, Cloud, Anderson and Austin 1991: 9).

Women are often prevented from having equal access to education, training, jobs, land ownership, credit, business opportunities and even to nutritious food and other necessities for survival (Gabriel, 1991: 73). It is therefore, necessary to acknowledge gender discrimination in development planning and instead work towards gender equity, in the hope of achieving not only economic growth but social justice as well. Kabeer (1995) thus argues that;

> Gender perspectives on development consider development as a broader process of social transformation unleashed by the attempts of diverse development agencies at local, national and international levels, both within the official domain and outside it, to achieve various, and often conflicting goals' (1995:70).

Planning is a strategic entry point for women in determining and controlling what goes on in the development process. Yet, planning is a conflicting process over the struggle for power over resources and benefits in which women are marginalized (Kabeer & Surachmanian, 1996). Hence, the planning process in general, marginalizes the women who still have to struggle to gain control over resources and benefits. Gender planning provides conceptual frameworks and methodological techniques to devise gender sensitive strategies for the design, implementation and evaluation of development projects (Patel and Ahmed, 1996).

In the changing social and economic context, gender mainstreaming in development planning is critical for determining the extent of participation of men and women in development interventions and the benefit from them. By gender mainstreaming, gender balance is promoted in decision making at all levels so that policy, program, and project priorities reflect a gender-balanced perspective and knowledge base (Wiltshire, 1995: 129).

Since the interests, needs and roles of men and women vary based on different social construction, development projects have different implications and impacts on men and women. Hence, the projects that are designed for the benefit of a community must consider the different roles, interests and the needs of both men and women, so as to be equitable and to ensure the long-term sustainability of the projects.

As discussed earlier in this chapter, the shift from a WID approach to a GAD approach saw more emphasis placed on the roles of both men and women and the relations between them, their different access to and control over resources, and their different needs (Campos, 1995; Makan, 1995). Thus, the growing emphasis is to think in terms of gender rather than assigning special or separate programs for women. A gendered approach in development projects primarily 'highlights inequalities in society, and stresses the fact that in almost all societies women are subordinate to men' (Skutsch, 1996).

In order to provide substantial attention to gender in any development planning including rural energy, it is necessary to work through the project cycle ensuring that gender issues are considered at every stage of the projects during planning, implementing, monitoring, and evaluation (Skutsch, 1996). This is a detailed approach for incorporating gender issues, which requires using different planning tools at different stages and at different levels of data aggregation. All policies, programs and projects must be evaluated on the basis of whether men and women were equally involved in their design, monitoring, and implementation, and the extent to which they enhance gender equity and equality (Skutsch, 1996; Wiltshire, 1995: 131).

Yong (1995) mentions that gender analysis should be carried out as a standard practice of any proposed project in a similar way as an environmental impact assessment, which is very common these days. This means that gender analytic tools and procedures need to be integrated into regular patterns of work. 'Thus the attention given to gender (or to women) is not a special but a normal planning task institutionalized into the outline of office activity' (Yong, 1995:6). This helps to ensure the sustainability of the projects.

Gender issues are to be addressed at every stage of project cycles. Preferably, it should start from the stage of project identification (Østergaard, 1992). Thus adequate priority should be given to gender aspects in plans of operation with respect to budget, selection and development of appropriate personnel, and training of local women. 'Attempts should be made to find out from local women what they want and need' (Østergaard, 1992: 8). However, the women's capacity to express their needs and interests vary depending on the situation. Women with little autonomy or direct access to resources have obviously less exposure to act and think in alternative ways. But, once they have options to have greater awareness, their views and ideas of actions will change (Mayoux, 1998:243).

In order to have systematic knowledge about gender in the project area, it is essential to collect relevant data consistently on gender issues and to perform baseline studies in the pre-appraisal phase. The pre appraisal missions with broad terms of reference would help to ensure that proposed projects are relevant to local society and culture.

Gender dimensions should be investigated consistently in later stages of the project cycle such as during operational planning, implementation, monitoring and impact studies, and information should be organized so that they can be used for the planning of future projects (Østergaard, 1992:8).

The stakeholders (for instance, donor's and the local administration of the recipient country) of a project should also stress gender awareness. The general tendency in development organizations is to have more male staff and they are more oriented to technical, financial, and administrative work (Østergaard, 1992). This is also true of both expatriate and local personnel in recipient countries as well as the appraisal and evaluation teams. A balanced distribution of project staff (both male and female) and 'supplementing of technical and administrative know how with social, psychological and anthropological expertise would greatly improve an agency's ability to incorporate gender issues appropriately in development planning' (Østergaard, 1992:9).

Apart from this, gender awareness training should be given to all project staff as a regular mainstreaming process to ensure their positive attitude towards the female staff and all gender activities in the institution. Gender training is considered as a useful tool in challenging gender biases in development planning by improving women's power while at the same time motivating both men and women to implement gender sensitive planning (Bryon 1995; Moser 1993; Monkman, 1998). Smyth and Porter (1998:60) put emphasis on gender training for development practitioners or implementers (who are working within the context of a development program) as a strategy to address the root causes of systematic inequalities between men and women in the development process. Sometimes, the gender training is also presented as the technical solution to the stubborn refusal of development policies and processes to become gendered. Regmi and Fawcett (1999:65) from their research experience in drinking water projects in Nepal, point out that a key target group for gender training should be men who perpetuate negative stereotypes of women.

The energy sector as a technical field falls under the control of men. Women, however play the key role in managing the rural energy as users, producers, and activists as well as in meeting the family's basic needs (Cecelski, 1995; Skutsch, 1998). Too often, women are perceived as not having the ability to apply relevant knowledge to energy issues, and as lacking the negotiating skills that are essential for designing and implementing energy policy reforms. Neglect of appropriate education and training can seriously hinder energy development efforts as well as undermine the full participation of women in the development process (Wakhungu and Cecelski, 1995).

As in the case of other project planning, rural energy planning requires the gender issues to be considered as an integral part of the whole planning process. A gendered approach is to be integrated in energy project planning as a standard measure since this approach treats differences between men and women in society as an important variable that needs to be considered in rural energy planning (Makan, 1995; Skutsch, 1997). Skutsch (1998) further analyzes the principal motivations of including gender in energy planning on three grounds:

- 'To promote gender equality and to empower women ('changing social relations so that women can fulfill other strategic objectives through the mediums of energy') (1998: 947)
- To improve the welfare of women (reducing women's drudgery and improving their health conditions by meeting practical energy needs) (1998: 947)
- To increase project efficiency (recognizing the importance of gender and thus considering different roles, interests and priorities of men and women in project design)' (1998: 948)

As rural energy technologies have different implications for men and women and they have different interests, needs, and roles, gender issues have to be taken into account when planning the rural energy programs.

Gender and Technology

Technology is the systematic know-how people use as an extension of their natural abilities. It is a part of human culture that has strongly affected social development in industrialized countries. The nature of society however, is not determined by its technologies, since they are developed, produced, and used within social context (Smeds, 1985).

Gendered Nature of Technology

Omvedt and Kelkar (1995:3) point out that technology is typically linked with 'production' for its practical purpose, which may include the production of human beings ('reproduction') in a broader sense, and is somehow equivalent to the Marxist concept of 'forces of production' that refers to the relations between humans and nature in the process of production. In other words, technology consists of the processes, understandings and material objects with which human produce. Sen (1990:128) draws attention to 'social technology' arguing that production is not only the relationship between the raw material and the final product but also the social organization that allows the use of specific techniques of production in factories, or workshops, or on the land. Thus, the social processes of production, their modes of organization, and their interrelationships are all part of technology. Here, social relations, processes, structures and institutions become complex but vital issues to be considered. Gender is the most central feature structuring social relations (Omvedt and Kelkar 1995: 4).

Technology, like most aspects of progress is usually thought of as a masculine invention and activity (Omvedt, et al, 1995). In reality, we are all intensely involved in and affected by technological practices. Technology is not simply functional products (machines, tools and gizmos), but a system of interaction that affects social relations between men and women. Men and women are situated differently in relation to technologies (Terry and Calvert, 1997). Terry and Calvert (1997) further question why men are readily associated with high-end technologies and what social structures might look like if technologies were really developed with women in mind.

As Boserup (1970) pointed out because women are rarely provided with training in the modern sector, the involvement of women in modern technology is automatically restricted. Despite this, at the subsistence level of agricultural production, especially food production, women are always affiliated with some kind of technology. For instance, grinding, husking, and pounding of grains and other basic foods for family consumption are always carried out by women (Boserup, 1970: 163). She has pointed out the effect of colonialism on women's status in the following way;

> It is the men who do the modem things. They handle industrial inputs while women perform the degrading manual jobs; men often have the tasks of spreading fertilizer in the fields, while women spread manure; men ride the bicycle and drive the lorry while women carry headloads, as did their grandmothers. In short, men represent modern farming in the village, women represent the old drudgery (Boserup, 1970:56).

Women's alienation from modern technology is a product of the historical and cultural construction of technology as masculine (Cockburn, 1993; Cockburn and Ormund, 1993; Wajcman, 1991). Technology, from this perspective is seen as being much more than simply artefacts or 'hardware', but also refers to the knowledge and practices which are involved in its use (Mac Kenzie and Wajcman, 1985). As pointed out earlier, women's access to technological innovation is restricted with the presumption that they have less knowledge to use and operate the technologies and less need for them. The truth is that the women are cut off from training in skills for modern sector employment undermining their capacity for technical innovation (Boserup, 1970).

Wajcman (1991:149) suggests that it is useful to examine the relationship between technology and culture.

> Technology fundamentally embodies a culture or a set of social relations made up of certain beliefs, desires and practices. Treating technology as a culture has enabled us to see the way in which technology is expressive of masculinity and how, in turn, men characteristically view themselves in relation to those machines (Wajcman1991:149).

The idea of technology as masculinity has important symbolic dimensions that enter into gender identity. Masculinity, it is argued, is partly constructed through notions of technical competence: 'It is evident that men identify with technology and through their identification with technology form bonds with one another'(Wajcman, 1991:141). In contrast, the idea that women lack technical competence is not merely a sex stereotype but 'does indeed become part of feminine gender identity'(Wajcman, 1991:155). Benston (1992) argues on the same line:

> Male power over technology is both a product of and reinforcement for their power in society. Even at the household level, every time a man repairs the plumbing or a sewing machine while a woman watches, a communication about her helplessness and inferiority is made (Bentson, 1992:37).

Men not only have a wider range of action around technology than women do but that action implies a great deal of control over the physical and social world. Domination over nature meaning control over the physical world is a central feature of present day technology, which remains less accessible to women (Kramarae, 1988: 19). As argued by Griffin (1978) and Merchant (1980), science and technology are often promoted at the expense of nature, which has a close tie with women's lives.

A gendered approach to technology can not be reduced to a view which treats technology as a 'set of neutral artefacts' manipulated by men for their own interests Wajcman, 1991:25). While it is the case that men dominate scientific and technical institutions, it is perfectly plausible that there will come a time when women are more fully represented in these institutions without transforming the direction of technical development (Wajcman, 1991). Thus it can be pointed out that men dominate the technology because of the patriarchic structure of society, but if women were involved in envisioning technologies, they may be able to design the artefacts in line with their own interests. Males have strong prejudice over female technical capabilities, which has for example hindered women to become involved with men in drinking water projects in Nepal (Regmi and Fawcett, 1999:65).

Evidence from different parts of the world shows that women are actively engaging in the production of technology and that they have knowledge associated with it. Women in the Pacific Islands have used traditional technologies that they developed themselves through locally available resources. They invented and used tools for food gathering and preservation, for making clothes, for healing, and made baskets and containers for everyday required activities. The majority of women are still associated with traditional technologies and knowledge, traditional healing practices and medicines, goods for the home, food production and collection, and the use of naturally occurring materials such as plants found in the Solomon Islands, which is used to enhance mother's milk because it is high in protein, vitamins and minerals (Lechte, 1993).

In particular, rural women have been very creative with technologies around the house, around the farm and around their workplaces for their families' survival. For instance, in the rural hills of Nepal women introduced kitchen gardening as a means for using household wastewater for irrigation. Similarly, in rural parts of Thailand the women used to make dolls, key rings, and mattresses from dry corn leaves and sell them in local markets so as to get supplementary income for their living (Author's personal observation, 1995).

Technological innovation is considered as a symbol of modernization and is supposed to improve the status of people. However, Tiano (1984) argues that modernization has resulted in women losing traditional roles in agriculture and handicraft production, and thus losing some of their autonomy, influence, and access to resources. As Boserup (1970) pointed out, women are more involved in agricultural production, which requires manual labor like weeding, planting, transplanting and so on, but men are more involved, if the agricultural activity is mechanized. As a result, women automatically lose their control over the resources. In rural areas of Nepal, women are often not represented on drinking water and forest committees. There is a presumption that they know nothing of relevance even though the rural women use and manage the water and forest resources very economically (Regmi and Fawcett, 1999). Lack of women's representation is particularly true in the case of urban technologies. Hence, it is not always true that technological innovation has a positive influence on women.

Kelly (1981) asserts that women are excluded from an understanding of techniques and of the physical principles by which machines and tools operate. This exclusion is important because technique is often overlooked as a major component of technology, even though underlying technique or knowledge of how to use technology is more important than the actual machines. After all, if all the machines are broken, they can still be repaired as long as the human being that built them retains the knowledge that was used to build them in the first place.

The exclusion of women not only from active participation in scientific and technical fields, but also from training in basic physical and mechanical principles means that even when women use tools or machines, they are marginal to a male-created and male-dominated technology. Women are less educated than men and they are rarely provided the technical training. The normal practice is that the development and evaluation of technology is done by men, who have limited knowledge about women's daily lives and problems (Grint and Gill, 1995).

The basic assumption persists that technical solutions can be found for any problem. Efforts to develop science policy institutes in many developing countries, to negotiate systems for the equitable transfer of technical knowledge, to develop international journals for the publication and dissemination of discoveries of even the appropriate technology movement, all rest on the assumption that a technological 'fix' may be found. The technological fix comes from the western attitude towards nature: it can always be improved upon by technology, and that traditional attitudes and practices regarding the environment are necessarily inadequate and improvable. Many advocates involved in development are now searching for the right technologies for women to ensure their participation in and the benefits of development (Anderson, 1985:59). However, there are many socio-cultural variables, which affect the successful diffusion and adoption of technology. For example, the improved cooking stove is not wrong in itself as a technology, but when it comes to the application, women have different problems in using it either because they are not trained properly, or they still feel more comfortable using the traditional stoves or there could be some other problems associated with culture.

Feminists have considered two important approaches to answer the question of how technology is gendered? First, men are the ones who primarily take decisions that shape technology. Second, men in general have achieved greater success than women in claiming skilled status, especially technical competence in construction, marketing, maintenance and design of technology (Cockburn, 1983; Elson & Pearson, 1981; Mc Neil, 1987; Philips & Taylor, 1980). Again, women's ability to compete with men is constrained by their socio-cultural status. However, Faulkner (2001: 85) argues that females have more subjective rationality connected with emotional relationships, and with concrete, empirical, and holistic approaches to problem solving. She further elaborates the heterogeneous roles of women who bring a more holistic approach in problem solving in engineering.

The eco-feminists in Asia strongly criticize modernization and westernization. They are proponents of cultural eco-feminism, the predominant form of eco feminism. The best known eco-feminists Vandana Shiva together with Maria Mies (1993) argue that 'An eco-feminist perspective propounds the need for a new cosmology and a new anthropology which recognizes that life in nature (which include human beings) is maintained by means of cooperation, and mutual care and love'(Mies and Shiva, 1993:2). Mies and Shiva (1993) further points out that there exists alternative, small-scale and holistic technologies rather than 'western science and technology' which is often the sources of ecological and human destruction. They advocate for subsistence production rather than cash cropping being under the men's control. Things would have been different if women were to control cash incomes. For example, women have more control over cash crop production in Africa and they appreciate the opportunity from earned cash incomes to buy foods and other necessities (Omvedt and Kelkar, 1995: 11).

There are emergent, pragmatic frameworks that accept western domination in innovation and welcome the use of science and technology to meet local demands

(Mitter, 1999: 10). For instance, videos and tape recorders have proved a good media of demonstration for women workers in different situations (one example: women workers marching in the street of Ahmedabad in India for voicing their demands) that have raised the spirit and confidence of other women in the region (Patel, 1996: 30). It is therefore, necessary to screen the goals and strategies and the implications of technologies rather than to reject them blindly.

Gender Impacts of Technology

Rural industrialization in the third world employs large number of women, but their representation in management and decision-making position is very low (Omvedt and Kelkar, 1995: 26). Women are mostly involved in manual work either with cleaning up the main product or by-product to make it ready for marketing. Mitter (1999:8) urges that new technologies should create new jobs for women in both production and computers. However, this may only open opportunities for women who are single, relatively young and sometimes highly educated and qualified, unlike the majority of women who have lost their jobs because of technological intervention. In addition, the majority of new jobs go to non-unionized workforces, whereas the jobs lost belonged to unionized women workers. The non-unionized work forces find it hard to deal with the number of problems in the workplaces brought up by the new technologies. For instance, the health hazards in electronic assembly and repetitive strain injury in computer terminals seems to outweigh the positive effects of such technologies (Mitter, 1999).

With growing industrialization, Malaysia has been able to take advantage of vast networks and services, better performance of industry and economies of scale. However, women havc not been able to gain equal benefits from technology-oriented economy. The majority of women are still employed in low skilled and semi-skilled categories. Only a few highly educated younger women have been able to enter into the field of information processing. Even in high-tech industries the majority of women are clerical workers and production operators. For instance, the majority of computer related jobs held by women are data processing rather than computer programming. In addition, technological change has resulted in job losses whereby, smaller groups of higher skilled employees (mainly men) have replaced the larger groups of lower level employees (men and women) (Sim, 1999: 39). Similar experiences can be shared from China, where hundreds of employees were laid off in textile industries after the introduction of new kinds of textile machinery. Women were the most affected group with this redundancy program comprising over 55 percent of the laid off workers in Sanghai (Haiyan and Meihe, 1999: 74). In Sri Lanka and in Bangladesh the garment industries employ more women as low cost laborers who produce relatively low value goods. The strength of development of the garment industries in these countries is based on the low cost of women's labor. However, with competition in the international markets, garment employers identified the importance of new (sophisticated) machines to be operated by men (Ponniah and Reardon, 1999: 94). An interesting point to raise here concerns why technological innovation is not fitted to women if they are as trained as are men.

Indeed, those technological changes having the most significant impact upon women are not usually aimed at women at all. Large-scale development projects and their attendant technology rarely include policy regarding women in their initial stages of planning. The problem does not lie chiefly with projects aimed at women (although they are often problematic as well). Rather as Whitehead (1985:32) points out, for large numbers of rural women the most significant forms of technological change are more likely to be the indirect consequences of both planned and unplanned innovation in agriculture as a whole. For example, the green revolution technologies, aimed to increase agriculture productivity have worsened the situation of women more than men, due to the socio-political context (such as unequal distribution of land and political power) (Agrawal, 1985:112).

Batliwala and Reddy (2003) have also pointed out that introduction of new technologies can worsen women's situation. When machines are introduced, women's work often becomes men's work and women laborers are displaced by male operators.

This bias is applicable to animal energy as well as mechanical energy (Batliwala, et al 2003). While developing and disseminating food technologies amongst village women's groups, the problems do not lie with the technology itself but its appropriateness for the group it is trying to serve. Very often, technologies designed to alleviate women's burden end up displacing women themselves (Rich and Cox, 1986). For example, processing mills often employ men for processing activities, which were traditionally performed by women. Clearly, such technologies can have an adverse impact on women, though they appear to be 'gender neutral'. In Indonesia, for example, a government initiative of mechanized rice hullers replacing 90 percent of hand-rice hulling (all women) between 1970 to 1978, with estimated job losses as high as 1.2 million in Java alone and 7.7 million in all of Indonesia (UNIFEM, 1988).

Technological innovation in the rural energy sector has a direct impact on women's workload and health. However, they are often neglected in designing such technologies even though they have knowledge and skill on the same. For instance, women are more skillful in fuel saving mechanisms, suggesting that they should be involved in designing the Improved Cooking Stove (CRT, 1999). As Cecelski (1992: 7) pointed out energy is considered as large-scale capital-intensive technological projects run by professional experts and investment has been biased towards the large-scale energy projects.

Introducing labor saving technologies will not be sufficient by itself to reduce women's drudgery; any program to introduce new technologies must acknowledge that a redistribution of responsibilities between all members of a community is necessary if women are to have time to fully participate in their country's development (Letche and Shanahan, 1986). For example, women should be assigned in important decision-making processes of planning the rural energy technologies so that the participation and ownership of the technology by women can be ensured. Similarly, women should be involved in the design, development, construction and maintenance of technologies (Letche et al., 1986:41).

In addition, technological interventions in the rural energy sector should come with a holistic approach aiming to integrate gender awareness training, income generating activities, saving and credit schemes, and local capacity building (especially of local women group) so as to ensure the successful diffusion and dissemination of technologies.

Gender and Rural Energy Issues

The conventional energy paradigm views energy as a highly technical field dominated by engineers and other professionals but this fails to recognize the local people's knowledge and skills including those of women. Women's expertise in management of energy resources has been ignored or discounted as irrelevant to energy policy and planning (Cecelski, 1992). Global energy decision-making has emphasized large-scale, high technology energies, which absorb most international aid. These projects provide electricity and gas to a few elites who are able to take advantage of them but do not serve the majority of consumers who need energy for cooking (Farhar, 1999).

As discussed earlier, women's metabolic energy is often made invisible and almost forgotten by the energy planners (Cecelski, 1995; Clancy, 1997). For instance, water mills for grinding grains fall under the energy sector, whereas women doing the same task with other indigenous technologies do not. Ignoring human energy disadvantages women in particular, since it is well known that women in general, provide more labor by working longer hours than men in both developing and industrial countries (Cecelski, 1992: 8). Makhabane (2002a: 86) argues for gender-sensitive energy policies and interventions that address women's needs and concerns regarding rural energy.

Women as the primary users of household energy have expertise in local biomass resources, including fuels properties and have knowledge about fuel-saving techniques For instance, women can differentiate between those fuel wood species which burn fast with high heat and those, which burn slowly with low heat and those, which smoke (Cecelski, 1995; Kelkar, 1995). Women are the ones most affected by an energy crisis (Batliwala and Reddy, 2003, Cecelski, 1995). For instance, the growing scarcity of firewood and other biomass resources adds hours to women's workday. Because, women have to walk long hours to collect the firewood from distant forests and sometimes, it takes the whole day to collect a bundle of firewood because of its scarcity in the forest. Men are not directly affected by the firewood crisis, but they still might have less firewood for selling or for some other purposes. Cecelski (2001) argues that:

> The real rural energy crisis is rural women's time, with women working longer days than men in providing human energy for survival activities such as fuel and water carrying, cooking, food processing, transport, agriculture and small enterprises, non monetized work which is largely invisible in national energy accounts and labor force statistics (2001:3).

Studies on the energy transition in developing countries can hardly afford to ignore women's key role in biomass use and collection. In addition, fuel preparation as well as cooking and tending fires are almost exclusively women's tasks and take many hours each day (Dankelman, 1995: 317). An emphasis on development and basic needs goals can lead to an examination of how energy can save women's time in collecting firewood, grain grinding and water pumping, thus releasing labor for other development needs. Similarly, concerns about the environment have led to studies on indoor air pollution from cooking and the exposure of women and children to smoke (Cecelski, 1995: 562, Smith, 2002). In addition, women and children often have less access to forest areas in the case of reserve forests and private plantations. Because of a scarcity of firewood, women do not boil water long enough, and cook food items with low nutritional value that requires less cooking time. This in turn, affects family health (Dankelman, 1995: 143). Women especially become victims of a different health hazard due to firewood scarcity. For instance, a study in Uttarachal, India, indicated that miscarriages are to be linked to heavy load-bearing work during pregnancy, which are five times of the national average (30 percent). Similarly, in Nepal, a high incidence of uterine prolapse among women is likely to be linked to carrying heavy loads of wood soon after childbirth (Nishimizu, 2001).

Despite knowing the above facts, the majority of energy planners (normally male) rarely consult women 'for whom they are planning or discuss the problems from their perspective' (Skutsch 1995:3). Too often, assumptions are flatly made regarding energy interventions and acceptance of energy saving technologies is taken for granted without carefully analyzing the needs and priorities of women (Skutsch, 1995).

Energy analysts and policy makers at the macro level have not paid enough attention to gender issues (Cecelski, 1995; Parikh, 1995; Skutsch, 1995). Energy use by different sectors and groups of society, such as farmers, manufacturers, and industrialists are considered to be legitimate aspects in formulating energy policy, while gender issues are accorded less importance. The common response is; 'Energy is there for all to use, what difference does it make who uses it?' But in reality it makes a considerable difference depending on who uses it, and who collects it, how much time is spent, and what is the expenditure (Parikh, 1995: 746). Even the little attention paid to gender issues is confined to the household sector with the assumption that women are supposed to manage the household. However, much of women's work goes beyond the household sector and spills into agriculture and food processing, services and manufacturing (Cecelski, 1991). On the other hand, energy planners tend to overlook the fact that, many income generating activities undertaken by women are based in the household (Clancy, 1999). In addition, women are not only users but also a part of an energy supply system. For instance, they do not only gather the fuel but also produce charcoal, briquettes and dung cakes.

From a third world perspective, and especially from the viewpoint of rural women, the energy crisis is considered as a fuel wood crisis, as a large section of the population depend on biomass energy for their daily energy requirements (Cecelski, 1992; Nyoni, 1997). In this sense, it was pointed out that the rural women find it more difficult to cook than to grow the food (Agrawal, 1986). However, perceiving the energy crisis as synonymous with fuel wood shortages misses the link between energy and productive systems in rural areas and particularly the gender component of access to and control over resources (Nyoni, 1997). For instance, women may have access to agricultural land but no access and control over a tractor. Similarly, women can have access to rural electricity for different kind of income generating activities, but the usage of electricity and the income derivied from activities associated with this is still controlled by the men. It is therefore, essential to address energy needs of rural women in a wider context of agriculture, income generating activities, and their own human energy input (Nyoni, 1997).

There is clearly a need for renewable energy technologies ranging from improved stoves, biogas, solar power, windmills and so on, but, what is women's role in designing, adapting and using these technologies? Will they increase women's burden in maintaining them and will women have sufficient training to use them? These issues are to be addressed at macro level policies (Parikh, 1995: 747). The different implications of the wider use of renewable energy sources for women and for men have hardly been examined. Research and project reports on renewable energy do not include gender disaggregated information. Just as women's activities have been overlooked in development and energy policy generally, they have been ignored by renewable energy programs since the same approaches and channels are involved. To date, too few studies have measured the actual labor saving, income or other impacts of new energy technologies on women's work and lives and benefits are often merely assumed (Carr and Sandhu, 1988).

Cecelski (2000: 27) argues that many labor saving technologies have failed not only to save women's time and energy but they have worsened the socio-economic condition of women in some cases. She further argues that technical issues are not only determining factors for the projects to be successful, but also external factors such as access to raw materials, (including land ownership, and control over cash crops), access to credit, the social and cultural context, management and organization, leadership, and marketing (2000: 29). The energy technologies and energy services must make women self-sufficient. Here, gender considerations in the design and implementation of new technologies are crucial (Makhabane, 2002a: 86).

There exists a big gap between gender policies as adopted in government and donor policy statements and actual energy planning practices (Skutsch, 1998). This is because their policies lack gender indicators, which would show whether such policy objectives have been achieved or not. Hence, the policies are to be interpreted as achievable objectives in order to fulfill the gap (Skutsch, 1998). Most policy makers view energy policies as gender neutral, despite knowing the fact that men and women are affected differently by such policies in the developing countries. A market-oriented approach with adequate attention to different interests and needs of men and women is essential for achieving equitable distribution of energy services. Since women are the major energy consumers in rural areas of developing countries, it is important to know how the priorities of women will differ from those of men (UNDP, 2000). For instance, an evaluation of biogas program in India showed that women and men had different criteria for interpreting its positive impact. In the Gurgaon district of Haryana India, the discussion with families using biogas indicated that women are concerned with the smokeless ness and convenience of biogas plants but the men value the benefits of the manure produced. Similarly, women found time savings in terms of reduced fuel collection and food preparation, while men looked positively on the faster cooking and timely availability of meals with biogas cooking (Dutta, 1997).

The issue of gendered access to and control over energy resources is very important. In most cases, women have no or little control over the forest resources whether they are private or public, though they have access to use the forest resources. For instance, in Nepal, the women have direct access to the community forest to collect firewood and fodder but they have no say in any decision-making about the community forest. It is the same with rural energy technologies, to which women have access to use but they are rarely involved in decision-making processes including planning and designing the technologies. For instance, in Nepal, the operation of biogas plants (mainly mixing dung with water) is women's work, while the men select the land (location) for installing the biogas plant. However, women's involvement in the selection of location is very important to ensure their efficiency since they are the ones preparing for the operation of the gas plant such as fetching water, carrying dung from the stable and so on (Author's personal observation, 2002).

Women have many barriers to participation in income generating activities, even if some energy projects provide such opportunities. They often have difficulty in accessing credit due to lack of land title, ownership of livestock or other property needed as collateral for loans. In some regions, women are treated as legal minors and are not permitted to engage in financial contracts. Similarly, they may be restricted from interacting with the community, which limits on their ability to benefit from extension services or to acquire inputs, market finished goods or organize with other women. These constraints have to be taken into account when considering energy projects (Kartha, and Larson, 2000).

In Zimbabwe, both men and women have access to woodlands since they are communal resources but women are most affected by the increasing pressure on communal lands being encroached upon for agricultural and commercial purposes. In addition, there is a social dimension to firewood collection. For instance, in the western part of Zimbabwe, a status symbol is attached to the bride who makes a large wood pile during the first few months after marriage and those without a large wood pile are considered to be lazy (Nyoni, 1997). It is thus important to understand the priorities and preferences of different stakeholders when designing appropriate technological innovations in the rural energy sector. Energy projects have to be designed in such a way that it helps to enhance the decision-making capacities of women and to ensure their fair share of the benefits of the program.

Dutta (1997) points out a number of barriers for women to overcome if they are to be effective participants in rural energy programs. One constraint is the traditional decision making structure in society where men have to be convinced about every small expenditure in the kitchen, while women do not have any voice in the public sphere. Apart from the above, rural women rarely have access to information, education and training. In many cases, training programs for construction of improved stoves were aimed at men even though women were the main users of stoves (Dutta, 1997). For this reason, the extension workers directly interact with men while ignoring women who have in-depth knowledge of domestic energy systems (household energy needs, supply problems, immediate environment problems, and the needs and preferences of families). As a result, the rural energy technologies targeted at women are based on men's perceptions and excluding the indigenous knowledge of women (Dutta, 1997). Failure of such technologies due to women's reluctance to adopt and actively participate in such interventions is thus not surprising.

Energy research has little focus on technological and other improvements in areas of interest to women and the energy planners fail to acknowledge women's indigenous technical knowledge, experience and their innovative coping strategies, which has resulted in the failure of technologies (Cecelski, 1992). Much research has been carried out in the design of improved stoves aimed to save the use of firewood. Whereas, no attention has been paid to improving fuels and kitchen management, which could save even larger amount of fuel and also institutionalize women's indigenous knowledge and capacities (Cecelski, 1992:12). In rural villages of Nepal, women dry firewood and store the firewood near the stoves before burning, which makes it easier to burn thus reducing amount of fuel needed. Un-dried firewood is harder to burn requiring women's energy to blow it. Similarly, soaking beans and the use of lids on pots are some of the areas of knowledge of rural women, which have a high potential to save fuel (Author's personal observation).

In addition, there is very little research directly focusing on women and renewable energy but there are a number of cases where women are involved in the development of energy (Cecelski, 2000). Despite the fact that research has indicated that most of energy project failure is not related to lack of technologies, but rather, to institutional, socioeconomic and cultural, the continued belief of policy makers, even in their recent work on energy and efficiency, is on 'technical fixes' which will solve energy and environmental problems (2000: 32).

Cecelski further argues that women have been better extension workers than men when they are trained for maintaining energy systems such as water pumping. In addition, women have also become successful in involving themselves in decision-making and management of energy use and development. The economic framework for including human energy and health externalities will help women to be included in the energy sector. Overall, Cecelski (2000: 36) points out that excluding women from energy sector does not only hamper women but such energy projects will not be completely successful.

Conclusion

GAD theory has a prominent place in my research, since I am focusing on rural energy problems from a gender perspective. The GAD approach has been used to describe the dynamics and structure of gender relations and complex processes that include social, economic, political, and cultural aspects of rural energy planning.

Identification of practical and strategic gender needs and interests can lead to strategies for the empowerment of women. Rural women have practical gender needs to fulfill their immediate basic needs for living, and they look for strategic gender needs to fulfill their higher-level needs such as gaining self-esteem, freedom, and confidence. In the context of rural energy planning, identification of practical and strategic gender needs and interests is very important to ensure that rural women have met their basic household energy requirements, and pursued their strategic gender needs such as having time to become involved in some socioeconomic activities to increase their independence and confidence.

Gender analysis is perceived as an important tool for understanding the roles, interests, needs and priorities of men and women and the possible impact of projects on men and women. It helps to identify the opportunities and constraints in rural energy planning. Men and women have different roles, interest and needs, and these differences must be taken into account when considering any sort of energy intervention in rural areas. Since rural energy technologies have a direct impact on women's time and workload, there is a need for an appreciation of gender issues in rural energy planning.

Nyoni (1997) argues in favor of the following points in order to ensure that the women are not disadvantaged by the energy projects. a) women take part in decision making, b) women acquire benefits that are adequate remunerations for their inputs, and c) women have enough time to participate in energy projects without adding to their daily burdens. When implementing an energy project with a gender approach in mind, it should be ensured that each and every aspect of the project has been viewed from a gender lens and that women are equally involved in and benefit from it.

Chapter Three
Rural Energy: Issues and Options for Sustainable Development

> Women's survival tasks, with the exception of cooking, have been largely invisible in the energy literature: an electric pump that transports water uses energy, but a woman carrying water does not. A water mill grinding grain falls within the energy sector, but a woman doing the same task with mortar and pestle does not. Trucks transporting crops are consuming fossil fuels, but women head loading crops walk outside the energy balance.
>
> (Cecelski, 1995: 565)

As the focus of this thesis is on the gendered implications of rural energy technologies in the rural hills of Nepal, it is important to review rural energy issues in developing countries in general and within the Nepal's perspective. Since rural energy plays a central role in the development of the rural economy, issues and options associated with rural energy technologies are important factors to be considered. Many developing countries have experienced a variety of obstacles with the demonstration and the dissemination of rural energy technologies such as biogas, micro hydro schemes, improved cooking stoves and solar photovoltaic systems in demonstration villages or pilot projects. So far the application of such technologies has not been motivated by sustainability concerns, rather, planners have opted for them as alternative technologies for socio-economic development (Hommes and Hulscher, 1992: 528). However, the use of alternative energy technologies as substitutes for biomass energy (the use of which remains unsustainable around the third world), must address sustainability issues.

This study also aims to compare the socio-economic and gender implications of traditional and alternative energy technologies in Nepal, thus both types of technologies will be briefly introduced in the following sections.

Energy and Sustainable Development

In today's developing world, interventions have been targeted at economic growth while overexploiting the local natural resources, which has less or is of no benefits to the local communities. This has negative implication on addressing poverty and sustainable development. For instance, government supported logging activities in Malaysia threatened the livelihood of the communities of the rainforests in Sarawak, while the benefits were channeled to elites outside the region. These experiences were repeated in India, Thailand, Philippines, and Brazil (Vivian, 1992). Similarly, construction of big hydro-dams usually have many negative impacts on the local community as they destroy their settlements, the local vegetation, bio-system, and the whole socio-economic settings as is the case with Theun Hinboun project in Laos and on-going dam projects along the upper branches of the Mekong in China (Kazmin and Penh, 2002). Such projects have led to support for the concept of sustainable development.

Sustainable development was originally used to emphasize the need for economic growth, without placing too much pressure on the environment (Mak and Shearer, 1996). However, development means more than economic growth and thus sustainable development should include maintaining the economic, social, institutional, and political basis for improving human welfare (Munasinghe and McNeely, 1995). The World Commission on Environment and Development (WCED) defined sustainable development as the 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987: 43). Development without having any adverse impact on future generations, however, poses huge challenges. These are complex but needed to be understood to realize the opportunities for sustainable development (Elliott, 1999). Changes in thinking on 'what constitute development and how best to achieve it, and changing ideas about the environment' are of specific importance (1999: 10). Supporting the concept from WCED, Friedmann (1992:124) has emphasized 'intergenerational equity or fairness in the distribution of environmental costs and benefits'. His notion of an alternative development respects the 'traditions of territorial communities, and historical continuity' that indicates individual and collective identity (1992:124). Friedmann's alternative development challenges the development paradigm in the form of 'neo-liberalism' as supported by many donors and multilateral institutions such as the World Bank. The neo-liberal model emphasizes 'market-led growth, increased savings and private investment based on high profits, low wages; gradual industrialization, and outward-oriented development' (Brohman, 1996:31). These set of policies are regulated by the multilateral institutions, which exert global governance without considering the socio-cultural circumstances of the recipient countries (Hartwick and Peet, 2003:189). Neo-liberalism is a 'powerful means of simplifying complex social processes of development' (Brohman, 1996:31). However, such development excludes much of the developing world, which is based on subsistence economy, or landless rural workers and rapidly growing numbers of urban laborers, who strive for equity and justice (Friedmann, 1992:14). Although used as a new development strategy, neo-liberalism still follows the capitalist path of development ignoring the diverse contexts of development (Brohman, 1995; Mehmet, 1995; Wylie, 2000). Economic growth characterized by a handful of quantitative indicators (based on global market conditions) can not be sustainable unless it considers the other economic, social, cultural, environmental and political factors of the country, that have a prominent effect in most third world economies. Thus a growing concern is on the effectiveness of neo-liberal growth in resolving the development problems in the third world and the devastating effect of 'unlimited and unregulated economic growth on the global and regional natural environments'(Hartwick and Peet, 2003: 189).

Rees (1990) argues that the economy is an integral part of the biosphere and thus development is not sustainable if it fails to recognize the reality of ecological limits, which determine the carrying capacity of future development (1990: 49). Thus, sustainable development is a situation, when economic interventions must be responsive to ecological factors, and use of resources is minimized. A pragmatic approach is required in the design of new development projects, which advocates the need for environmental assessment and environmental economics (Adams, 1995).

Barbier (1987) emphasizes that in addition to environmental and economic dimensions of sustainable development, there are social dimensions. Contrary to the conventional emphasis of economic development, which is 'output' oriented, Barbier argues that the process of transformations (ecological, political, social, and cultural) is even more important, which contributes to production and distribution of output. The quantitative (economic gain) and qualitative dimensions (process of changes) are 'inseparable and mutually reinforcing' for sustainable economic development (Barbier, 1987:54). This concept demands a trade off between economic, ecological and social systems in order to maximize the goals towards sustainable development. The economic system for instance, has a goal of 'meeting basic needs, enhancing equity, and increasing goods and services'. The biological system sets its goals as 'genetic diversity, resilience, and biological productivity' and finally the social system aims at 'cultural diversity, institutional sustainability, social justice and participation' (Barbier, 1987:55). It is important to prioritize the goals that need maximum weight in a given circumstance. For instance, social justice and participation may require highest attention in a community, where people are strongly organized, while basic needs might need to be focused in another community where people are still striving for survival (Chambers, 1986; Muntemba, 1985; Pearce, 1986).

The poor find it difficult to trade-off in their search for livelihoods (Chambers, 1986): 'they know that cutting down trees will cause water shortages and that making charcoal can cause forest fires, but they have little choice' (Keeble, 2002: 8). A poor woman can not think about preserving the forest, while she has no fuel to cook to satisfy the hunger of her family. She looks for firewood that is freely available in the forest.

Nevertheless, many rural dwellers have more concerns in preserving the natural resources on which their livelihoods are based (Vivian, 1992). It is thus essential to recognize indigenous skills and 'traditional resource management practices' in relation to sustainable development (Vivian, 1992: 78). External projects that work for local development must incorporate the concerns, and activities of grassroots organizations, so that such projects can be 'self sustaining and self-replicating' (1992: 78). This requires people's participation. 'True participation goes much beyond the mere provision of labor and other inputs into projects initiated from outside the community' in order to ensure effective use of traditional knowledge and technologies (Vivian, 1992:77). It ensures the active involvement of local people in policy and plan formulation, implementation and decision-making processes of the project activities.

To sum up the views of different scholars, sustainable development is a process of growth that best satisfies all ecological, economic and social conditions of development. Hence, it is 'an equitable, empowering, need oriented, self-reliant, environmentally sound and economically viable process of growth' (Shailaja, 2000: 45).

No doubt, energy is a key input for sustainable development. However, energy is not an end in itself, but rather a means to achieve the goal of sustainable human development (Kartha and Larson, 2000: 27). Hence, growth can not be ensured with the availability of energy, but with quality of energy services that emphasize efficiency, equitable social distribution, and minimum environmental impact (Mak and Shearer, 1996: 293).

Energy use has multiple social dimensions, such as poverty alleviation, population growth, urbanization, and lack of opportunities for women (Johansson and Goldemberg, 2002). Recognition of a close connection between energy-use and social issues emphasizes how energy can be a means of achieving social justice, which also addresses the power relation between men and women (Makhabane, 2002a). At present, energy use patterns are skewed to the conventional energy sources, which do not only hamper the economic growth and conservation of environment, but also lead to increased social and gender inequities (Shailaja, 2000). For instance, depletion of biomass resources at a rapid rate has more negative impact on women than men in terms of increasing their drudgery in household energy management. The current level of energy consumption and production threatens the ecosystem, economic growth, and human survival. Johansson and Goldemberg, (2002: 34) discuss these points:

- 'modern energy services and electricity are not universally accessible, an inequity that has moral, political, and practical dimensions,
- the current energy system is not sufficiently reliable or affordable to support wide economic growth,
- negative local, regional and global environmental impacts of energy production and use threaten the health and well being of current and future generations'.

These issues present a global challenge.

There is a growing acceptance of the need for sustainable development policies in the energy sector in order to address economic growth in harmony with social equity and protection of the environment (UNDP, 2000). This view requires that energy policies are to be more focused on the services from energy than the energy itself (Clancy, Skutsch and Batchelor, 2003). For instance, energy services have to be accessible, reliable, and affordable particularly to the poorest. In addition, it is also important to demonstrate the choices and options of energy uses to the energy users. The conventional strategies are large-scale, supply oriented, and are fossil-intensive. They do not address the needs of the poor (Kartha, and Larson, 2000). Energy services in the past focused on technical and economic issues and more recently on environmental aspects of energy, with social concerns received little attention. In order to establish a balance, it is essential to consider all economic, social and environmental factors in parallel and use a 'people-centered approach looking at how energy affects people's lives' (Keeble, 2002: 8). Alternative energy strategies that address multiple social issues are required to develop a sustainable rural energy system and to help reduce poverty.

Rural Energy Issues in Developing Countries

The majority of people in developing countries live in villages or in small towns. Biomass fuels (firewood, wood residues, agricultural residue and animal dung) are the dominant domestic fuels for most rural people in developing countries. One third of all energy consumed in the developing world comes from biomass (World Bank, 1996a). Recent research results indicate that 80 percent of all households in the developing countries depend on wood as their primary source of energy (FAO, 2000). The use of traditional fuels (primarily firewood) in Nepal ranges between 70 and 90 percent, while in China it is less than 25 percent and in Bangladesh, India and Pakistan it ranges between 50 and 60 percent (Rijal, 1998a: 1).

Modem commercial energy sources, such as electricity and petroleum-based fuels, generally provide a small part of energy consumed by rural people, mainly because of supply and affordability constraints. The new and renewable energy sources (such as biogas, power from micro hydro plants) contribute only a small fraction of the energy consumed in most developing countries despite their promising potential. Over the years, rural energy systems have begun to place increasing pressure on the natural resources threatening the sustainability of such resources due to increased energy demand as a consequence of high population growth in developing countries (Schandorf, 1993: 15).

In addition to satisfying domestic energy requirements, biomass fuels are used in supplying energy for many rural industries such as brick kilns, lime kilns, drying tea and tobacco, smithies, potteries, and various village handicrafts (AIT, 1984; FAO, 1984). Similarly, biomass also provides many people in the developing world with a livelihood. In Africa alone, the production and marketing of fuels (firewood and charcoal) is a $5 billion business that employs more than 400,000 people (Douglas, Robert and Willem, 1997:3).

Energy demand in rural areas can be categorized into two purposes: domestic requirements and economic activities. Subsistence energy for the domestic sector dominates rural energy needs while energy demands for economic activities include agriculture and small-scale activities. The basic energy requirement of rural households includes energy needs for cooking, lighting, and space heating. Additional energy service needs that economic activities might require are for tilling, irrigation, post-harvest processing, milling, and processing heat (Rijal, 1998a).

Wood and other traditional fuels such as dung have numerous disadvantages however. They are far less efficient than other energy resources. For instance, a kilogram of wood generates only one-tenth of the heat yielded by a kilogram of liquid petroleum gas (LPG). Moreover, burning these types of fuels in an enclosed, poorly ventilated space presents a major health hazard. According to some estimates, smoke contributes to acute respiratory diseases that affect 4 million infant and children a year (World Bank, 1998a: 5). Studies have shown that nonsmoking women in India and Nepal who have cooked on biomass stoves for many years have a higher than normal incidence of chronic respiratory disease (Douglas and Willem, 1999). A recent study conducted by WHO indicated that respiratory diseases are the main cause of death in developing countries and domestic smoke pollution is the major contributing factor (Bruce, Padilla, and Albalak, 2002). A study in Gambia found that children who were carried on their mother's back as women cooked in smoky huts were six times more likely to develop acute respiratory illness than other children (World Bank, 1998a: 5). A study conducted in Nepal indicated that children under the age of two have an incidence and severity of acute respiratory infection (ARI) each week for six months. It also indicated the strong relationship between the maternally reported number of hours per day the children spent by the fire and the incidence of moderate and severe ARI cases (Pandey, 1989).

Women are the first and direct victims of health hazards with the use of biomass and the children and other family members follow (FAO, 2000). A study in Addis Ababa indicated that, carrying the heavy load of firewood from distant forests resulted in miscarriages, bone fracture, anemia, headaches, and chest pain in about 10000 women who supply one third of firewood consumed in the city (Haile, 1991). Physical and psychological violence against women can also be related to energy systems in some circumstances, where firewood must be collected in areas of civil disturbances. For instance, there are a number of documented cases of Somali refugee women being raped while gathering firewood around camps bordering the Somali-Kenyan border (Reddy, Williams, and Johansson, 1997). There are cases in India, where women committed suicide as a result of the physical and verbal abuses they receive due to their inability to meet their family's wood fuel requirement (Agrawal, 1986).

The use of wood fuel has also become critical due to scarcity caused mainly by commercial logging, firewood collection, and conversion of forests for agricultural farming and pasture. This has led to deforestation, soil erosion, and reduced soil fertility. Deforestation in turn, has forced many poor people to resort to even less efficient sources of energy, such as crop residues and dung materials that could otherwise have been used for fertilizer. Due to firewood scarcity, there typically is a price rise thus reducing access to firewood, which causes an increase in women's work (FAO, 2000: 6). Many children and adults, mainly females in developing countries, must spend up to several hours per day gathering fuel. This leaves less time for schooling and productive activities and thus perpetuates poverty (Ramani, 1988: 4). As indicated earlier, women and children in the third world suffer from different kinds of respiratory diseases and eye problems due to the use of low quality biomass fuels (FAO, 2000; World Bank, 1998a; Pandey, 1989).

In addition to household energy needs, there is an increasing demand for energy in developing countries for the provision of rural services such as water supply, health care and education, and for productive activities such as agriculture and small industries. Households are the major consumers of energy, their share of gross rural energy consumption averaging 85 percent. Most of this is consumed in the form of traditional energy sources used for cooking and constitutes 80 to 90 percent of the energy used by households (Farhar, 1999; Parikh and Laxmi, 2000). Agricultural activities consume between 2 to 8 percent of the total, depending on levels of mechanization, and mainly in the form of commercial energy used to power mechanical equipment. The energy consumption of rural industries, both cottage and village level enterprises, amounts to less than 10 percent of the rural aggregate in most countries. Firewood and agricultural residues constitute the principal sources of supply for these activities. Access to electricity in rural areas remains low in most countries. For instance, in Asia, the regional average is 48 percent, with the lowest rate of access in Nepal (2 %) and the highest in China and Malaysia (both 80 %). The use of electricity in rural households is confined mainly to lighting, the share of which forms only about 10 percent of the aggregate, rural energy consumption (WEC, 1998).

Goldemberg and Johanson (1995) argue that energy use has a positive impact on development and improvements in living standards. Energy is essential for economic and social development as it offers opportunities for economic and social activities. For instance, rural electrification provides access to services such as grain milling, street lighting, water pumping, and provision for better health and education services. Reliable and adequate energy supplies do not guarantee economic growth and employment generation, and their absence often prevents growth (SEI, 1999: 5). Households make choices among energy options on the basis of both the household's socio-economic characteristics and the attributes of the alternative energy options. The substantial difference in energy consumption between low and higher income households has been attributed to the fact that the households under poverty primarily use energy only for cooking, unlike the wealthier households who use the energy for various purposes including cooking, space heating and lighting (Reddy, Williams, and Johansson, 1997). Income is the dominating force in choosing an energy option and the relevant attributes of alternative energy options are accessibility, convenience, controllability, cleanliness, current cost and expected distribution of future costs (Leach, 1992; Reddy and Reddy, 1994).

Development in the third world is not possible unless the rural areas occupying a major portion of the countries are facilitated with basic infrastructure like energy for household needs, agricultural production and for small-scale activities. Energy is not only necessary for survival, but is also a critical factor affecting economic and social development. It is the women, who bear all the responsibilities to collect and manage the biomass fuels for household energy requirements in rural areas. Energy is directly related to women's work as they are the primary users and producers of traditional biomass fuels, providers of human energy, and the victims of energy scarcity, environmental damage, and technological changes (Cecelski, 1995; Grace and Arnoux, 1998; Skutsch, 1998). Hence, women's crucial role in the development process should not be ignored. Women have practical interests and applied expertise in the burning properties of different fuels, fire and heat management, fuel saving techniques, and advantages and disadvantages of different fuels and stoves (Cecelski, 1995; Kelkar, 1995). On the other hand, with adequate and efficient supplies of energy in rural areas, women could have more time and opportunities to be involved in various kinds of socio-economic activities leading to better quality of life of not only women but their families. Modern energy services can ensure the sustainable livelihoods of the rural population by increasing entrepreneurship opportunities especially for women (Clancy, Skutsch and Batchelor, 2003).

Since the increased use of biomass resources has negative socio-economic and environmental implications, many developing countries have started to divert their investment to a modern energy sector. Different kinds of renewable energy technologies have been introduced as alternative sources of energy in developing countries since the 1940s. The micro hydro plant is particularly important for rural electrification, while the biogas system is widely used for cooking and household lighting as well. Improved cooking stoves provide an alternative for household cooking and are mainly intended to save fuel wood. Solar energy in the form of solar photovoltaic and solar thermal systems is used for irrigation, telecommunication, water heating, cooking, and drying vegetables. Contrary to the conventional energy sources such as fossil fuels, coal and petroleum, and large hydroelectric sources, the renewable energy technologies are considered as a means towards sustainable energy systems.

The use of renewable energy technologies in South Asia is extensive, where more than

80 percent people live in rural areas, while in most ASEAN countries rural areas are mostly electrified. Among the various technologies in application, photovoltaic and micro-hydro systems have made a significant contribution in the ASEAN region, among which Indonesia and Thailand are the lead countries followed by Philippines, Vietnam and Malaysia. The scope of wind power in Southeast Asia is not very optimistic except in some islands because of the poor wind profiles (Timilsina, Lefevre and Cabrera, 1998:123).

Renewable energy technologies however, require special attention from policy makers in order to use them as better alternatives for rural energy development. Past experience tells us that the alternative energies are far from meeting the large demands of rural energy (Takase, 1997). On the one hand, rural people have difficulty in affording this type of energy, and there is a problem in its acceptability as well. This may be attributed to the approaches in dissemination and diffusion of rural energy technologies. Studies in the past have revealed that investment in the energy sector has been driven by the motive of economic growth ignoring other variables, which have greater linkages to the demand side (Pachauri, 1983: 217). Experience suggests that while determining the feasibility or adaptability of a particular technology, it is important to consider the priorities of the local people and bring about an integration of various development programs. For instance, an improved cooking stove program can be effectively combined with rural housing programs making it mandatory for all newly constructed houses to install these devices as a part of the design (TERI, 1992).

There is low priority placed on research and development by agencies implementing renewable energy technologies. Similarly, the problem also lies in a subsidy provided by government and donor agencies, which in many cases is most accessible to the higher-income households. For instance, a subsidy on electricity charges is only beneficial to those groups who can afford to pay the initial installment cost to have access to electricity. The initial costs associated with getting access to modern sources of energy are often very high for the rural poor who are typically unable to obtain credit (Douglas, Robert and Floor, 1997:8).

Lack of involvement of local communities, especially women, in planning, implementation and follow up of aspects of rural energy programs have been identified as important reasons for the inconsistent performance of these programs (TERI, 1998). Women's participation/involvement in any socio-economic activity and public sphere has become a part of existing socio-cultural values, which rarely encourage women to be an active member of the community/society (Dutta, 1997). Since rural women are rarely provided education and training in modern sector employment, their involvement in such activities is naturally limited (Boserup, 1970). If local communities are to contribute significantly and find sustainable solutions to their energy related concerns, there is a need to build capacities at the grassroots level in terms of creating awareness regarding energy issues, and developing technical and managerial expertise to plan and manage programs effectively (TERI, 1998). At the same time, local communities need to be made aware of gender issues, and the importance of women's participation in energy related activities to facilitate women's active participation in rural energy programs.

It is necessary to identify and analyze rural energy issues and problems in various countries, as they will have significant effects on gender and the socio-economic aspects of rural energy technologies.

Rural Energy Technologies: Challenges and Options

> Energy availability both by quantity and quality is a key determinant of the economic productivity of most human systems. The real contributions of energy resources in a sustainable development framework, to a greater extent, involve more complex issues, particularly with regard to the nature and degree of technological involvement (Osei, 1996:63).

Dependence on traditional fuels by more than 90 percent of people living in rural areas will no longer remain a reality, with its present usage level (WEC, 1999). Since much traditional energy is used outside the commercial sector, the volume of use remains invisible. This statistical invisibility of energy use hampers the development of an effective policy. The lack of institutional support found in most developing countries is partly a result of the fact that rural energy demand and supply are often not even included in energy statistics and balances (WEC, 1998).

Most developing countries rely on imported technology as the core of most new and emerging technologies, which involves a high initial cost. Many developing economies seek and adopt new technologies in order to become part of the global socio-economic system (Takase, 1997). The alternative energy sector could be more beneficial to many developing economies because of its relative universal accessibility and ease of decentralization of facilities. However, alternative energy technologies still have high costs in terms of initial investment as well as the regular cost of energy as compared to conventional ones (Dutta, 1998: 72). This is because conventional energy like firewood is freely available or low cost, although its depletion has a long-term negative effect.

The problem is that rural customers often are not able to get affordable credit, which makes it difficult to pay the high start up costs of improving their energy supplies (World Bank, 1998a: 9). A saving and credit scheme to mobilize local savings could help group members to accessing credit. However, rural credit facilities should essentially be integrated in rural energy programs in order to widen the financing of energy technologies as well as to support energy related micro enterprises. For instance, Grameen Bank in Bangladesh and Small Farmers Development Program in Nepal aim to lend poor women and small farmers respectively (Uphoff, Esman and Krishna, 1998). Such organizations are also using micro credit to support rural energy finance partnering with energy organizations (Farhar, 2000).

Many renewable energy technology initiatives sponsored by governments tend to address problems perceived by governments and include issues such as conserving foreign currency. Rural people rarely have a say in the design of such projects. Projects conceived without carefully consulting the intended recipients and beneficiaries face serious acceptance problems (Barnett, 1990: Jacobsson and Johnson, 2000; Malhotra, Dutta, and Venkanta, 1998). The priorities of rural communities, particularly the women, for whom rural energy technologies are designed and developed, must be known clearly, in order to develop appropriate solutions. The gender dimension in rural energy interventions is very important, requiring consideration of different implications of such interventions on men and women (Makhabane, 2002a; Skutsch, 1998). For instance, in Ghana, men benefited from bio gas generated electricity which enabled them to watching TV, and listen to music, whereas the women used the power for night time cooking, sewing and weaving, selling food at night, and also socializing in the church (Mensah, 2000). Too often, bureaucrats conceive projects, or donors offer readymade projects with the aim to demonstrate specific technologies or approaches. Due to the absence of well-articulated rural energy policies, the government lacks the necessary screening mechanisms to judge where aid could be most appropriately deployed (WEC, 1998). As a result, such projects will collapse after the donor's support is terminated. For instance, a few solar photovoltaic power supply for a remote clinic at Marymount Mission in Zimbabwe in the early eighties collapsed when weaned from donor support (Mapako, 1997).

If programs are to be self-sustaining, there must be a critical mass of users sufficient to support a repair service and willing to pay the necessary cost to keep their equipment in action (SEI, 1999:11). This is a major problem with rural energy technologies (mainly with the application of various micro hydro components) in many developing countries. In line with neo-liberalism, Kartha and Larson (2000) argue that modern energy services help people to increase productivity by improving their physical and mental capacity, and this, in turn enable them to pay for energy and services. However, a great challenge for energy planners is to identify the strategies that will really help satisfy the local needs. Any kind of energy intervention in rural areas should give due emphasis to the socio-cultural aspects of the communities, the bio-physical aspects of the area as well as their technical, financial, economic and environmental suitability (Rijal, 1998b: 116). The rural energy projects should be evaluated on the basis of their replicability in order to maximize their impact. This is a criterion that is rarely pursued as a principal objective of many projects (WEC, 1998).

The success of rural energy technologies often depends upon the dissemination and diffusion of strategies and approaches. A necessary condition for the development and diffusion of a new technology is that the knowledge base is increased by means of experiment. However, the existing competence levels, networks, and institutions actually hinder this process (Carlsson and Jacobsson, 1997). The existing systems may be 'locked in' to the established technologies due to the high dependency of innovation, and actors may therefore, not look for opportunities outside their traditional areas (Jacobsson and Johnson, 2000: 633).

Most often, the programs have strong leadership from central government and are characterized by a 'top down' rather than a 'participatory' approach. For example, the Chinese Biogas Program in 1950, and the Indian Biogas Program in 1978 characterized this type of diffusion where government agencies had chosen a technology and tried to generate campaigns for mass construction of it (Barnett, 1990:546). This practice still exists in many parts of the developing countries. A great effort must be made to understand the impact of macro policy environment on the introduction of technology and harmonize the diffusion strategy with local physical, human and institutional resources. Specific actions should be planned accordingly to build local technical and institutional capabilities so as to ensure the successful diffusion of rural energy technologies (Barnett, 1990:551). As stated earlier, participation of local communities in the design and delivery of energy services and also in financing the rural energy technologies can contribute to their sustainability (World Bank, 1998b: 4). Participation of the local community can be ensured through encouraging involvement of groups, which represent the rural poor. The 'Village Development Society' formed to manage the community biogas digesters in Karnataka, is a good example of community participation (Kartha and larson, 2000).

One of the reasons for the slow rate of diffusion of AETs in many developing countries is the high front–end cost (Mathur, 1997: 253). As discussed earlier, only the high-income families can have ready access to such technologies. This problem could be solved through proper credit mechanism, lower cost equipment and lower service requirements (Mathur, 1997).

The problems of rural energy can not be dealt with in isolation. Poverty and dependence on biomass go hand in hand (World Bank, 1998a). As household incomes rise, people normally switch to modem fuels, if these are available. Higher income countries also depend much less on bio fuels than the poor countries. In line with the World Bank neo-liberal stance, it is argued that the best schemes for improving rural energy may sometimes fail if other policies prevent economic growth. For instance, subsidies on energy consumption tend to benefit rich people more than the poor. A recent World Bank study of seven countries showed that high-income households benefit disproportionately from the subsidies, largely because they use more electricity. For instance, liquid petroleum gas (LPG) in Hyderbad, India was subsidized in 1980 but only the richest 10 percent of households could use it (World Bank, 1998a: 9). This was because it was only affordable by those groups due to the high device costs. Donor agencies, especially the World Bank have been vocal in arguing for better financial management in the energy sector and price reform in particular. In some cases, improved competition in the energy sector has led to falling prices for modern fuels making them affordable to low income households (SEI, 1999:18). Rural energy interventions sometimes fails to address the needs of the very poor, because they are designed to focus on improving overall energy efficiency and increase economic growth.

Proper management of rural energy technologies in terms of planning, implementation, monitoring and evaluation is another important issue for the sustainable development of rural energy. The 'bottom up' approach in management of rural energy technologies does not only increase their diffusion rate, but also increases the sustainability of such technologies. Thus, both a decentralized planning process and an area-based approach are best able to address local needs and maximum use of locally available resources (Kaushik and Verma, 1996). It is also important to diversify the institutional base for project formulation, and implementation, with special attention being paid to rural communities particularly the women, and the private sector (WEC, 1998). For instance, different local institutions can come up with different energy projects suitable to the local community.

There exist many opportunities for cooperation in the rural energy sector, and many donors and international agencies are involved in providing financial, technical and managerial assistance for promotion and development of rural energy technologies. However, there seems to be a big communications gap among the agencies. For instance, the sector or project work may be driven by agendas established by a particular aid or development agency without much cross-communication and exchange of experience amongst the donors and external development agencies (WEC, 1998). Similarly, between donors and governments, there is still insufficient recognition of the fact that any motive for radical policy change and new approaches can not succeed without stakeholders arriving at consensus. Due to this reason, the recipient government sees the changes as externally imposed conditions leading to frustration on all sides (World Bank, 1996a). The multilateral development agencies such as UNDP, and the World Bank, can help to facilitate a more coordinated and integrated approach on the part of donors and other external development agencies by creating a good policy environment. The multilateral agencies for example, can facilitate a positive relationship between the government and donors. The responsibilities of government and the donors should be made clear for any new program intervention. For instance, grants from donors for rural energy technologies should be supported by appropriate rural energy policies at national level and proper allocation of resources at the local level.

The other argument for increasing donor assistance for national capacity building particularly in policy formulation is that the international and development community should be sensitive to the articulated needs of developing countries (WEC, 1998). There needs to be an open two-way flow of information. At the same time, the government should decentralize the rural energy planning and allow the rural population to express their needs. The national and local NGOs can play an important role in communicating and articulating the need of the people to the government.

However, the real solution is for greater inclusion of rural people themselves in the decision-making processes that affect them. The World Bank (1998a: 11) states that local input is vital to success. Local people understand their situation better than others. Donors and other development agencies can assist in the management of this change by playing the role of catalyst/facilitator.

Governments, non-government organizations, donors, and international development agencies can all play an important role in the development of rural energy. The government with the help of donors can initiate the development of infrastructure at the village level to allow access to energy resources, and to provide credit facilities and subsidies through a rural banking system. Non-government and community organizations (NGOs) can serve as catalysts for facilitating the process of local capacity building in order to develop technical and managerial expertise of local people to plan and manage their programs effectively. Donors and international agencies are a big support for funding and promoting the technology.

In most countries, no government agency takes the primary responsibility for rural energy needs. Few resources are devoted to data collection and analysis, two important steps in developing rural energy policies and strategies. The multi-lateral development agencies can play an important role in bringing rural energy into general policy dialogue with discussions around development, and by co-financing investments in the sector. Another vital area for greater coordination and cooperation is in the stimulation of research and development (R&D) for the rural energy sector. Lack of adequate information about the rural energy sector and energy database is a serious constraint intervening at various stages of the rural energy planning process (Hills, 1988; Kartha and Larson, 2000). There is a clear need for R&D effort on technologies suitable for rural energy supply and use. Therefore, considerable investment should be made in research and development for understanding the needs of potential users and to consider a wider range of options for meeting each of these needs (UNDP, 2000).

Rural Energy Policies in Developing Countries

The free-market policies of the industrialized world place emphasis on 'profitability as a bottom line' of the energy sector exploiting the energy resources of third world countries to support their large-scale energy intensive production (Laing and Rosseli, 1999). This has worsened the energy-development situation in the third world. Promoting balanced economic growth through the supply of least cost energy is the basic element of energy policy in most developed countries, while third world countries can not rely on this policy of economic growth due to their complex processes of development (Pachauri, 1983). Yet, national energy plans in developing countries is based on a 'sectoral approach, which is centered around fuel supplies' without considering the nature of energy needs and demands (Hulscher and Hommes, 1992: 528).

The energy sector absorbs a large share of national investment in developing countries (Parikh, 1995: 745). Until recently, this investment has not been sufficient to meet basic needs and amenities. In many developing countries, energy policies in the past were mainly focused on urban and industrial development, increasing supplies of electricity through construction of large, centralized power plants, long-range electrical distribution lines and on procuring sufficient supplies of liquid fuels (UNDP, 2000). Meanwhile, the energy needs of rural households, farmers, and small businesses were given less priority. However, joint pressures from social, environmental and market forces have led to new perspectives on energy policies, that promote greater attention to the social dimensions of energy decision-making.

As mentioned earlier, more than 2 billion people in developing countries, particularly in rural areas, are still using traditional fuels, such as wood, charcoal and dung for cooking because they lack basic modern energy services. The lack of modern energy services seriously restrict the people's ability to improve their living situations, or even to meet their subsistence needs (World Bank, 1996a). Energy policies in developing countries have mostly been directed towards sustaining economic growth particularly fulfilling urban industrial needs rather than fulfilling basic energy needs of the poor people or reducing drudgery (Rijal, 1998b). Even policies for rural energy intervention are driven to increase the energy accessibility and efficiency for rural people in line with the neo-liberal model of development. In this sense, rural energy technologies are mainly directed at increasing supply of energy and reducing the consumption of fuel (Pachauri, 1983).

Electricity supply in developing countries is often characterized by poor quality and frequent shortages or failures. For instance, in India irregular and curtailed electricity supply in the past caused an increase in annual consumption of electricity (SEI, 1999). A study has found that the cost of unreliability in electricity supply to the industrial sector in India has been estimated to be at least one percent of GNP (World Bank, 1993). Hence, rural energy intervention should be more focused on sustainability considering its multiple environmental and social costs (SEI, 1999).

Energy issues are complex and linked to policies and multiple economic sectors and national conditions. This complexity is even greater when the distinct economic and social roles of men and women and their diverse energy needs are taken into account. Many governments have included the idea of promoting decentralized renewable energy technologies in their national energy policies. The focus has been on the supply side with little attention to the energy demand characteristics of women and rural communities (Misana, 2001). In addition, energy policy formulation and planning mostly takes place at the national level in a top down manner without representation from the local level and a gender perspective is often neglected (Clancy, 1999).

However, in some parts of Africa, like Malawi, local rural energy activities were aligned with the national policy environment. With a decentralized national policy, community development committees were engaged in introducing briquette-making technology, and provide training to women's groups on the same (Mabona, 2001). The government policies of South Africa, revealed the need for gender sensitivity and also showed the importance of integrating energy with other development sectors, so that women could own the land, obtain rights to crops and have access to financial resources (Makan, 1994).

In most of the countries in Latin America, emphasis was given to energy supply programs in rural areas with the use of renewable resources (OLADE, 1999). In Latin America and the Caribbean, renewable energy such as solar, wind and geothermal power are reliable sources, which can be profitably exploited for rural electrification and production. However, there is a need for more energy projects in rural areas (Thomas, 1998).

The national policy for developing rural energy in China states that policies should be framed according to local conditions and various forms of energy should be exploited based on their local availability. So far the main constraints to the development of alternative energy technologies (AETs) in China are lack of; regional focus, technical personnel, local level financing institutions, attention from local governments and public awareness (Mengjie, Gehua, Mingsong, and Yi, 1999). In India, development of AETs was encouraged through mobilization of institutional financing, and private sector investment through development of entrepreneurship and incentives reflecting the neo-liberal policies of development. The major policy emphasis was to encourage market development, women's participation, minimize subsidies for fossil fuels, and reduce the existing price distortion between renewable and conventional energy sources (Rijal, 1999a: 43). Recently, in the Eighth Plan, importance has been given to long term integrated planning with emphasis on energy end use as well as on an efficient strategy for long-term energy supply (Bansal, 1999: 95).

In Pakistan, there is no clear-cut and comprehensive national policy for the development of AETs. AETs appear more expensive than energy from conventional technologies; and the country lacks the institutional capacity for planning, developing, and financing more innovative AETs (Rijal, 1998a:18). The eighth planning document includes discussion about the development of biomass energy by increasing the availability of biomass, using it effectively, and increasing the market structure for fuel wood and crop residue. However, there are no adequate policies to promote decentralized renewable energy systems or end use appliances. Policies were mainly directed to reduce the consumption of fuel wood (Abdullah and Rijal, 1999).

In Nepal, consideration was given to development of AETs in the Eighth Plan (NPC, 1992). However, inconsistent government policies have restricted the development of such technologies. For instance, the existing tariff policies have raised the cost of micro-hydro projects in Nepal, since duties are levied on alternators required for micro-hydro generators, whereas there is no duty on diesel generator sets (Rijal, 1998c). There is a clear national policy framework to support decentralized micro hydro systems to meet rural energy needs. Supportive policies are also there in relation to financing and credit availability as an essential element to support decentralized systems. However, there is a lack of coordination between different levels of government and between different sectors and gender concerns have been particularly absent in the past (Misana, 2001). In addition, the policy statements are not supported by appropriate institutional and financial requirements in terms of program and budgetary requirements (Rijal, 1998a). Specific information on Nepal's policies on rural energy is discussed in Chapter Six.

Gender Perspectives in Rural Energy Policies and Programs

Although most policy makers view energy policies as gender neutral, the fact is that men and women are affected differently by energy policies since their work roles differ, as is the case in many developing countries (Skutsch, 1996). Energy poverty has a disproportionate effect on women and girls especially in rural areas. For instance, with the increased burden on women, daughters are forced to drop out from the school to assist with household activities, limiting their opportunities to move forward through education and increasing the likelihood of family poverty (Cecelski, 2000; Clancy, 1999). Rural energy needs for domestic, agricultural and small scale, informal production activities, where women predominate, are given less priority (Skutsch, 1996).

National energy policies in Latin America, have given emphasis on environmental and economic factors while women's needs and concerns are still to be incorporated (Branco, 2002). It is the same in South East Asia, where energy policies mostly focus on the production aspect and women's energy needs are not adequately addressed. Energy policies have not recognized the agents who contribute to sustainable utilization of energy (Polestico, 2002). Parikh (2002) argues that present energy policies in India and other South Asian countries are still not responsive to women's needs although there is a growing attention to involving women in assessing and adapting fuel and technology choices. A greater political commitment is essential to place gender and energy issues in the center of development policy (Parikh, 2002). Experience from the Regional Wood and Energy Development Program in Asia (RWEDP) shows that gender is yet to be institutionalized by energy sector institutions in different countries of Asia in order to address women's energy concerns (FAO, 1995). In Africa, there are no clear policies to integrate gender concerns into rural energy projects from the early stage of designing, monitoring and evaluation of the projects. Sustainable energy discussions often take place separately without considering measures to address poverty and gender inequalities (Makhabane, 2002b). A case study of Namibia and Swaziland conducted by South African Energy Network (SAGEN) indicated that the government bodies lack initiative to implement energy policies that address gender issues at both national and local levels (Utonih and Dlamini, 2001).

Policies do not make clear the role of women and implications of AETs on women, even though they have a significant role in deployment of AETs and women are the ones, who are directly affected by such technologies. It is rather hard for policy makers to focus specifically on women's needs and priorities. Therefore, it is imperative to have national policies to support gender equity and advancement of women, which can support improved energy policy. A case study conducted in Uganda and South Africa indicated that policy mechanisms in other sectors must also reflect the considerations related to women and energy in order to smoothly support to the extension of energy services (Feenstra, 2002). An energy project (Energy for Rural Women's Enterprises) designed by UNIFEM for supporting rural women to be involved in small rural industries in Ghana indicated that consultations with women helped to increase their participation in appraising energy equipment and adapting it to meet their needs. In addition, such consultations provided important insights into the actual needs of rural women to improve their occupational opportunities (Mensah, 2001). Similar experiences can be found from other energy projects supported by different donors in Asia and Africa, such as Rural Energy Development Program (REDP) in Nepal (to be discussed in detail later in this thesis), Upesi Rural Stoves Project in Kenya, and Solar Electric Light Fund (SELF) in Vietnam (Deuba, 2001; Njenga, 2001, Everts and Schulte, 1997)). SELF has received a lesson learning experience with Vietnam Women's Union in involving women in promotion and successful implementation of technologies throughout the country. Women were very active in promoting solar home systems in rural areas. Many of the technicians installing solar home systems were women (Everts, et al., 1997). However, gender implications and impacts were not considered at the time of intervention. An introduction to improved kiln technology for some women in Mali has proved that women can be effective producers and managers of household energy technology (Sanogo and Skutsch, 2001).

When all stakeholders including women are involved, there is likely to be an increase in the chances of success and equitable outcomes for rural energy programs. Educating women, and women's organizations about energy policies can increase their ability to contribute to energy solutions (Clancy, 1999). They can also play important roles as educators and activists concerning energy efficiency, renewable energy sources and better use of traditional fuels (UNDP, 2000). An inclusion of gender concerns in a broad range of sectoral policies can improve the effectiveness of energy programs and the ability to reach overall development goals as well. Policies that support the advancement of women and girls are particularly important in reinforcing sustainable energy policies that target women. Such efforts are needed at local, regional and national levels in both public sector activities and the development of civil society participation in policy making (Karlsson and Mcdade, 2001:12). An adequate focus is needed to provide energy services, meaning that a comprehensive demand analysis of all energy needs is essential for addressing gender needs and ensure sustainable livelihoods (Clancy, Skutsch and Batchelor, 2003). It is especially important to address the 'human energy' needs managed by women, that has not been visible in national accounts.

Development policy makers have started to pay more attention to the rural energy crisis, since it affects the very survival of the vast majority of the world's population, who live in rural areas of developing countries. In addition, it is also deeply inter-linked with the whole concept of sustainable development. The linkages between rural energy and sustainable development, however, need to be understood in the overall context of the energy situation in developing countries (FAO, 1990:6).

An Integrated Approach to Rural Energy Planning

Rural energy plays a catalytic role in rural development and thus the issues need to be addressed in an integrated manner. There is a complex linkage between energy, the environment and agricultural production and thus an integrated approach to rural energy planning is necessary. For instance, agricultural productivity can be increased with energy inputs (such as pump irrigation) in rural households, and the extra income can be used in turn, for improved energy services. This may help to reduce women's workload. Similarly, agriculture residue may be used as fuel by rural households during the post harvest period, when women have no time for collecting firewood. However, this has negative implications for the environment caused by soil degradation due to the shift of residue from farm to fuel (Clancy, 1997). These factors influence the local conditions having different implications for men and women. Hence, the rural energy planning should be based on an integrated approach tailored to the local situation.

Top down or centralized energy planning exercises does not pay adequate attention to the variations in socioeconomic and eco-cultural factors at the micro-level, which influence the success of any intervention. In addition, top down planning can hardly achieve the equitable allocation and utilization of available resources in rural areas unlike in case of local level planning and implementation. Thus, decentralization has been advocated in the interest of efficient utilization of resources and for ensuring more equitable benefits from development (Sinha, Venkata and Joshi, 1994: 407).

In many countries, the critical problem in rural energy planning is a lack of integration with national energy planning. This is mainly because of the low level of coordination between local, regional, and central level organizations and partly because of the relatively decentralized nature of some energy technologies. In addition, there is a lack of institutional capacity at national or local level for assessing rural energy needs, overall demand, and energy technology options, and evaluating the technical performance, socio-economic impact, and institutional/organizational aspects of projects. The institutional and organizational factors are generally attributed to the roles of government agencies, non-government organizations and user groups in determining the planning process and intervening in the process of technology diffusion, which can directly or indirectly affect the rate of success or failure of rural energy project (Pereira, 1988: 403).

In China, for example, there is an institutional mechanism through which energy planning is decentralized. There are several commissions and ministries that administer the energy sector in China. Each of them has different responsibilities and functions. These commissions and ministries have branches in provincial and national level governments. The state commission is responsible for overall energy planning of the energy sector, with inputs from provincial and country level offices of the commission. (Mengjie, Gehua, Mingsong and Ding, 1999: 61). In Nepal, there is no comprehensive rural energy planning as such, though the perspective energy plan has been formulated for the energy sector as a whole. Rural energy issues are addressed in a non-integrated fashion by individual line agencies. There is no coordination between institutions on program interventions, implementation or monitoring (Banskota and Sharma, 1999: 129).

An area based integrated planning approach is necessary that consider socio-cultural and economic variables, their relationship to the existing and designed pattern of energy consumption, environmental constraints in micro regions, and, above all, the needs and priorities of the rural people, especially, the rural women. The existing approach for planning and implementing energy programs is typically top down and sectoral. The targets for these programs are also imposed from the top down (for example, pump sets to be energized, villages to be electrified, biogas to be installed and so on). A separate ministry or department is needed to be responsible for different energy resources and programs for rural areas (for example, forestry for firewood, electric power for rural electrification, renewable energy for solar, biogas, wind and so on) (FAO, 1990:18). A great degree of coordination is essential among different agencies to integrate their plans and programs to reach lower grassroots levels.

Rural energy planning requires as much functional devolution as possible through participatory appraisal techniques (process learning approach) in planning, design and implementation, and monitoring and evaluation. For example, community forestry programs and their success in Nepal demonstrate that proper intervention can be made through capitalizing on the local indigenous capacity for group organization, credit mobilization and development of entrepreneurship (Banskota and Sharma, 1999:140).

Institutional mechanisms and coordination arrangements need to be developed at different levels including grassroots planning and implementation for rural energy planning and projects, district level units and agencies, national level policy guidance and planning to provide political and economic support to the program. In order to have planned inputs of energy for the sustainable development of rural areas, rural energy should be linked with economic plans, programs and policies at the national level, as well as area-based, agricultural and rural development programs at the grass roots level (FAO, 1990: 11).

Since rural energy planning can not be separated from country level planning in different sectors, and from other community level activities, an integrated approach to rural energy planning puts emphasis on a holistic view leading to sustainable development for the country. A complete framework for energy policy is also essential including both centralized and decentralized planning options so that rural energy planning can be directed according to the economic and social priorities of particular regions (Pandey, 2002: 100).

Development of Rural Energy Technologies in Nepal

Energy is an essential component of an economy. A significant proportion of the global economy is dedicated to providing energy services in the form of cooking, heating, lighting, motorized appliances and industrial processes. The overall energy demands of Nepal are predominantly met by traditional, semi-commercial and non-commercial fuels, like firewood, agricultural residue and animal waste. As mentioned earlier, traditional fuels account for 88 percent of Nepal's total energy consumption (CES, 2000). There have been significant environmental impacts, including the depletion of forest resources, and also reduced agricultural productivity due to the conversion of biomass from farm to fireplace. In 1991/92, Nepal spent about 32 percent of its merchandise export earnings on importing fossil fuels (Banskota and Sharma, 1999). Substitution of firewood by kerosene is limited to urban areas and their suburbs only. Such substitution in the rural hill and mountain areas is difficult because of the lack of transport facilities and poor earnings of the rural population in general. Only about 14 percent of the total population (three percent of the rural population) has access to electricity (Banskota and Sharma, 1999:107). There is a growing demand for energy and the supply is insufficient for meeting the ever-increasing demand due to the increased population and modernization.

There are abundant sources of renewable energy in Nepal that could be developed through use of technical and institutional tools in order to fulfill the growing energy demands of the rural population. Many of the renewable energy resources have proven to be technically and often financially feasible. For instance, micro-hydropower and biogas technologies have been demonstrated as technically viable energy alternatives in Nepal. These technologies can meet the energy needs of rural households, while offering significant potential in terms of reducing women's drudgery, improving health conditions, and providing socio-economic opportunities to rural women (Rijal, 1998a). Rapid promotion of these technologies requires the provision of subsidies, access to rural credit, availability of human resources for technical backup services and adequate information on resources and technology (Amatya and Shrestha, 1998b: 205). If renewable energy technologies are to provide an alternative to conventional forms, they have to be reliable and affordable.

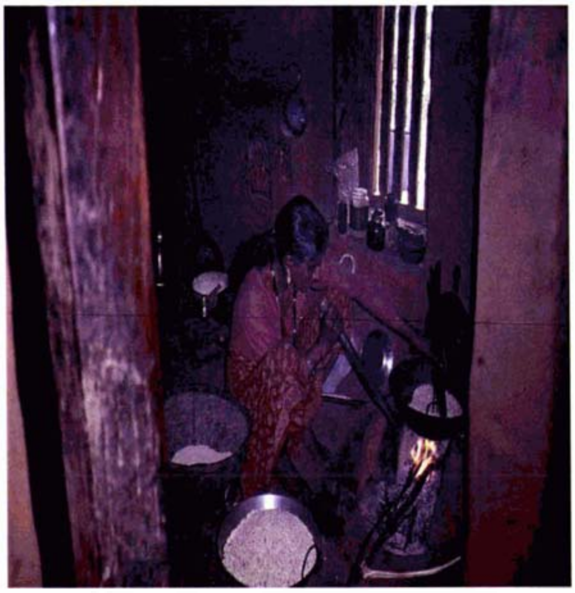
Both traditional and alternative (renewable) energy technologies are briefly explained in the following section.

Traditional Energy Technologies

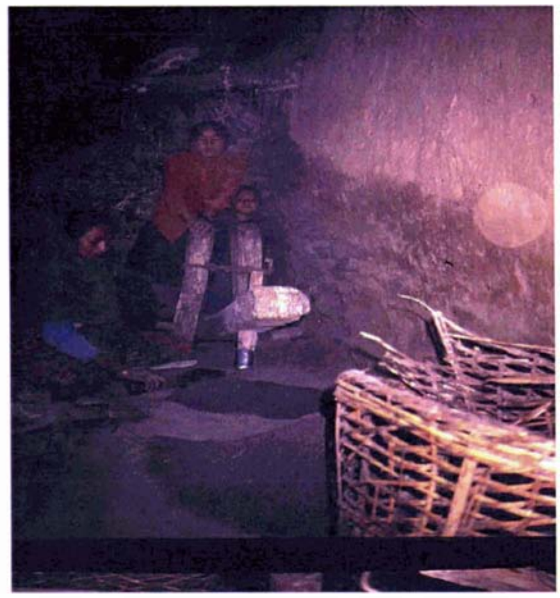
Energy technologies that are conventional and indigenous are regarded as traditional energy technologies. They include the traditional mode of burning firewood for cooking and space heating, and the indigenous way of processing agricultural produce. The indigenous energy technologies commonly used in rural Nepal for agro-processing are d*hiki, janto* and *ghatta* (See Figure 3.1).

Traditional Stoves: Rural women in Nepal use the traditional stoves for cooking the family meals, preparing livestock feed and for warming the house during the winter. In such stoves, fuel is burned openly in a traditional way and thus any kind of biomass can be used. In most cases, three big stones are placed in three corners to stand the cooking pots (See Figure 3.1). They are known as one hole stoves. There are also two hole stoves whereby firewood is placed from one entry point. In such stoves, there is no way for the smoke to be directed outside, so it spreads around the kitchen. However, in some houses, small holes or a small wooden window are built in the kitchen walls, from where the smoke can pass out. Since the majority of the population residing in the rural areas rely on biomass fuel, traditional stoves are the major cooking

Figure 3.1: Traditional Energy Technologies



Woman preparing day snacks with traditional stoves



Woman and children hulling grain with dhiki

Girls grinding spices with Janto

Grinding flour in water mill (*ghatta*)

Source: Fieldwork, 2002

technology all around the country.

Dhiki: This is a kind of traditional technology used for rice husking. Many rural households in Nepal still rely on the *dhiki* for grain processing, where there are no power or diesel mills. The rural women wake up very early, around 4 am for husking rice in the *dhiki* before they start their other daily activities. It takes about an hour to husk 10 kilos of rice. *Dhiki* can be also used for grinding rice to produce flour to make *roti* (local bread) for special festivals, and for making beaten rice. Considerable human energy is required to use *dhiki* and at least two people have to be engaged in using *dhiki*. Poor rural households who can not afford to process grains in bulk, still use *dhiki*. For small quantities of grain, women still prefer *dhiki* even if mills are available. There are three reasons behind this: a) poor families in the rural areas do not often have ready cash to pay at the mill b), it involves considerable time to go and wait at the mill, and c), it is women's labor used for *dhiki*, which is freely available at home.

Janto: *Janto* is a stone block, which is used for grinding grains like corn, and pulses. This is part of the standard household technology in rural area. Once again, women wake up very early in the morning around 4 am, to use the *janto*. Women either use *dhiki or janto* early in the morning for hulling or grinding grain respectively. It takes about an hour to grind 10 kilos of corn using *janto*. Like *dhiki*, *janto* is a popular traditional processing technology at the household level.

***Ghatta* (traditional water mill)**: In the mid and high hills of the country, the traditional water mills (*ghatta*) located on the banks of streams and rivers has been a part of villager's lives. *Ghatta* has been an important source of energy for grinding their food grains for centuries. It is estimated that about 25,000-40,000 water mills are in operation in Nepal (Bachmann and Nakarmi, 1983).

There are many perennial streams and rivers in Nepal, which have been used to create hydro power through the use of traditional (wooden blades/shaft) water mills at very low output (0.5 kw) only for grinding purposes (Shrestha and Shrestha, 1998: 276).

Construction, maintenance and operation of such mills is normally done by local men. These traditional forms of energy for agro-processing consume relatively more time than modern mills and are a heavy workload for women. Due to the low efficiency of traditional water mills, their use has been limited to simple grinding purposes, not fulfilling other efficient processing needs like oil expelling and paddy hulling. Overall, traditional technologies do not fulfill the processing demands required in rural areas. An alternative model for energy is needed for fulfilling basic household energy demand as well as for fulfilling the processing needs of the rural community.

Alternative Energy Technologies

Alternative energy technologies (AETs) are the new, renewable and non-conventional forms of energy technologies, which use local energy resources other than commercial fuels (petroleum products, gas, coal and so on) and biomass fuels in traditional forms (Amatya and Shrestha, 1998a). They primarily include micro-hydropower (MHP) plants, biogas plants, solar energy system and improved cooking stoves (See Figure 3.2). The different alternative energy technologies are briefly explained below.

Micro-Hydropower Plant (MHP)

Micro-hydropower is considered to be a clean source of energy which does not have adverse impacts on the environment. MHP plants are very helpful for capitalizing on the decentralized nature of hydropower sources and fulfilling the electricity demands from scattered settlements in the hills and mountains. Electricity generation through converting the motion of flowing water to steady mechanical power is the basic feature of MHP schemes (Shrestha and Amatya, 1998:141).

However, micro-hydropower for rural electrification alone is not economical unless it is linked to rural industry and economic activities (Basnet, 1998; Bhadra, 1998). Micro hydro has a good potential for rural industrialization in Nepal, mainly for establishing small processing industries, and providing alternative employment opportunities to

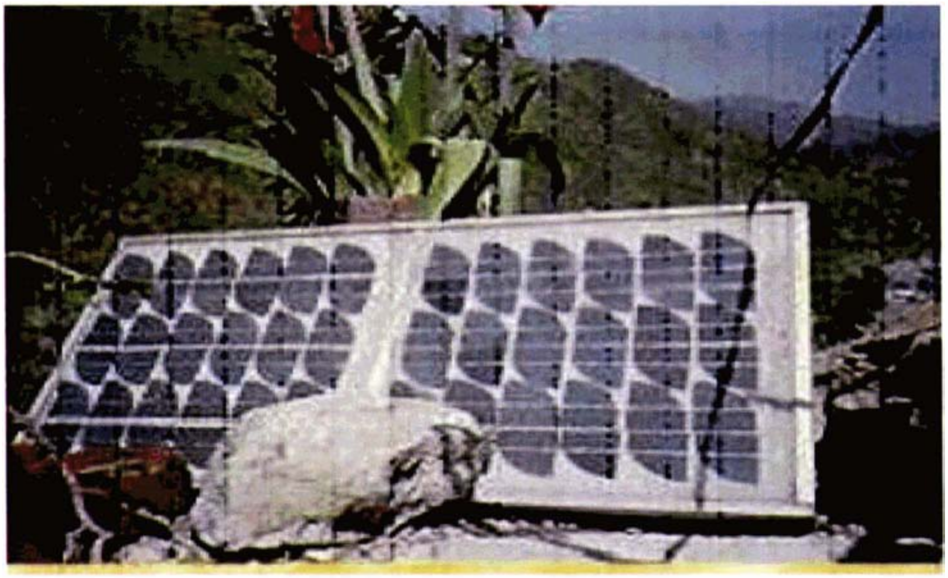
Figure 3.2: Alternative Energy Technologies

Improved Cooking Stoves

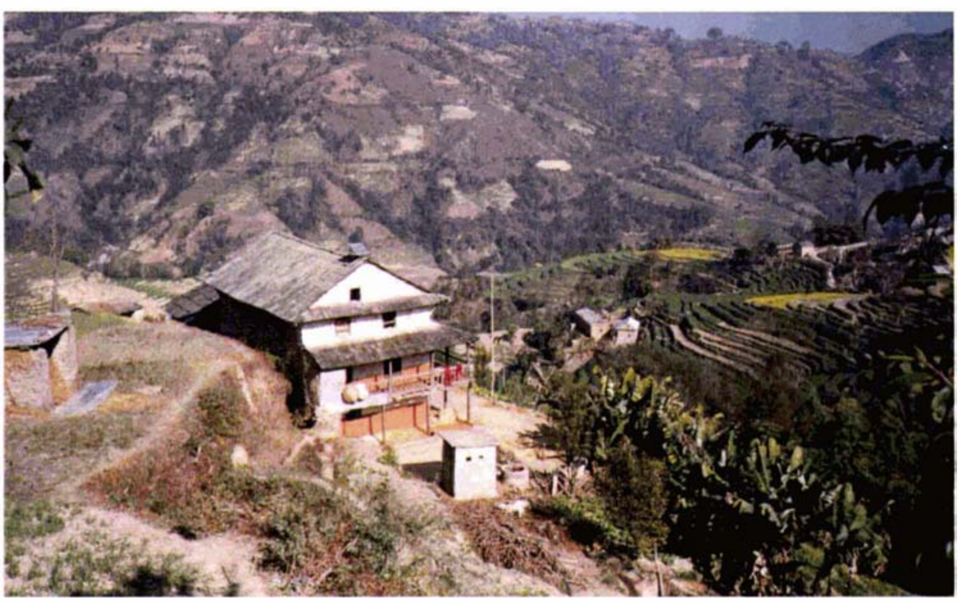
Toilet Attached Biogas Plant

Micro-Hydro Turbine

Micro-Hydro Mill



Solar Photovoltaic System



Solar lighting with the panel placed on the top of the roof

rural people including women. Since, agro-processing, cooking and weaving activities are primarily carried out by women, use of hydropower is expected to have significant impact on women in terms of reducing women's drudgery. The installation of micro-hydro plants has not only reduced the drudgery for women but also altered the division of labor between sexes. For instance, after installation of micro-hydropower, male members of the family normally carry the loads for processing, while previously, all the grinding and husking operations were done by women (Rijal, 1998a: 154).

Rural electrification through micro hydropower began in Nepal during 1970s. A total of 947 micro hydropower turbines, with a total power of 8.6 mw have been manufactured and installed in Nepal. They are mainly used for agro-processing activities, other small-scale activities and electricity generation (Adhikari, 1998; Shrestha and Amatya, 1998:143). Overall, the micro hydropower has a positive impact on rural life providing the rural electricity offering the numerous opportunities for small-scale activities for both men and women.

There are two types of subsidies available for micro hydro plants. These are capital subsidies and subsidies on equipment. The present policy has a provision for subsidies only on the cost of electrical equipment and the transmission and distribution system. The amount of subsidy is 75 percent in remote mountainous districts and 50 percent for the remaining districts (Shrestha, et al., 1998: 147). Subsidies are channeled through the Agricultural Development Bank, Nepal (ADB/N). Various donors such as UNDP, German Technical Cooperation (GTZ) and Danish International Development Agency (DANIDA) have been involved in providing the financial and technical support for promoting micro-hydro plants in Nepal.

Micro-hydropower schemes enables local villagers to be involved in the full range of activities from initiation and implementation to operation, maintenance and management. When villagers contribute labor and local materials, the costs incurred are lower, and when villagers are committed to properly planned and executed projects, the possibility of their long-term success increase significantly. However, a few case studies of micro-hydro plants have indicated that the very poor, who can not afford to pay cash at the mill, use the mill only for expelling oil. They still use traditional modes of processing for grains (Aitken, Cromwell and Wishart, 1991). Hence, only those who are not desperately poor can take full advantage of power mills.

Biogas Plants

Biogas has been one of the most popular types of energy plants in the terai (low land) and mid hill region of Nepal, due to their high suitability in these areas. They have enabled an increase in the quality of life of rural people especially women. Biogas is mainly used for cooking and lighting but sometimes as a fuel for internal combustion engines. Biogas plants are structures in which raw materials are fed, digested and the biogas is stored. There are two main constructions in biogas plants: the digester pit, and the gas storage tank. Biogas is produced by the anaerobic digestion of organic wastes and water, for which an airtight digestor is a prerequisite. The digestion process ferments a natural mixed bacteria culture and produces gaseous products and a liquid effluent, which is stored in the storage tank (CRT and ICIMOD, 1997:30).

Dung from cattle is the main potential source of biogas in Nepal. The possible contribution of human waste is not big, but such waste is available on every farm, and important in relation to sanitation. For instance, if human waste was to be used for biogas plant, construction of a toilet would be a prerequisite. This would help with hygiene and waste management. However, rural people normally hesitate to use human waste to generate the gas to be used in their kitchen.

Besides the supply of dung, other limiting factors for biogas plant installation are water and altitude the latter impacting on temperature. In the rural hills of Nepal, water is a scarce resource and tap water is not usually available. Installation of a biogas plant requires one bucket of water to mix with every half bucket of dung. It is again an extra burden for women to collect the water from distant places. Similarly, installation of biogas plants is not feasible at very high altitudes because of insufficient heat, required for gas formation. It is estimated that 1.5 million households in Nepal can install biogas plants that are technically feasible (BSP, 1995). This figure is almost three times more than the number of households that have access to electricity (14% of the total population) in Nepal at present.

The history of biogas development in Nepal began with fabrication and installation of a prototype unit at Godavari in 1955. In 1977, Gobar Gas Company (GGC) was established for the promotion of biogas technology as a joint venture investment of the ADB/N, the Development and Consulting Services (DCS) of the United Mission to Nepal, and the Fuel Corporation on Nepal. Due to the success of biogas development programs and the availability of a government subsidy, as well as the interest and involvement of a number of INGOs and donor agencies, private biogas companies became established after 1990 following the government privatization policy (WECS, 1987).

The Biogas Support Program (BSP) was set up in 1992 as a joint venture between ADB/N, recognized biogas companies, and the Netherlands Development Organization (SNV-Nepal) to support the biogas program through subsidies, quality control, and training. After introduction of the BSP, various private companies have been set up for the construction of biogas plants. At present, 41 biogas companies are officially recognized for the construction and maintenance of plants. The involvement of the private sector is very encouraging with the support from INGOs and government subsidies (Gongal and Shrestha, 1998: 163). Once BSP made an announcement of a flat capital subsidy of NRS. 7000 (US $ 98.6) and 10000 (US $141) for each biogas plant in the terai and hills respectively, the installation rate for all sizes of biogas plants increased rapidly (MOF, 1996).

The biogas program has to be supported with good promotional packages including training and education for the user groups, mainly women, who are to be involved in plant operation and use of biogas for cooking. There has to be an awareness program supported by an extension network for effective use of slurry from the toilet fed biogas plant to convince the rural people of the multiple uses of the biogas plant (Gongal, et al., 1998). The women who are the principal users and immediate beneficiaries of the biogas need to be involved not only in use and operation of the plant but also in decision-making processes of area selection, planning, and management of the biogas program.

Different studies have indicated that in most instances, biogas has a time saving effect on women's workloads (WECS, 1995b; Keizer 1993; Britt 1994). The average amount of time saved as a result of biogas use ranges from two to four and a half-hours per day. The studies mention that cooking, collecting water and firewood, and cleaning utensils are the activities most dramatically affected by the introduction of biogas. However, the installation of biogas plants has changed the working structure of women in such a way that it appears to increase women's workloads (Gongal, et al., 1998:168). For instance, the daily water requirement for mixing the dung and stall-feeding (instead of cattle grazing) needs to be compared with the time saved in cooking, collecting firewood and livestock fodder. As Britt (1994) also pointed out the net effect of biogas on workloads of women may be mainly on reducing the hardship of collecting the firewood. However, the women using the biogas work just as long as they did before by substituting one activity with another.

Biogas plants in Nepal appear to be a successful technology, and they help to improve the life quality of women. However, there seems to be no significant changes in the workloads of women or the power relations between men and women. Men continue to be the primary decision maker for use and operation of the plants and women have no control over the plants and the benefits from the plants. Opdam (1997) discusses that the success of biogas technology in Nepal is mainly due to the men's interest in adopting the technology so as to increase their social status. Women were just the silent followers using the biogas for meeting their household energy requirements.

Improved Cooking Stoves

As discussed earlier, burning low quality fuel such as wood, straw, dung and rice husk has many negative impacts on the lives of rural people particularly the women who have to be in the kitchen. For instance, the smoky environment means rural women suffer from heart disease, and eye disease. Further, these traditional stoves can consume vast amount of firewood and take a long time to cook (Bajracharya and Gongal, 1998: 171).

The improved cooking stove (ICS) is a simple low cost technology that offers multiple benefits to its users, including savings of the fuel wood consumed by traditional stoves. It works on the principle of increasing the concentration of heat directly under the first cooking pot and then channeling the heat to the second burner to cook two pots at once. It conserves heat and reduces heat dissipation with minimum waste (Shakya 1985; Sulpya 1984).

There are several improved stove designs in Nepal. The most common stove prior to 1990 was the improved insert type stove. This two-pot stove is made from three separate ceramic pieces and a clay chimney. It is surrounded by a mud mix. The three pieces are a firebox, to which the first tunnel is attached, a separate second hole for a pot with a baffle attached, and a rear tunnel attached to the chimney base. This model has two openings for cooking pots, one behind the other. Fuel wood is burned beneath the first opening. The fire and heat travel from the first opening to the second, heating up the pots on them. The smoke produced inside the stove exits through a chimney made of clay bricks and dung (CRT and ICIMOD, 1997: 68). The amount of fuel saved depends upon the comparative efficiency of the ICS versus the traditional stove. Potential fuel wood savings with the ICS range from 25.6 percent to 40 percent compared to use of the traditional stove (Sulpya, 1991: 10).

Various rural development organizations in Nepal have been promoting this simple and cheap technology for many years. So far, about 90,000 ICS of various types have been promoted and disseminated by the government, NGOs and private sector agencies

(Bajracharya, et al., 1998:173). However, the efficient use of these stoves largely depends upon the package of programs that come along with the technology. There have to be strong promotional programs through training and education, and programs need to be integrated with other economic activities such as credit for livestock. In the absence of proper training and education, the technology is largely unaccepted and the program is a failure.

Some other problems with regard to ICS use are concerned with inflexibility of use for diverse purposes, people's social and religious beliefs, availability and accessibility of free biomass resources as the main source of rural energy, lack of adequate involvement of women in the ICS program and lack of financial and institutional support to local NGOs and research institutions (CRT, 1999: 42).

Solar Energy Technology

The radiation from the sun can be captured and converted into heat and/or electricity. Solar energy is traditionally used for drying purposes, mainly as these relate to agricultural products. Recently, efforts have been made to develop solar dryers for large-scale crop drying (Shrestha and Bajracharya, 1998).

A significant use of solar energy in Nepal in the form of Solar Thermal Technology has been solar water heaters and solar dryers (Banskota and Sharma, 1999). Solar water heaters are used for heating water in households as well as in hospitals, schools, hotels, and lodges. Another use of solar heaters is in preheating water for industries requiring process heating. Solar water heaters are produced and marketed commercially. Different types of solar dryers have been used in the country for drying spices, fruits, vegetables, and herbs. However, solar dryers have not been so popular due to the high capital investment required and lack of specific designs for different products and quantities. Solar cookers are also another type of thermal technology, which absorbs the direct radiation from the sun and transfers it into a pot in a box (Banskota, et al., 1999).

Another important use for solar energy is generation of electricity from solar photovoltaic systems (SPV). Solar energy provides the required amount of electricity from SPV effectively and safely. Solar cells convert light directly into electricity by a process called the photovoltaic effect (Banskota, et al., 1999; Shrestha and Bajracharya, 1998).

Nepal has a high potential for harnessing solar energy. The monthly daily global radiation in Nepal varies from 120 to 260W/m^2, with the annual total sunshine duration ranging from 1900 to 2500 hours. SPV systems have been used extensively in telecommunications. According to one estimate, more than 6000 units of 50 W module SPV systems are in use in different parts of the country by the Nepal Telecommunications Corporation (WECS, 1995b). Nepal Electricity Authority (NEA) has installed SPV stations of 30-35 kw in capacity in remote parts of the country, such as Simikot, in Humla, Gamagadi in Mugu and Tatopani for purposes of rural electrification. Lately, private entrepreneurs and NGOs have been showing interest in the promotion and dissemination of Solar PV home lighting systems. The cost of PV home system (30-35W) ranges from NRS 30,000 to 35,000 (US$ 429-495) depending on the system's capabilities and facilities (Shrestha, et al., 1998: 183). These home systems are becoming popular in several areas of Nepal. The government of Nepal has had a subsidy scheme for household SPV systems since 1995. Fifty percent of the capital cost was subsidized for these systems under the financing scheme of ADB/N (Adhikari, 1998: 127).

The high initial capital cost and poor promotional strategies are the major constraints to development of SPV in Nepal (Amatya and Shrestha, 1998b). SPVs are affordable to only the higher income households, where there is income generation based on outside farm activities (such as tourism, rural market centers and so on). There are a number of barriers in expansion and dissemination of SPV system. For instance, there is an inadequate network of technical back up services for timely repair and maintenance/replacement of components. Similarly, there are no adequate promotion and demonstration services resulting in ineffective use of SPV. For these reasons, SPV has been not very effective in rural areas of Nepal despite the high potential of solar energy (Amatya, et al., 1998b).

Among the four different alternative energy technologies implemented in different districts of Nepal, all types of energy technologies were considered in my research as highlighted in later chapters.

Conclusion

As mentioned in the earlier sections, biomass has been a major source of rural energy in developing countries. The increasing use of biomass for the purpose of energy in rural households has led to depletion of renewable energy resources at an unsustainable rate. This has not only caused an increase in the drudgery of women but also reduced the soil fertility, leading to deteriorating environmental conditions. Alternative energy technologies, which do not use energy resources in their conventional form, largely help reduce the use of biomass resources. At the same time they reduce the drudgery of women through saving their time and labor in collecting firewood and food processing. In addition, AETs help to reduce domestic air pollution and improve the health conditions of women and children. Apart from the above, AETs such as micro-hydro plants help in creating economic opportunities, especially for women, by providing electricity, which enables people to establish small-scale activities in rural areas.

In order to ensure the sustainability of rural energy technologies, an integrated approach to planning is essential to establish a link between the rural energy issues at the grassroots with plans and policy at district and at national level. At the same time, gender issues need to be integrated into local level energy planning and in national policy perspectives in order to ensure active participation of women. Women need to identify their own needs and priorities and to become involved in planning activities with stakeholders recognizing their indigenous knowledge and skills in management of energy resources.

Chapter Four
Conceptual Model

> If a gender approach is to be adopted in energy planning, this does not mean setting up a few special projects to try to benefit women but to view all the projects with a 'gender spec'.
>
> (Yong, 1995: 6)

This chapter discusses the conceptual framework of my research based on the previous chapters and highlights on a working model of participatory rural energy planning in Nepal. It is particularly concerned with answering the question 'how can gender be effectively integrated into rural energy planning in Nepal?', which is the main theme of my research. The basic philosophy behind this framework is to increase active participation of women in alternative energy initiatives, including planning and energy based small enterprises leading towards their empowerment, and thereby developing sustainable rural energy systems in Nepal.

Conceptual Framework of the Study

As mentioned in the previous chapters, the real concern of my study is on integrating gender into the planning, and implementation of rural energy technologies, which to date has not been a common practice. Sustainable development will remain a distant dream unless development practices, activities, and benefits are shared between men and the women.

As women are the primary users and beneficiaries of rural energy technologies, they should be involved in each phase of planning, management and implementation of such technologies. Neglect of women in conventional energy policies in the past should thus not be repeated in the promotion of alternative energy technologies considering their direct implication on women (Cecelski, 1992). 'Given the critical role that women play as energy managers in developing countries, greater sensitivity to gender disparities, and in particular to the concerns of women, could improve the effectiveness of energy programs' (UNDP, 2000:36).

The need for institutionalization[1] of gender approaches in energy programs and policies has become very significant in order to acknowledge women's roles, indigenous knowledge and skills in management of energy resources, and thereby to ensure the sustainability of rural energy programs.

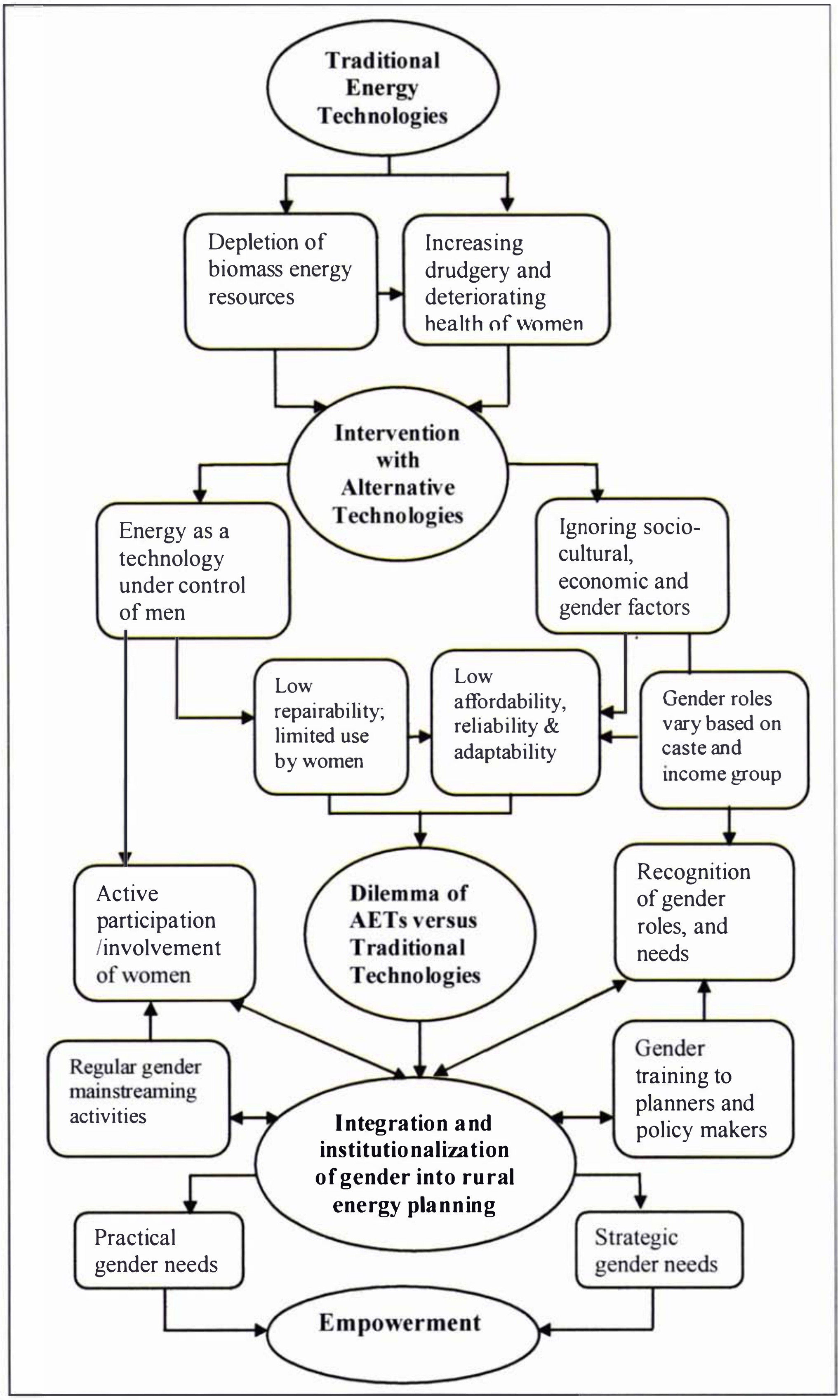
Figure 4.1 helps to explain the ideas and conceptual framework of my research. Since my research focuses on socio-economic implications of rural energy technologies from a gendered perspective, an attempt has been made to identify the issues relating to alternative energy technologies versus traditional energy technologies.

Traditional energy technologies which include traditional stoves (the traditional way of burning firewood), and traditional modes of processing like *dhiki, janto, and ghatta* as discussed in Chapter Three, have many limitations. For instance, cooking with traditional stoves cause faster depletion of firewood resources, a reduction in agricultural productivity (transfer of biomass from farm to the fireplace), increase in the drudgery of women (women's time is required on laborious tasks such as fuel collection) and it affect women and children's health with increased domestic air pollution. Women's drudgery further increases with scarcity of firewood, since they have to walk very long distances to collect the firewood to fulfill their basic energy demands. Similarly, women spend a lot of time and energy in processing grain with traditional technologies. However, such indigenous technologies are still used as an integral part of rural livelihoods.

Alternative energy technologies (AETs) have been initiated in order to address the above problems caused by the use of traditional technologies. AETs primarily aim to

[1] Institutionalization of gender approaches refers to incorporate the gender concerns as a regular part of organizational activities.

Figure 4.1: Conceptual Framework of the Study



Source: Mahat, 2002

increase energy supply in rural areas by meeting the household energy requirements as well as meeting the energy requirements for agriculture and small-scale activities such as water pumping, running of small mills, and household industries. They thereby reduce the use of biomass resources with a view to maintaining sustainability of rural energy resources.

However, the use of alternative energy technologies versus the traditional technologies has been a big dilemma in countries like Nepal, where rural people have very little awareness about environmental concerns, and have very limited knowledge about the efficiency and advantages of alternative technologies and no cash income to pay for the technologies. In addition, traditional technologies remain popular as they have some advantages over AETs. For example, traditional stoves fulfill the multidimensional demands of rural households such as cooking and heating the house whereas improved stoves and biogas plants fulfill only cooking needs. In addition, energy policy makers rarely emphasize on the needs and priorities of local people particularly women, who are the primary users and beneficiaries of energy technologies. Rather, such technological interventions are based on subsidies available from donors. The impetus of such technologies is to save fuel wood, not to reduce the drudgery of women. Thus there is a focus on reducing expenditure of fuel but not of human energy in exhausting physical tasks such as collection and carrying of fuel wood, transporting the fuel wood and processing grains (Cecelski, 1995). Energy is not only mechanical power but also metabolic power that mostly comes from women in rural areas (Cecelski, 1995; Skutsch, 1998). Rather, energy is considered as a technical phenomenon, and controlled by men. Socio-cultural factors, including gender roles and responsibilities, which largely determine the successful diffusion and adoption of the rural energy technologies are rarely taken into account. For instance, women (who have greater experience and skills in management of biomass resources than most men) are often ignored in planning and designing of energy projects. On the other hand, gender roles largely vary in different society and community and among different ethnic group, and income group within a community. It is thus important to account for varying gender roles from different socio-cultural groups with regard to alternative energy interventions. However, at present, affordability, reliability and adaptability of alternative energy technologies especially by women based on different socio-economic and cultural backgrounds including ethnic diversity has been largely ignored. In these circumstances, women are unlikely to adopt rural energy technologies and their sustainability remains questionable.

Here, one may ask the question: how can we ensure the sustainability of rural energy technologies if we do not consider the women's needs and priorities, and their roles and responsibilities in managing energy resources? It is almost impossible to accomplish the sustainability of rural energy projects without considering both women's immediate concerns and their strategic needs. The fact can not be denied that women are primarily responsible for fulfilling the daily household energy requirements. Their practical need is thus to have an adequate energy supply for household requirements while saving their time, reducing their heavy workload and health problems. Men's needs are generally limited to household energy supply with interest in saving fuels rather than reducing women's drudgery, and an interest in energy supplies for irrigating the farm. A strategic gender need is providing women with more time and opportunities to be involved in social[2] and economic[3] activities, thus enabling them to be independent (at least financially) and confident.

It is essential to integrate gender concerns into planning, and implementation of alternative energy technologies in order to address both practical and strategic gender needs (Skutsch, 1998). Not only men, but also women have to be involved in each phase of rural energy planning starting from the problem identification, program design, program implementation and monitoring and evaluation of the program. Issues like women's needs and priorities, their access and control over resources and benefits, women's participation, and impact of program on women and the possible indicators to measure the effect of an intervention on women have to be addressed when planning rural energy technologies (Dutta, 1997).

[2] Social activities refer to the activities that help to increase opportunities for social involvement such as group meetings, literacy programs, and awareness development activities.
[3] Economic activities refer to the activities that help to generate income.

In order to adopt a gendered approach in rural energy planning, it is important to institutionalize gender through participatory practices. In other words, rural energy projects have to be designed with a gender lens that incorporates gender analysis as a regular task (Skutsch, 1996; Yong, 1995). It is equally important to provide gender training to the planners and policy makers in order to make them aware and help them to develop gender sensitive plans and policies. Identifying gender needs, gender access and control over resources and benefits, and participation of men and women in different stages of the project cycle has to be carried out as a regular process in rural energy planning. In such analysis, needs have to be identified by the women and men themselves through participatory practices rather than the planners guessing their various needs in a top down manner. This helps women own the project and benefit from it in terms of fulfilling their practical and strategic needs, leading to their self-enhancement and empowerment.

The institutionalization of gendered approach to participatory practices is explained through the 'Participatory Planning Model' described in the following section.

Understanding Participation and Empowerment

It is both appropriate and important to discuss the concepts of participation and empowerment at this stage, as they provide the contextual understanding for the participatory planning model to be discussed in a later section.

Participation in this thesis is a term, which is used to describe the process under which the intended beneficiaries are actively involved in each stage of a project for their benefit. Below are various views of scholars regarding participation.

The World Bank's Social Assessment Group considers participation as a process, whereby beneficiaries influence the direction and execution of development projects rather than merely receive a share of project benefits (World Bank, 1996b). According to the World Bank Learning Group (1996b:3) "participation is a process through which stakeholders influence and share control over development initiatives and the decisions and resources, which affect them".

Manoukian (1989) argues that participation should indeed be at the center of all development efforts and the people should be viewed as partners and actors for their own development. . In this sense, participation is a process of empowering the people, which enables them to make their own judgment, to take command, to gain in confidence, and to make their own decisions (Chambers, 1995: 30).

Marshall Wolfe and UNRISD (United Nations Research Institute for Social Development) have given a very practical definition of participation and it is highly useful in developing world. Wolfe (1983: 2) defines participation as the 'organized efforts to increase control over resources and regulative institutions in given social situations, on the part of groups and movements hitherto excluded from such control'. This definition provides a very simple understanding of participation and allows us to assess merits and limits of participation in development.

Denis Goulet (1989) argues that the merits and demerits of participation may be best analyzed in terms of its diverse application.

Participation as a goal or as a means

Participation can never be taken exclusively as a goal; and the goal has no meaning unless it also incorporates some instrumental merit as a means (Goulet, 1989: 166). Participation as a means aims to accomplish the project goal more efficiently and effectively, as opposed to participation as an end, where a community sets up a process to control its own development (Nelson and Wright, 1995: 1).

On the first definition, participation is regarded as a means of improving the quality and relevance of projects by facilitating their implementation and acceptance. The second definition sees participation as an end in itself-as an essential component of a democratic society to ensure the well being of the individual and communities. Accordingly, participation as an end is closely linked to questions of empowerment and control over decision making. The dual character of participation is evident in most development settings (Goulet, 1989: 166).

Participation according to the scope of the arena in which it operates

Participation sometimes exists within small arenas, such as the domestic affairs of a family, for instance, when children and spouses all have some voice in decisions. Depending on the scope of the arena, its impact on development will vary accordingly (Goulet, 1989: 166). For instance, when all the community members have their say and participate in some kind of decision in running a community school, it can be said that community participation is occurring.

Participation's originating agent

Participation can start from three distinct sources: it can be induced from above by some authority or expert, generated from below by the 'non expert' populace itself, or catalytically promoted by some external third agent. Diverse social actors pursue quite different objectives when they initiate participation. Elite groups, governmental or other, usually seek some measure of social control over the process and the agents of participation. Participation from below takes place during a crisis and in response to some threat to a community's identity, survival or values. It is the most difficult but 'most pure' form of participation, which starts at the bottom and reaches progressively up to the level of decision making. This type of participation is initiated by the interested non-elite populace at an early point in the sequence of decision making. A third originating source of participation is the catalytic action of third party change agents-technicians, community organizers, missionaries or militants of some movement (Goulet, 1989).

Participation according to the moment at which it is introduced

Different types of participation exist according to the moment at which they are introduced. For example, participation can emerge at the moment of diagnosing a problem, of selecting one possible course of action, of implementing a selected action and so on. The quality of participation depends on its initial entry point. For instance, whether participation leads to the empowerment of the masses or not depends when the participation begins, in the overall sequence of steps (Goulet, 1989).

An interesting question to consider here is whether participation is necessary for development? Essentially, different kinds of development require different forms of participation. Goulet suggests that

> 'people centered development', which assigns priority to the satisfaction of basic human needs of the poor masses, to job creation, self reliance, and the active preservation of cultural diversity, obviously requires a form of participation in which non elites play an active role in the diagnosis of their own problems (1989: 167).

Top down growth oriented approaches to development on the other hand, do not initiate participation from the people. Rather, the government imposes development programs for the purpose of gaining popularity. For instance, most of the rural development programs (for example, the Integrated Rural Development Program (IRDP) in Nepal) around the third world reflect such a type of participation. In this case, the bottom up participation will generally be confined to micro activities. However, this kind of participation is not a true form of participation. Although such participation is easy to promote, it can hardly achieve the empowerment of non-elite groups and free them from manipulation (1989).

Other authors have also raised important questions about the nature of participation. Often questions which arise include; who participates (a few elite groups or broader range of people)?, what do they participate in (a more limited or broader range of decision making)? and how do they participate (as a recipient of benefits, or as a project designer)? and for what reasons do they participate (as a means towards other objectives or as an end itself)? Participation is thus a complex phenomenon and a multi dimensional concept (Brohman, 1996: 251; Goulet, 1989).

Empowerment

The emphasis on participation is significantly linked with empowerment, since projects and programs should seek the accountability of the local people who are supposed to be empowered by participatory interventions. Hence, local people including disadvantaged groups like women must be involved in the processes of decision-making.

> Empowerment is demonstrated by the quality of people's participation in the decisions and processes affecting their lives. In theory, empowerment and participation should be different sides of the same coin. In practice, much of what passes for popular participation in development and relief work is not in any way empowering to the poorest and most disadvantaged people in the society (Oxfam 1995:14).

Empowerment is a process to make people self-reliant and independent. In addition, it is also a strategy for improving the women's position in society. Women must be able to express themselves in order to gain access to resources and opportunities. This may lead to some solid actions to change the existing situation. 'Premises in the empowerment approach are that people reflect on social reality and are able to criticize the social system and its ideological concepts, and that this may lead to determined actions to change the situation' (Touwen, 1996: 48).

Young (1993) critically examines the use of the terminology 'empowerment' by many development agencies as meaning entrepreneurial self-reliance. She states:

> The term echoes the general emphasis within the mainstream on unleashing the capacity of individuals to be more entrepreneurial, more self-reliant. It is closely allied to the current emphasis on individualistic values: people 'empowering themselves' by pulling themselves up by their bootstraps' (1993: 163).

This suits the neo-liberal, private sector growth-oriented strategies of certain agencies. On the other hand, an empowerment approach to development can also mean people's participation in the policy-making and planning processes. According to Friedmann (1992) who wrote a notable book on the subject, an empowerment approach, as a strategy to an alternative development, focuses on improving the conditions of people's lives and livelihood that starts from the household. An emphasis is placed on empowering people especially those from disadvantaged communities by protecting their interests and rights.

Friedmann (1992: 33) suggests three different aspects of empowerment:

social power, as having access to 'certain bases, such as information, knowledge, skills, participation in such organizations, and financial resources',

political power, as the access to decision making, 'in particular those decisions that affect a person's own future', and

psychological power, 'as the individual's sense of potency and self-esteem', which may positively influence his/her access to social and political power.

Obviously, the concept of empowerment is closely linked to the notion of power. For instance, in a male dominated society, the concept of empowerment has emerged as a strategy for improving women's position in the society. Batliwala (1993) further points out that empowerment is a process that involves redistribution of power, particularly within a household. In the context of South Asia and the Philippines, strong debates about empowerment have emerged among development practitioners seeking effective strategies to support women to change their situation (Batliwala, 1993; Sen and Grown, 1988). Thin (1995) argues that the gender basis of empowerment should reveal the patriarchal social structure, which obstructs the improvement of women's situation at all levels of society.

There are three different types of power; 'power within', 'power over' and 'power to'. 'Power within' refers to self-confidence, self-awareness, and assertiveness (Oxaal and Baden, 1997:1). 'Power over' indicates the relationship of domination or subordination. 'Power to' relates to having decision-making authority, power to solve problems and can be creative and enabling (Oxaal, et al., 1997:1). Within a gender and development context, empowerment does not necessarily reflect women's ability to exercise 'power over' but 'power to' (Monkman, 1998; Rowlands, 1998). Kabeer (1994: 229) argues in favor of 'power within' which has to be self-generated and not be given.

Presenting various examples of grassroots organizations from South Asia like Grameen Bank in Bangladesh and SEWA in India, Kabeer (1994) puts emphasis on participatory processes of needs identification where women's voices can be heard. She focuses on the collective dimension as an adjunct to personal empowerment. 'New forms of consciousness arise out of women's newly acquired access to the intangible resources of analytical skills, social networks, organizational strength, solidarity and sense of not being alone' (1994: 245). Group solidarity is important to have an influence in decision making at the project level, however, the individual dimension of empowerment should not be neglected. Batliwala (1993) distinguishes between personal and collective empowerment. She argues that 'empowerment is not merely a change of mindset, but a visible demonstration of change, which the world around is forced to acknowledge, respond to and accommodate as best it may' (1993:10). Rowlands (1997:115) argues that the collective dimension of empowerment is closely connected with the personal dimension, since it is difficult for a group to become active without some critical mass of individuals who have achieved a personal degree of empowerment. However, the powerful individuals within the group represent the collective empowerment leaving the weaker ones behind.

Based on the above discussion, empowerment can be understood as a process to enable local people (both men and women) to actively and freely participate in the decision making level of a targeted project and enjoy the full benefits from it. The nature of empowerment will vary depending on the scope of a project, the participants, the originating agent and the stage at which empowerment is introduced.

Participatory Approaches to Development Planning

A growing body of evidence suggests that development efforts have a greater chance of being successful in the long-run, if the key players such as governments, donors, and especially, local people feel that they have a genuine stake in the outcome. This enables them to influence and share control over the development initiatives, decisions and resources, which affect them (Adams and McCracken, 1994:36).

For example, the World Bank has been using the participatory approach to development in its programs designed for poverty alleviation in developing countries. It is also used as a strategy for sustainable development. This is based on the belief that when people identify their own problems and are involved in program planning, implementation, monitoring and evaluation they feel more ownership of the program (World Bank, 1994). Canadian International Development Agency (CIDA)'s emphasis on participation of beneficiaries lies in the notion of ownership of the development process. Without a sense of ownership in projects, the benefits are likely to be short-lived. Therefore, participatory development is a process by which individuals and the community are actively involved in all phases of development (CIDA, 1991).

Participatory development involves greater equity in economic and political power, more democracy, a greater role for local organizations and self-government, respect for human rights, the full participation of women in political and economic decision-making, competitive markets and dynamic private enterprise (Beaulieu and Manoukian, 1995: 212).

The question arises as to whether participatory approaches have been effective in planning development projects in the third world. There has been a much talk about participatory development approaches in the past especially with regard to development projects, but the realization and practices have yet to be institutionalized. Transferring the concept of ideal participation into a practical field is a challenge for development practitioners who need to face different obstacles in the process.

The growing notions on participatory approaches share a common emphasis to enable local people to play an active role in their development. Participatory development has a message ultimately about power and change. It aims to provide equal opportunities and equal rights to men and women for local development thus empowering disadvantaged groups in society (Chambers, 1997).

Despite the great focus on 'people's participation', and 'target oriented achievement', the actual situation continues much as it was in the past. The bureaucrats have often ended with following remarks:

> 'Why is it that our planning can never ensure proper implementation?'
> 'It was a good plan but there were problems of implementation'
> 'People did not participate'
> 'They can not see what is good for them'
> 'How can we force them to do what they, in their ignorance, reject completely'
> (Jain, 1991: 339).

No doubt, there must be something missing in the planning mechanism, which means that people are reluctant to participate in programs, which were designed for their betterment by the bureaucrats but not by the people themselves.

The majority of development projects are guided by the standard principles for a given technological intervention rather than seeking local people's participation. The development practitioners treat people as objects rather than subjects of development.

> Conventional modes of rural development explicitly or implicitly, treat people as objects of change and the relation between development agents and the people often takes the form of a subject acting upon an object; (rural) people have been told what to do. The outcome is a delivery approach that is, an attempt to

> bring development to people through deliveries of knowledge and resources from outside (Sethi, 1987: 52).

It is a rare practice that people's knowledge is incorporated into development projects. Until recently, development projects have hardly sought to incorporate people's knowledge into project design and planning, despite the recognition of their practical knowledge as an important input for project success (Oakley, 1991:163). There is a real need to fill the knowledge gap between the experiential knowledge of rural people and the professional knowledge from outside. In order to bridge the knowledge gap, and value the contribution of all participants, Korten (1980) suggests that,

> There must be a high degree of fit between program design, beneficiary needs, and the capacities of the assisting organization... the critical fit is between the means by which beneficiaries are able to define and communicate their needs and the processes by which the organization makes decisions. This may require changes at both the community level---developing a way for the poor to express their needs-----and the assisting organization's level----developing ways for the organization to respond to such information (Korten, 1980:496).

This process needs to be very transparent and requires a lot more flexibility to adjust with the existing circumstances. This reflects an ideal process of participation with an emphasis on two way learning and provides enough scope for deriving alternative solutions.

Participatory development has placed women as equal partners with men in the mass of rural people as a dominant feature of major development strategies (Oakley, 1991:164). However, the truth goes far beyond this. Afshar (1991) points out that if women's interests are not specifically addressed by policy makers, women will not benefit from increasing prosperity. Women are still often misrepresented and benefit less than men from development projects. Therefore, it is important to understand gender differentiation in the process of participatory development. Gender dimensions are often neglected in rural development projects and women are marginalized from the benefits (Uphoff, 1986: 152). Participatory development must not be oriented to divide women from men but should treat them as equal constituents of the rural community (Oakley, 1991:164). Given the emphasis on empowerment in participatory development, as key social actors both men and women should be provided with equal opportunities and access to resources. Moser (1989) identified the empowerment approach as an important approach for gender planners, and could be seen from a gender and development perspective. This could also be combined with an approach to development that values 'bottom up' or 'actor-oriented' strategies (Rowlands, 1998: 16).

Today, participatory development is perceived as follows: a) it is holistic rather than sectoral, b) it is more people-centered than community-centered (avoiding the assumption that communities are homogenous), c) it is a learning process rather than a technological fix, d) it is less an instrument rather than an end in itself (Schneider, 1995: 31). This approach has more fundamental implications, which can be reflected at the local level, within the political and administrative environment and in aid agencies.

Local communities play a major role in participatory development efforts. Local development organizations or a group approach is an effective strategy for participatory development to be sustainable. Thus, local government structures like Village Development Committees (VDCs) in Nepal can be powerful participative structures. They can assist the poor in organizing themselves thereby raising their voices in decision-making processes. NGOs can also be effective in reaching the poor in many cases. Development workers, local or external, can be the key persons in initiating the participatory development process. The ideal role of the development worker in a participatory process is essentially to encourage people to reflect on their situation, build up their critical awareness of what they might wish to change and how they might go about it (Mathur, 1995: 159).

External agencies like the World Bank, UNICEF, UNDP and others have begun to invest heavily in projects that seek to promote a participatory model of development. However, the question arises as to whether such agencies with global concerns and macro approaches can play a meaningful role in building local participation. Moreover, there is always a risk that participatory development imposed from outside may lead the poor from one form of dependency to another. Despite knowing the true values of local participation, the external agencies still have a large role to play in identifying projects that meet their policy requirements, providing funding support, monitoring implementation, evaluating the outcome and so on. For example, Grameen Bank in Bangladesh would not have been a successful participatory development project, without enough funding support from International Fund for Agricultural Development (Mathur, 1995: 160). However, international agencies must try to understand and exercise a participatory process at the local level when supporting local projects.

External agencies would do well to remember that participatory development is a demand driven process, which is based on the dynamics, perceptions, priorities, capabilities and resources of the people. In this sense, it is used in opposition to the conventional project approach, which is usually supply driven and dominated by financial considerations. Participatory development can not be achieved by imposing a blueprint from outside and thus development should be initiated from within rather than from outside or above (Schneider and Libercier, 1995). Top down planning leads to coercion, which in turn results either the passiveness among locals or an active resistance to the development encountered (Muller, 1991). However, in reality, participation almost always requires stimulation from outside, because local people do not have the required combination of knowledge, skills, time or resources to identify and work towards meeting their goals.

Whatever participation we talk about, the reality and the methodology is still complex and the poorest among the poor are still left behind in the participation and empowerment process. The strategy now, must be towards creating practical solutions for addressing this issue so as to ensure the real participation and empowerment of every individual including the poorest rather than not just that the group is represented and the real poor (who truly need to be empowered) are left out. Only then, we can expect development to be sustainable as argued by Pretty and Scoones:

> If development is to be sustainable, planning will have to begin with the people who know most about their own livelihood systems. It will have to value and develop their knowledge and skills, and put into

their hands the means to achieve self-reliant development. This will require a reshaping of both philosophies and practices associated with development planning. It will have to become much more adaptive to local needs (1995: 157).

Adaptive planning implies that local people participate in both agenda setting and controlling processes (Pretty, 1994). Two crucial approaches to institutionalize adaptive planning are to improve accountability and to increase the number of stakeholders who have different interests concerning the project. Adaptive planning offers the opportunity for local level negotiation on the sharing of the gains from the planning processes, and encourages an active bargaining process for external support (Pretty and Scoones, 1995: 161).

Participatory planning in its true form includes two types of participation; a) interactive participation under which local people participate in joint analysis, which leads to action plans and the formation or strengthening of local groups or institutions that determine how available resources are used; a) learning methods are used to seek multiple viewpoints, and b) self-mobilization under which people participate by taking initiatives independent of external institutions. They develop contacts with external institutions for resources and technical advice but retain control over how resources are used (UNDP, 1990).

Participatory Planning Model: Rural Energy Planning

Similarly to other development planning, rural energy planning invites a very participatory approach, under which both practical and strategic gender interests and needs are reflected and appropriate planning mechanism is developed to meet those needs. 'Rural energy planning calls for as much functional devolution as possible through participatory appraisal techniques (process learning approach) in planning, design, implementation, and monitoring and evaluation' (Banskota and Sharma, 1999:

129). Genuine participation can be ensured through developing and incorporating concrete mechanisms in the planning process (Dutta, 1997):

> Participatory rural energy planning is a response to conceptualize decentralized planning and implementation of rural energy interventions with the active involvement of local communities especially women; and provide methodological tools to facilitate the process (TERI, 1998: 3).

Lack of an effective planning mechanism, inadequate human capacity at the grassroots level and shortage of appropriate institutions have often hindered user participation in rural energy planning. As argued by Leeuwis (2000), participation involves various methodological principles, and a range of participatory methods and techniques in order to become functional. The common phenomenon is that all stakeholders are supposed to participate as a process of planning, decision-making and/or social learning. However, situations within which participatory interventions take place can be rather complicated, within which the participatory intervention takes place. Thus, the practitioners have to be prepared for managing the conflict and adopting a negotiation approach (Leeuwis, 2000)

I have developed a Participatory Planning Model relevant to the rural energy sector in the Nepalese context. This will be outlined in this chapter and used as a means for analyzing actual rural development practices in Nepal later in the thesis.

The Participatory Planning Model is based on the project cycle approach, which involves four main stages (Table 4.1).

- Intervention Identification
- Project design
- Project implementation
- Project monitoring and evaluation

Activities under different stages are listed in logical order and outlined in Table 4.1. The first step in any rural energy planning is establishing rapport with the village

Table 4.1: Participatory Rural Energy Planning Model

Interventions Identification	Project Design	Program Implementation	Monitoring and Evaluation
Rapport Building Discussions with local leaders, getting support Preliminary assessment of needs and interest groups Collection of baseline information: PRA exercises	**Technology Demonstration** Clarifying demonstration objectives Explaining technology to small groups/selected HHs Response: Accept/Reject Performance review /feedback from beneficiaries particularly women	**Capacity Building** Training of local personnel Training of local women and men in communities	**Needs and Purpose** Clarify purpose to community Review activities Determine monitoring and evaluation Prepare questions Discuss information needs
Needs Assessment Prioritizing people's felt needs, gender needs Sensitize the people to their urgent needs Identify the issues/problems, constraints and potentials Provide information available on potential solutions	**Program Design** Preparing action plan scale of intervention Identifying beneficiaries Arrangement of finances non-finance resources (raw material, labor) Procurement of resources and stocking Market identification Persons responsible Back up support Time schedule Supervision Training requirement	**Benefits and Impact** Mechanism to ensure the benefits for targeted beneficiaries (including women) Mechanism to assess the effect of intervention on disadvantaged group (eg., the very poor; women)	**Indicators and Tools** Establish indicators Select tools for information collection Discuss who will do monitoring/evaluation Periodic analysis
Setting Objectives Integration of needs and stakes with energy needs Assessment of intervening agency's capabilities and organizational mandate Fixing primary and secondary objective	**Networking** Coordination with local and national level line agencies	**Sustainable funding** Identify funding from beneficiaries, government, and NGOs/donors	**Feedback** Improvement in monitoring mechanism

community. As an outsider, it is extremely important for staff from an intervening agency to create a non-threatening atmosphere of mutual trust and confidence with the people so that they feel comfortable to voice their opinions (World Bank, 1996b). Hence, it is necessary to understand the existing village politics and dynamics (relationships among different group and parties) and the past history of conflicts to form good relations with relevant parties (Malhotra, Dutta and Venkanta, 1998).

Once a friendly environment is built, different interest groups, key individuals and their needs and perceptions are roughly assessed and good rapport has to be established with each group. In order to develop an understanding of the community it is important to collect some basic information at the initial stage.

At the next stage of intervention, the needs and priorities of different individuals, and groups should be assessed in terms of their most urgent and immediate needs (Brohman, 1996). The real problems and issues are analyzed in terms of the strengths, weaknesses, opportunities and constraints to addressing them further. Sometimes it may be necessary to set the indicators (eg. amount of firewood needed in the next five years) to sensitize the real problems, so that the real issues can be understood. It is essentially a process of building awareness. For instance, the shortage of firewood may not be perceived as an immediate problem, since women are used to managing it somehow, but it is going to be a major problem in the near future. In addition, men put higher priority on problems in the economic sphere, while women have higher priority in the family sphere (Malhotra et al., 1998). People can be sensitized by providing them with relevant information (thus creating awareness) through different techniques such as focus group discussion, presentations, slide shows, and demonstration site visits.

The underlying needs and stakes need to be integrated and assessed in terms of capability of executing agencies such as infrastructure requirements, human resources, and so on. The primary and secondary objectives of an intervention should be stated in relation to their priority and based on the past experiences of the intervention. The past experiences help to point out the reasons for success and failure of interventions.

Project design is the final stage of planning. In this stage, the issues which emerge from the objectives of the intervention are to be carefully identified in order to address them for implementation. Project design also specifies the scale of the intervention. Decisions relating to finance, infrastructure, technical matters and so on have to be made depending on the nature and scale of the intervention (World Bank, 1996b).

Technology demonstrations for the targeted beneficiaries help to assess the people's likes and dislikes regarding technology and so they accordingly reject or accept the technology or make any modifications if necessary. Once the technology has been successfully demonstrated, the implementation program has to be designed. This includes drawing up a detailed plan of action specifying the role and responsibilities of the community, men and women, specific individuals, and the fixed activities with possible time schedules. Such a plan allows different stakeholders to be a working partner and to manage specific resources and activities efficiently. In this phase, it is important to establish a network with different line agencies at the local and district levels in order to get proper support for implementation of the desired energy program.

Rural energy planning is not complete, unless it incorporates various tasks at the stage of implementation, monitoring and evaluation. Capacity building of local communities, especially women, is very important to make sure that they have enough skills and confidence to participate in implementation activities. Similarly, it is important to develop mechanisms to identify the impact of interventions on women and also to ensure that the project benefits women (Dutta, 1997).

When considering the monitoring and evaluation of new interventions, it is essential to devise appropriate indicators that measure the explicit effect of intervention on local people again targeting women. The purpose of monitoring and evaluation should be explained clearly to the community in order to get their full support in this activity.

Different groups in the community should be involved as partners in order to review the objectives and activities (World Bank, 1996b). This process will help to identify the training needs and the needs for modifications if any.

Overall, the project cycle approach provides a standard base for participatory rural energy planning with enough gender consideration.

Conclusion

The conceptual framework of my study explained in an earlier section of this chapter has been presented as a basic theme of my research in relation to the rural energy technologies including both traditional and alternative energy technologies. This has clearly pointed out the need for institutionalizing gender into provision of rural energy technologies, so as to ensure the sustainability of such technologies to bring equitable benefits to men and women and empower women. At the same time, this should reduce the problems caused by traditional energy technologies.

In a later section, the concept of participation and empowerment is explained in detail, so as to understand the need for participatory planning approaches in the rural energy sector. The Participatory Planning Model is then developed based on the project cycle approach that explains the broader rural energy planning framework such as intervention identification, project design, program implementation, monitoring and evaluation. The Participatory Planning Model is supposed to be an ideal model that stands as a part of my theoretical framework focusing on a major theme of my research, which is how to integrate gender into planning and implementation of rural energy technologies and thereby to ensure participation and empowerment of women. The use and application of this ideal model and its appropriateness will be reflected in the subsequent chapters.

Chapter Five
Research Design and Methodology

> Research methodologies reflect different worldviews to a point, but they are a means to an end and not an end in themselves. Whether you are using deductive or inductive research, or qualitative and quantitative techniques, good design and flexibility is critical.
>
> (Storey and Scheyvens, 2003: 234)

In line with the quotation from Storey and Scheyvens (2003) above, I designed my research carefully but as the chapter will show the success of data collection was dependent on flexibility when in the field.

This chapter aims to explain the research design and methodology I have used to achieve my research purposes and to introduce the research setting. Both quantitative and qualitative methods have been used in my research and the specific tools utilized are explained below along with reasons for using different methods. Later in this chapter, I have highlighted insights and experiences from my fieldwork.

Research Framework

In many social research studies, quantitative and qualitative approaches are used as complements to each other. They can be used concurrently to discover better understanding of the issues being studied. However, the difference between the qualitative and quantitative approach is not simply the difference between multivariate statistics and in depth interviews, between Likert scale questionnaires and open-ended questionnaires or between surveys and case studies. The distinction between the two relates to the treatment of data rather than the research methods as such (Denscombe, 1998: 173). Qualitative research tends to be associated with detailed description of cases, events and people. On the other hand, quantitative research is associated with analysis using statistical procedures. Consequently, researchers should be cautious about their choices of approaches (Lee, 1992).

Unlike quantitative research (which is concerned with frequencies and distributions to arrive at statistically projectable data), qualitative research addresses the nature and structure of attitudes and motivations and aims to explore in depth the feelings and beliefs of people and to learn how these feelings shape their behavior (Goldman and McDonald, 1987: 7). A quantitative research methodology is appropriate where variables can be measured in quantitative terms and hypotheses can be tested, and inferences can be drawn from samples to populations. Qualitative methods on the other hand, are appropriate when phenomena under study are complex and social in nature (Liebscher, 1998: 669). Neuman (1997: 329) points out that under quantitative research, measures are systematically created before data collection and are standardized, whereas under qualitative research, measures are created in an ad hoc manner and often specific to the individual setting or researcher. Creswell (1998) suggests that it is better to engage in a quantitative study prior to conducting a qualitative study so as to identify the focused area to be explored in detail. Denzin (1978) has pointed out that there is an advantage in using multiple methods to enhance the understanding of phenomena.

As this study is exploratory and evaluative in nature, I have used both quantitative and qualitative techniques to provide an in depth study of the problems. This study has also employed the concept of triangulation by different methods of quantitative and qualitative data collection are used.

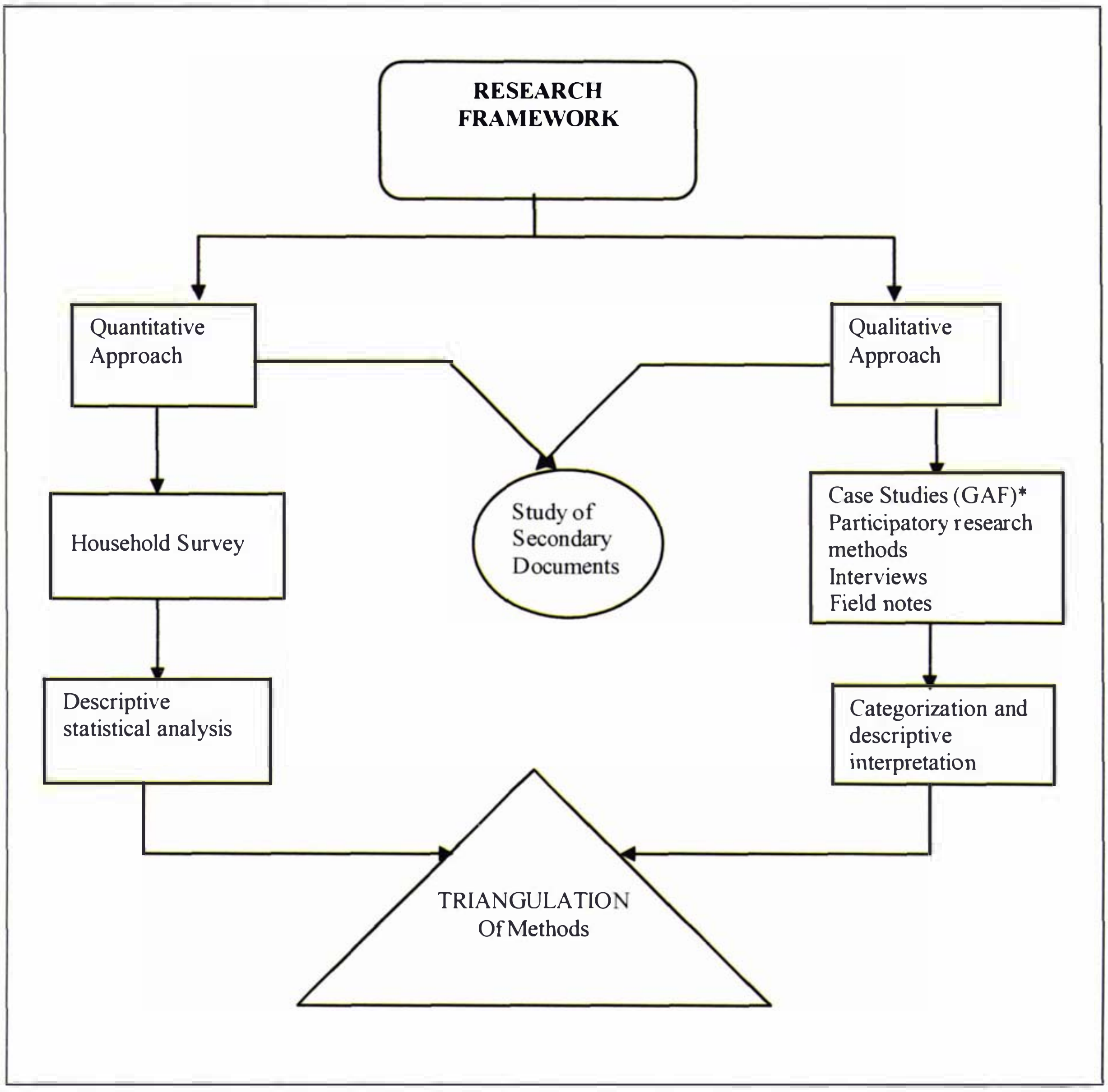
The triangulation method refers to a combination of strategies to study the same phenomenon involving 'between methods' or 'across methods' derived from multiple quantitative and qualitative methods of data collection (Creswell, 1994; Das, 1983; Denzin, 1978). Burgess (1984: 145) points out that methodological triangulation involves the 'within method' and the 'between method'. The 'within method' is using the same method on different occasions and the 'between method' is using different methods in relation to the same object of study. Creswell (1994: 174) mentioned that multiple methods of data collection and analysis might be drawn from 'within method' approaches such as different types of quantitative data collection strategies, or alternatively 'between methods' drawing on qualitative and quantitative data collection procedures (e.g. surveys and in-depth interviews).

As identified by Greene and others (1989), the purpose of triangulation is to seek convergence, corroboration, and correspondence of results from the different research strategies. According to Sliverman (2000: 50), the researcher can gain insight into many different aspects of the phenomenon through the use of multiple methods. One may have to be skilled in many forms of data collection and analysis in order to use the multiple methods. The rationale of this method is 'to increase the validity of constructs and enquiry results by counteracting or maximizing the heterogeneity of irrelevant sources of variance attributable especially to inherent method bias but also to inquirer bias, bias of substantive theory and biases of inquiry context' (Greene, Caraceli, and Graham, 1989: 259).

The triangulation helps to uncover multidimensional aspects of a phenomenon. This assists to neutralize any bias inherent in particular data sources, investigators and methods by using them in conjunction with other data sources, investigators and methods (Jick, 1979). Brannen (1992: 63) suggests that the validity of findings and the degree of confidence can be enhanced through deployment of multiple methods of data collection. Brannen further mentions that the findings from one type of study can be checked against the findings from the other type of study. Linking quantitative and qualitative data is desirable in this sense that it helps to elaborate and develop a detailed analysis in order to enrich the study. Quantitative and qualitative data can be used as complementary to each other during different stages of data collection (Miles and Huberman, 1994: 41). Hence, the triangulation method is very helpful for cross checking and taking the corrective actions in time.

My research framework explaining how triangulation works, is presented in Figure 5.1.

Figure 5.1: Research Framework



Notes: * GAF stands for Gender Analysis Framework, which was used as basic tools for case studies.

As indicated in Figure 5.1, the quantitative approach of my research is principally based on a household survey design which uses a standardized questionnaire. In contrast, the qualitative approach uses various participatory research methods, and small case studies with an emphasis on a gender analysis framework. Field notes were also written as an integral part of my research process. The information collected through participatory research methods is both supplementary as well as complementary to the information collected through the household survey. Document study was another important source of information of my research, under which library materials, government reports and manuals, and other published and unpublished sources from different agencies were reviewed. Information collected through quantitative approaches was analyzed and interpreted using appropriate statistical tools and techniques. Qualitative information was categorized according to groups of parameters and interpreted in a descriptive way.

Research Design

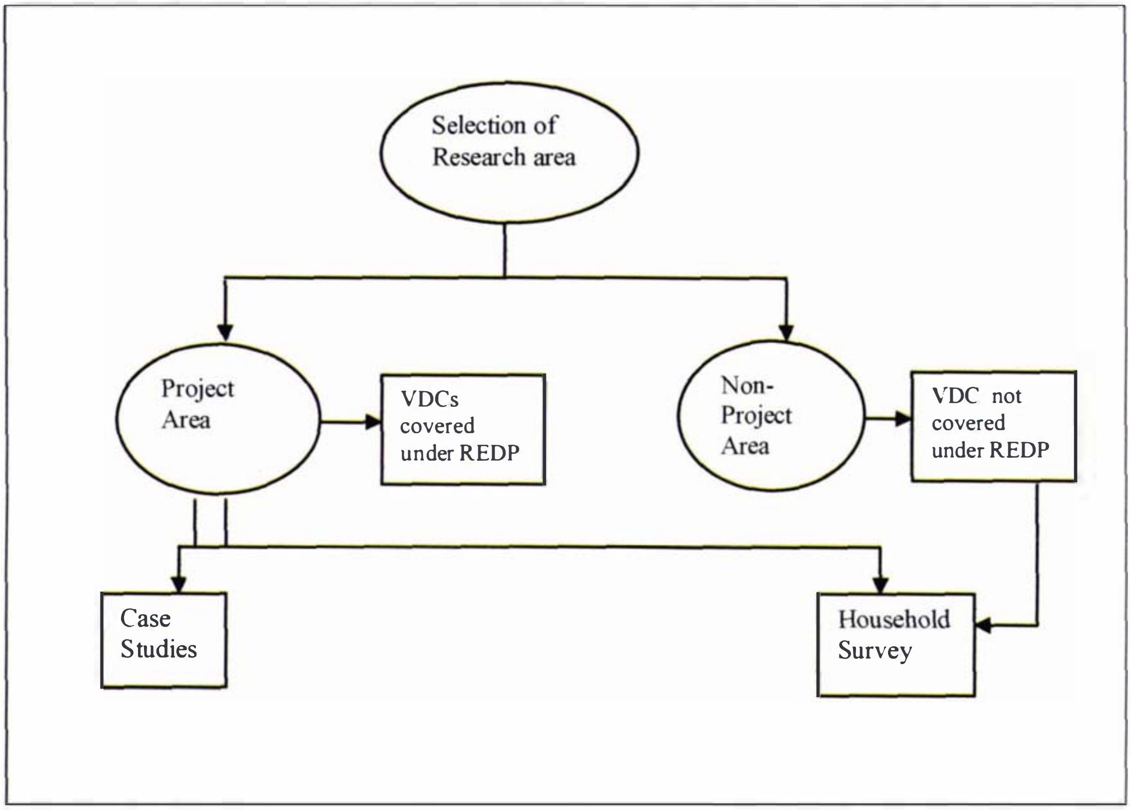
In order to produce empirical evidence to fulfill the set objectives, data collection is necessary in a particular location. The process of discovery requires primary as well as secondary data, which have to be collected using appropriate methods and techniques, including household surveys and rapid appraisal methods. This study includes both "exploratory" and "evaluation" analysis. An analysis has been done using "with" and "without" project situations in order to see the comparative advantages and disadvantages of alternative and traditional energy technologies. “with” and “without” project situations refer to the areas with and without project intervention by the Rural Energy Development Program (REDP)[1]. Household surveys were conducted in both project and non-project areas and were integrated with participatory research methods. Detailed case studies (mainly based on participatory research methods) were also conducted in separate VDCs of the project area covering positive and negative features of

[1] REDP is a project supported from UNDP to implement alternative energy technologies in different districts of Nepal. A detail introduction of REDP is presented in chapter six (pg. 164-165).

all related technologies. The case study analysis focused on the selected user's groups of different technologies located in the different villages of the project area.

My research design is presented in Figure 5.2 below.

Figure 5.2: Research Design



A household survey was one of the two major sources of information. Each individual household in the study area was considered as a sampling unit. A household is defined as a unit of family members[2] living together and jointly sharing the costs and benefits. A household is a unit of residence and consumption, and is the unit, which pools and distributes resources (Bryceson, 1995; Cameron, 1998; Evans, 1992).

[2] In a Nepalese context, family members in a household also constitute the parenthood relation.

Additional primary data was gathered from key people such as women's group leaders, community leaders, the village elders, energy development group, promoters/facilitators, project staffs and professionals through using participatory research methods. To get general information on energy development interventions, indigenous knowledge, local potential and problems with regards to the management of available resources, members of Forest Users Groups, persons belonging to local NGOs and village elders were consulted. Small case studies were conducted focusing on participatory research methods including gender analysis and focus group discussions.

Efforts were made to avoid some data collecting errors such as coverage error (not allowing every household in the study area to have an equal chance of being sampled), sampling error (only some members being asked to provide information), and measurement error (obtaining inaccurate answers to survey questions due to unclear questions or instructions, tendency to provide socially acceptable answers, and deliberately lying). Having an up-to-date household population list, random sampling, indirect questioning and trust building with the respondents minimized these errors.

Before the field data collection took place at various levels, a considerable time period was given to the literature review to build up the strong theoretical background of the study. An in depth review of the literature helped to understand the issues of rural energy, gender and energy issues, and interventions and sustainability in depth to identify the position of other scholars in the field. This also helped me to define and correctly focus on the issues that needed further explanations and raise questions, which were not addressed previously.

Experience of different researchers, local people, planners, project implementers, and extension workers were also integrated to fill the identified knowledge gaps.

Research Setting

The fieldwork was undertaken in Kavre district for five months between November 2001 to March 2002. Selection of the particular sites was based on the political division i.e., Village Development Committee (VDC)[3].

A VDC has a total of nine wards[4]. A ward consists of one or more villages depending upon the number of households. Due to rugged topography and the presence of small settlements, a ward may cover a large area. The village size in the hills varies from 10-15 households to a couple of hundred households. Although variation may exist between the settlements and the wards due to elevation and slope, complementary concern with formal local level political and development units is necessary for studies of local resource management and rural development planning, as VDCs are the lowest level of local government bodies responsible for planning.

In view of the recently promulgated Decentralization Act, where the district development committees (DDCs)[5] and VDCs are being given more development roles and planning responsibilities, it has become more important and necessary to consider a ward as the basic planning unit within a VDC. However, elevation, slope aspects and other variations, which cause larger variation within a short distance in the hills, was taken into consideration during the sampling procedure.

Four VDCs from Kavre district, namely Nayagaon, Katunjebeshi, Mangaltar, and Pokharichouri, were selected as the "project area" considering the potential aspect of energy technologies and availability of such technologies in the area. Two VDCs Katunjebeshi and Mangaltar, were used for a detailed household survey and the other two were used for case study analysis. A separate VDC (Methinkot) close enough for

[3] VDC is a part of legislative body and a lowest political and administrative unit (local authority) at local level.

[4] Ward is a small sub unit within the VDC, comprising of one or more small villages. One VDC consists of nine wards.

[5] DDC is a part of legislative body and a political and administrative unit at district level.

homogeneity, but without any rural energy projects was taken as the "non-project area" so as to make a comparison between the two areas. Similarly, one other VDC (Mahadevsthan) was also selected for a case study analysis of biogas plants, supported by Biogas Support Program (BSP).

The general information related to selected VDCs is presented in Table 5.1.

Table 5.1: General Information on Selected VDCs

VDCs	Total HHs	REDP Benefited HHs	Distance from district headquarter
Nayagaon	770	140	16.09 km
Mangaltar	683	138	27.35 km
Katunjebeshi	606	125	22.53 km
Pokharichouri	540	120	32.80 km
Methinkot	757	No project	20.90 km
Mahadevsthan	1585	BSP	24.00 km

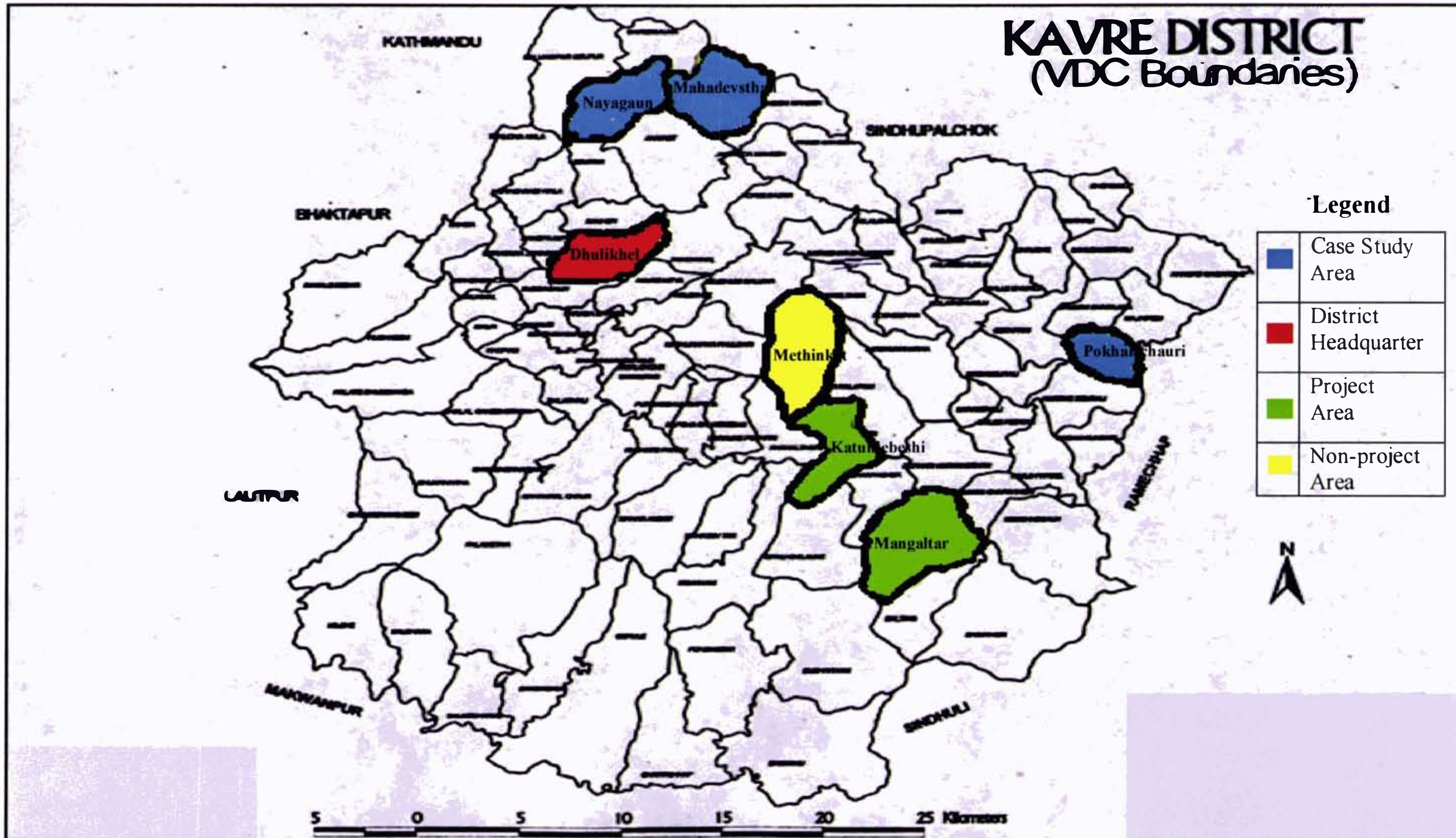
Source: District Profile, Kavre, 1998.

Kavre District

Kavre is a hill district lying in the central development region (See Figure 1.1 in pg.5). It is 35 kilometer east from Kathmandu ranges between 1007-3018 meters in elevation. It is linked with Ramechap and Dolakha in the east, Kathmandu, Bhaktapur and Lalitpur in the west, Sindhupalchok in the north and Sindhuli and Makawanpur in the south. Administratively, the district is divided into 87 Village Development Committees (VDCs) and three municipalities (See Figure 5.3).

The total population of the district is 333,181 and the average household size is 5.3 (NRA, 1997). The population in the district is a mix of different ethnic groups

Figure 5.3: District Map of Kavre



Source: GIS Unit PDDP NEP/95/008 1999

including *Brahmin/Chhetri*, *Newar*, *Gurung*, *Tamang*, *Tharu*, *Magar*, *Kami*, *Damai and Sarki*, *Bhojpuri*, *and Limbu* .

Agriculture is the primary occupation of the district population. People are also engaged in fishing activities, sales services and as production laborers. The total economically active population (EAP) in the district is 152,765 of which 73,234 are female. EAP in Nepal stands for the population group aged above 10 years who are engaged in any kind of production activities (CBS, 1999). The energy consumption pattern in Kavre district is presented in Table 5.2

Table 5.2: Energy Consumption Pattern in Kavre District

Energy Resources	Percentage of Consumption
Firewood	85 %
Agricultural residue	9 %
Petroleum	5 %
Electricity	1 %
Total	**100 %**

Source: REDP,1997

In terms of renewable energy systems, only one percent of total energy consumption is derived from electricity. Out of 87 VDCs in the district, only some wards of 39 VDCs are connected to the national grid. Firewood provides 85 percent of the total energy consumption in Kavre.

Kavre is one of the first districts where the REDP made its initial intervention to promote and implement alternative energy technologies in the country. Currently, there are 15 districts, where REDP has implemented the rural energy projects (REDP, 2000). Kavre district has been selected as the research implications will have a wider application throughout the country because the features of this mid-hill area are representative of many other parts of the country as 39 districts out of 75 districts fall into this category.

Research Tools and Methods

As explained earlier, various research tools and methods were used for carrying out the field research. I used different methods according to the nature of information required at different stages of data collection. For instance, I conducted the household survey as a basic source of primary data in both project and non-project areas so as to compare the socio-economic situation in two areas. Apart from the household survey, I conducted structured and semi-structured interviews with key individuals at the village level and with representatives of different institutions at the local and national level. I also carried out detailed case studies with specific communities in the project area who have access to different technologies. The case studies were mainly based on participatory research methods, and gender analysis.

The different tools and methods are explained below.

Detailed Household Survey

I conducted a detailed household survey in three VDCs of the Kavre district: two VDCs where REDP had implemented the rural energy program and, one other VDC, where there is no rural energy program. I developed a set of standardized questionnaire, which was based on a gendered approach seeking to draw gender issues in energy management and development at the household level. Under the household survey, idiographic information, information related to the socio-economic status of the household, energy resources, problems and potentials of such resources, use and development of energy technology, impact on women's workload and health, and the level of gender participation at different stages of energy planning were obtained.

The questionnaire was later translated into the Nepali language from English. An adult female was interviewed from each household. Normally, it was hard initially to get women to answer the questions. So we started to talk with men of the household at first and this made it easier to talk with women later on.

Determination of the sample size

The sample size is affected by the characteristics of the population (size, type, and location). Smaller samples are adequate for a homogenous population, whereas heterogeneity requires larger samples. The Village Development Committees (VDCs) in the study site cover a large area where settlements lie between low elevations and high elevations. The selection of wards was done according to the availability of rural energy technologies in the project area, and in the non-project area, it was based on minimum homogeneity features such as similar topographic condition. The sample size was determined on the basis of the total beneficiary households and total households in project and non-project areas respectively (Table 5.3 and 5.4). At least 20% of the total households were sampled to administer the survey questionnaire.

Table 5.3: Number of Sampled Households in the Project-Area

VDC	REDP benefited HHs	Sample HHs	% of the Total
Katunjebeshi (two wards)	125	30	24%
Mangaltar (three wards)	148	50	34%
Total	273	80	29%

Source: REDP Annual Report 1998; Field Survey, 2002

Table 5.4: Number of Sampled Households in the Non-Project Area

VDC	Total Number of Households	Sample HHs	% of the total
Methinkot (three wards)	205	65	32%
Total	205	65	32%

Source: Field Survey, 2002

Sampling method

The sampling was done at two levels. Firstly, the selection of the VDCs and settlements was done through a judgmental or purposive sampling[6] approach. Since the purpose of the study is to explore, analyze, find interrelationships and compare the various aspects of energy technology between the "project " and "non-project" areas, the wards or settlements and the VDCs were purposely chosen to accommodate these factors. The selection of the communities in two different areas was based on homogeneity criteria, which provided an adequate basis for comparison.

At the second level of sampling, a number of households were randomly[7] sampled from the total number of households in the selected wards/settlements. The random table was used for selecting sample households. The list of households for the project area was obtained from the REDP office at Dhulikhel and in the non-project area, it was obtained from the ward chairman.

In the project area, the households were sampled out of the beneficiary households in a few villages. In the non-project area, the households were sampled out of the total number of households in selected villages.

Table 5.5: Sampling Methods

Study Unit	Purposive Sampling	Simple Random Sampling
VDCs	*	
Settlements(Wards)	*	
Households		*

[6] Purposive sampling refers to the selection of individuals/groups based on the purposes of research (Tashakkori and Teddlie, 1998: 76).
[7] Simple random sampling is a selection procedure under which every individual has an equal chance to be selected (Tashakkori, et al., 1998: 75).

Participatory Research Methods

Participatory research methods often used as a synonym to PRA (Participatory Rapid Appraisal), PAR (Participatory Action Research) and RRA (Rapid Rural Appraisal) are considered as very effective tools of participation and development:

> The basic premise of participatory research is that marginalized and disadvantaged persons can empower themselves through examining their own situation, developing understanding of the political, economic, and social determination of that situation, researching alternative scenarios, taking action that grows out of their own culture and values; and thus adding to the knowledgebase for the enhancement of the quality of life (Cassara, 1987: 40)

Contrary to traditional research methods which view people as providers of information, the nature of PRA is based on learning from the people directly on site, and gaining insights from their local knowledge base. PRA is a practice developed under the leadership of Robert Chambers, which enables people to initiate their own development. PRA is an approach and method to facilitate, listen and learn from the local people, to encourage them to express their ideas and feelings, and problems, and to enhance their awareness and confidence to develop their own plans and carry out the necessary actions (Chambers, 1997). The ultimate goal of PRA is empowerment, which has a fundamental principle that respects the capability of local people in representing, analyzing, planning and controlling their own development (Blackbum and Holland, 1998; Chambers, 1994; Gujit and Comwal, 1995).

PRA by its nature is a process of empowerment that requires a long-term commitment of outsiders to facilitate the process and to realize the outcome (Chambers, 1997; Crawley, 1998; Blackburn and Holland, 1998). PRA is a part of the development process that leads to control over the process by the people who are supposed to receive the local delivery action and the development benefit (Blackburn and Holland, 1998: 119). Hence, carrying out PRA itself may not be possible for an academic researcher within the limitations of his/her research requirements. In addition, the academics can not be confined to the information analyzed from the local people and need to analyze the information further to fulfill their research objectives (Cancian, 1993). However, for the purpose of this research, I used various tools of PRA as a technique for collecting qualitative information to analyze my research objectives. These techniques were very appropriate to my research considering that techniques such as focus group discussions and the Gender Analysis Matrix can help to examine gender issues which are very sensitive in the rural context.

Much of the qualitative information in this research was collected using PRA methods. Apart from the household survey, I used these methods in all area in order to get both supplementary and complementary information on some important issues, such as the perceptions of different groups regarding the use and adoption of technology, level of awareness of gender and energy issues, their preference of one technology over the other and to see development patterns in the villages.

Specific participatory research methods used include;

Social mapping

A social map is a good technique for a researcher to get a general picture of an area through participants drawing a map depicting important information about the area. In my research participants were invited to draw a village map including village boundaries, distribution of resources, access to technologies, household status, and other such features. This helped me to understand the village characteristics including institutions and other resources in the community. This map was constructed in the case study villages, as well as in the survey area.

Drawing of the social map was an exciting and interesting process. I, with my research assistants, made initial walks throughout the villages observing the village area and invited the local men and women to gather in an open place to draw the map. The next day we gathered in the designated open space underneath a big tree (*Chaoytari*) to draw the map of the village. I first started by introducing myself formally to the village people, stating my purpose for being in the village, and requesting their cooperation. About 30 percent of the village people, both men and women, participated actively in drawing the map. The men and women were excited to show their houses on the map and they were also joking with each other that their houses might be left out, and, therefore they would be let off from being included in any development activities. It was a very enjoyable process, which helped me build rapport with my research participants.

Focus group discussions (FGD)

Focus group discussions is one of the most popular forms of PRA and a basic method of qualitative research. In a focus group discussion, eight to ten people assemble in the presence of a trained moderator who guides a discussion lasting about two hours (Goldman and McDonald, 1987: 7). Focus groups are generally regarded as a useful way of exploring attitudes on non-sensitive and non-controversial matters (Denscombe, 1998). The effectiveness of a focus group interview very much depends upon the attitude of the facilitator. The focus group interview technique is a 'socially oriented research method capturing real life data in a social environment, possessing flexibility, high face validity, relatively low cost, potentially speedy results, and a capacity to increase the size of a qualitative study' (Krueger, 1994: 37). The focus group is characterized by homogeneity. However, it allows sufficient variation among participants to raise contradictory opinions. Homogeneity is sought in terms of gender, education level, age, wealth, ethnicity or family characteristics (Krueger, 1994: 77).

For the purpose of my research, focus group discussions were conducted with men's and women's groups separately, in order to know their views and opinions about rural energy technologies, their likes and dislikes, acceptance and rejection, their interests and needs and so on. Differentiating women and men in a discussion may empower women since they may feel more confident to confront their issues within their own group rather than in a mixed group (Chambers, 1997). The group participants were selected from different men's and women's groups based on standard selection criteria to ensure representation of different ethnicities, literate and illiterate people and user groups of different technologies.

Figure 5.4: Household Survey Interview

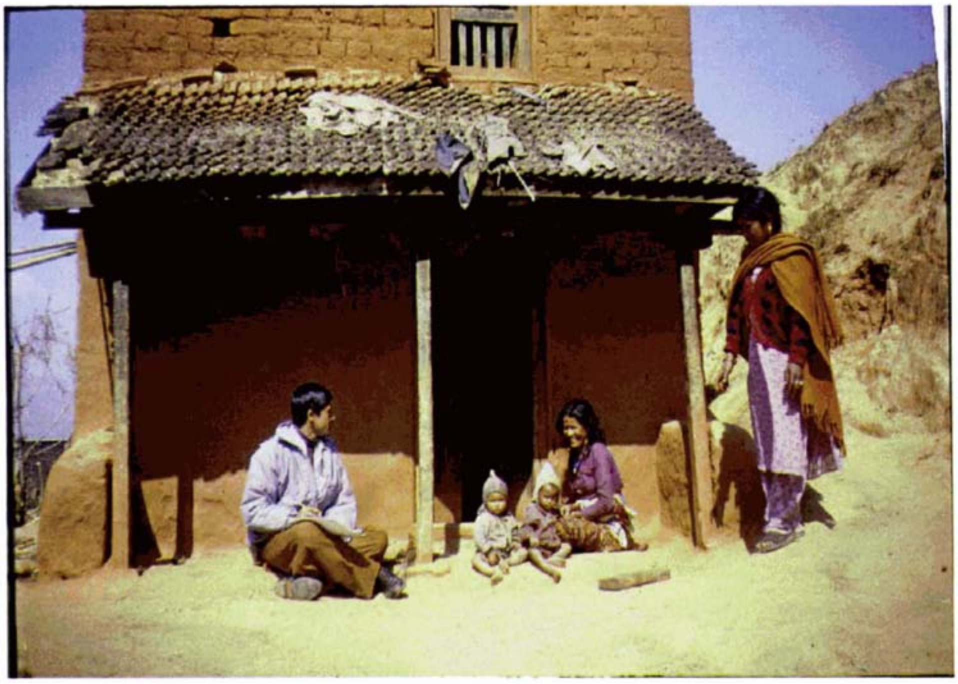
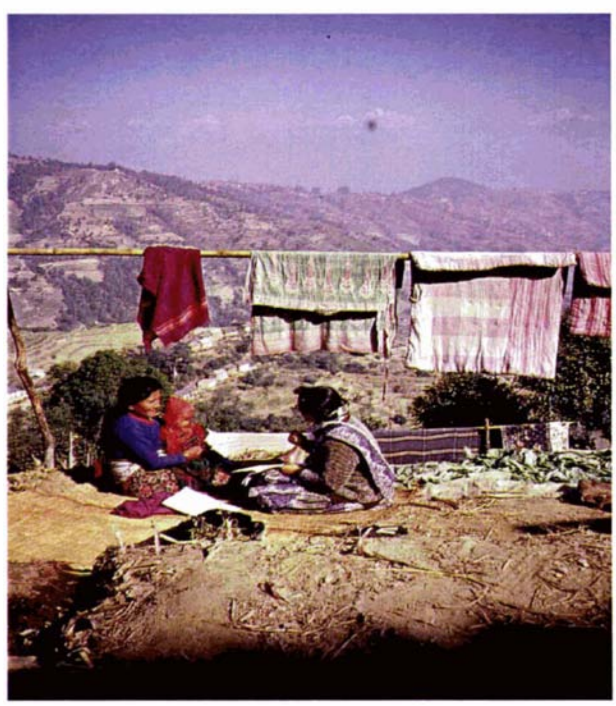


Figure 5.5: Interviewing a Key Informant



Source: Field Survey, 2002

Figure 5.6: Drawing of Social Map by the Local People

Figure 5.7: Focus Group Discussion with Women's Group

Source: Field Survey, 2002

At least two people were needed to facilitate the focus group discussions. I facilitated the discussion and my assistant noted down the outcomes. Men were always interested to listen to the women's discussions and stayed around while we were having the discussions with women's groups, since they had enough time to do so. Women also seemed to be interested to hear the men's talk but they needed to rush off to do their work. In addition, the women did not feel comfortable to stay around while the men were talking.

Preference ranking matrix (PRM)

PRM is a matrix that records the preferences and ranks of individuals over one alternative to other. This matrix is prepared with a group of individuals, and the alternatives with highest ranks/preferences are identified. A common form of preference ranking uses a matrix with items/options along the horizontal axis and the elicited criteria along the vertical axis (Rietbergen, and Narayan, 1998). This method is suitable for assessing the prioritized needs of local people and for comparing options and alternatives. This technique works well in a group as it can reveal interesting differences among group members.

For the purpose of my research, a preference ranking matrix was carried out with different women's groups and a mixed group of men and women prioritizing their needs and interests, and their choices of traditional and alternative energy technologies. The standard criteria were developed to enable the best comparison between traditional and alternative energy technologies. The preferences of women and men were noted. The technology with the highest score represented the highest preference.

Direct observation

Direct observation by definition requires the researcher to be in the field, or to be present in the natural settings where the phenomenon under study takes place. This enables the researcher to understand about the participant's lives and their perceptions concerning the phenomenon under study (Maykut and Morehouse, 1994). This technique does not rely on what people say but draws on the direct evidence of an eye witness observing events first hand. It is based on the assumption that in many cases it is best to observe the actual situation (Denscombe, 1998: 139).

Direct observation was an important part of my research, so I could learn about different aspects surrounding gender and energy technologies and to provide contextual information in the area. For visualizing linkages between the spatial parameters and location specific activity (for example, level of gender awareness and the problems in adoption of rural energy technologies in different villages) direct observation provided me with an opportunity to understand the situation and supplement the information collected through other sources.

Case Studies

> Case studies focus on one instance (or a few instances) of a particular phenomenon with a view to providing an in-depth account of events, relationships, experiences or processes occurring in that particular instance (Denscombe, 1998: 32).

A case study is designed for a detailed analysis of an event/case in its natural setting using a variety of methods and sources. Creswell (1998: 65) points out that the case study is an in depth analysis of a single or multiple cases, and a number of sources are used to collect the data such as interviews, observation, document study and so on. It is a research strategy and not a research method. The concept of the case study includes the important aspect of the decisions in research. As Hammersely says 'it highlights in particular the choices we have to make about how many cases to investigate and how these are to be selected' (1992: 184-5).

For the purpose of my research, four small cases (four technologies) were selected to make sure that each technology under study was analyzed in detail. The case studies were carried out from three different VDCs (not covered under the household survey) covering the detailed aspects of gender issues and the technologies concerned. An effort was made to highlight the effective and ineffective energy projects (based on the consultation with local people and project staff and based on my own observation) and their socio-economic implications for rural communities. Various tools of gender analysis (GA) were used for detailed gender analysis in the case study villages, apart from using the other participatory research methods. Among the different tools of GA, activity profile and gender analysis matrix (GAM) were used considering the needs of my study and their simplicity in application.

Activity Profile

An activity profile is based on the concept of a gender-based division of labor and includes four major elements: gender and age, time and the activity locus(March, Smith, and Mukohopadhyay, 1999: 33). All relevant productive and reproductive tasks are identified, and questions such as who does what and how much time is involved to carry out the activity were recorded (Overholt, Cloud, Anderson, & Austin, 1991:11). The date of the activity profile depends upon the nature of project. If the project is involved directly in the areas of activity, greater detail will be required (March, Smith, and Mukohopadhyay, 1999: 33).

An activity profile was prepared with groups of women of different ethnicities using different technologies. The purpose of this profile was mainly to see the workload of women and the time availability for them to involve in any social and economic activities. The activity profile recorded the daily activities that women perform on a regular basis. However, it was not a very accurate account of the real workload of women, since their activities vary according to different time-periods and different seasons. There were many extra activities the women performed apart from their regular activities. For instance, during the heavy agricultural season, the women worked on the farm as well as at home performing all the household chores. Because of time limitations during my fieldwork, it was not possible for me to prepare an activity profile for all the different seasons. However, I recorded the extra activities for different time-periods and respective times for each activity so as to get an indication of average working hours, even though it can only give a general picture.

Gender Analysis Matrix

Gender Analysis Matrix (GAM) is a framework for gender analysis, which is used to determine the different impacts of development implementations on men and women. It helps to identify and accommodate the needs and interests of men and women. The GAM encourages critical thinking about gender roles and the perceptions of society on men and women's labor. It shows the gender impact on labor, resources, time and culture (Parker, 1993). GAM can be used in planning, designing and also at the monitoring level to see the gender perspectives in different situations.

I used the GAM for my field research in order to see the positive and negative implications of AETs on men and women. It was basically aimed at finding out the impact of AETs on women's workloads and on their time, resources and culture. Initially, talks took place with a women's group and then separately with a men's group in order to get their views about the implications of AETs on men and women. Later, the analysis was shared with a mixed group of men and women to determine whether the decisions of men and women together differed from the separate groups. Finally, all the matrices was combined and a single matrix was developed showing the positive and negative implications of AETs on men and women.

Interview with Key Individuals

Interviews were conducted with key people like the VDC leader, women's group leaders, village elders school teacher, foresters, who were believed to have a detailed knowledge of the current situation. This kind of interview was conducted in a very informal way in order to get both complementary and supplementary information on gender and energy issues. The perceptions and attitudes of those interviewed regarding gender roles in energy management, traditional versus alternative energy technologies and development problems and potentials were discussed in detail. Some issues, which appeared to be important during the survey were further explored with the key participants. In order to guide this kind of interview, a checklist of agendas under discussion was prepared (See Appendix III).

Consultation with Various Government/Non Government Agencies

I consulted the representatives of various government and non-government agencies working in the rural energy sector in order to have broader views and opinions on policy matters, rural energy issues and problems and potentials. Consultation was in the form of semi-structured and unstructured interviews. This kind of interview helped me to have broader thoughts on policy matters, practical problems in program implementation, and the potentials.

An unstructured interview is designed in such a way that emphasis is placed on the interviewee's thoughts (Denscombe, 1998: 113). The researcher's role is to be passive by starting a theme topic and letting the interviewees develop their ideas and pursue their own train of thought. Under the semi-structured interview, the interviewer has a clear list of issues to be addressed but he/she is prepared to have more flexibility while talking about the issues (1998: 113).

Field Notes

Field notes are an important means of recording observations in the field. We tend to forget many occurrences and thus continuous note taking is necessary to overcome this tendency. Observers are often able to take notes on the spot and can do so continuously during their entire time in the field (Lofland and Lofland: 1995: 89). Neuman (1997: 364) mentions that field notes must be as concrete, complete and comprehensive as possible. Small talk should be recorded even if it does not appear significant at the time of observation. It may become significant later on. Neuman (1997) further argues that the researcher's emotional feeling and private thoughts must also be included in such notes. This helps researchers to reflect a situation nearer to reality. Field notes can be taken during the observation itself or immediately afterwards (Denscombe, 1998: 120). Field notes were used as an important part of my research process. I took a note of the methodological issues, which arose in the field, my personal insights, feelings and impressions during the research process. For this purpose, I kept two journals; one for recording general observations and one for recording personal feeling and thoughts. These kinds of notes help to improve the validity of the research as well as to enrich the analysis of research findings.

Documents Study

Various published and unpublished sources were reviewed with the aim of gathering additional information and the other reference information supporting the primary data. Apart from the primary data, studying various research reports, brochures and other related documents was very helpful to obtain the supportive information for my research. While most academic articles could be sourced from Massey University, a lot of secondary data specific to rural energy issues in Nepal had to be collected during field work. Such data included for example, annual reports of the Rural Energy Development Program (REDP), brochures and reports of other energy sector institutions, planning documents from National Planning Commission (NPC), and district profiles from district office, Kavre. In this regard, offices in Kathmandu and in Kavre district were visited.

Data Processing and Analysis

The information and data collected from the field was processed and analyzed using different quantitative and qualitative measures.

Descriptive Statistical Analysis

The bulk of quantitative data was processed and analyzed using SPSS. A code book and dummy tables were prepared prior to the analysis. Descriptive statistics particularly maximum and minimum distribution, mean, standard deviation, and frequencies, were computed as per the requirements so as to describe and verify the research objectives. For instance, cross tabulation with frequencies was used to see the problems and potentials of rural energy technologies, and gender roles in household energy management in project and non-project areas. The chi-square test was also done to see the independency of variables based on project and non-project areas. Analysis of variances (ANOVA) was used to determine differences in mean scores of women's labor, time and their workload in two different areas. Multiple response variables were presented in simple tables. Bar charts and pie diagrams were developed as necessary to facilitate a bird's eye view on issues such as average time for collecting firewood, time availability for social and economic activities and for the children's study hours, ethnic composition and literacy status.

Descriptive Interpretation

Data obtained from open-ended questions, observation, informal discussion, and focus group interviews was categorized, classified or tabulated for in-depth interpretation. Field notes were sorted and used for supporting qualitative descriptions. Tables and matrices were presented and discussed in a descriptive way. The detailed analysis of qualitative data was done by articulating the issues into different subheadings.

Finally, all findings from both quantitative and qualitative analysis were presented logically in conjunction with each other to enrich the analysis. For instance, the workload of women obtained from surveys was supplemented by the case studies based on focused group discussions and observations.

Experiences from Fieldwork: Issues of Methodology

As mentioned earlier, I used the triangulation method with considerable flexibility, compromise and improvisation. Separating quantitative from qualitative approaches was not practical in my study. Hence, both approaches were used as complementary and supplementary of each other. The different techniques of qualitative and quantitative approaches were used for data collection based on the availability of time and appropriate ways of exploration.

Field Trip

When I just arrived in Nepal for fieldwork, an emergency state was announced and restrictions imposed for holding public meetings, traveling in the evenings and nighttime. This created difficulties for my fieldwork, since I had planned to have a number of group discussions and interviews with the local people. I waited for the situation to calm down.

The situation became more critical and the violence was increasing around the country especially in the western districts. My research area; located in the central development region was less effected by the insurgency movement. However, my district Kavre, was said to be a top Maoist area. Still, I was determined to do my fieldwork. I with my research assistants went to a few villages for preliminary observations and for pre-testing my questionnaire and found a very normal situation. For security purposes, I was required to inform the district administration about our period of stay in the villages. I informed the district officer in writing to ensure my security and that of my research assistants during our stay in the district and villages. This also provided a feeling of security for myself and my research colleagues. We felt safe enough to go to the villages.

I found it quite exciting to go to the villages in Nepal after studying in New Zealand for two years in a distant environment. As I was born and grew up in a remote village of Nepal, I had a sufficient understanding of local culture and the village people in rural areas. This prevented me from having a "psychological gap" (in carrying out the fieldwork, unlike many foreign researchers (Rajavi, 1992). The village people developed a variety of feelings towards me. Some of them thought that I might help them in getting a new development project while others thought that I was doing my job as a staff member of the REDP. It was an unsettling experience to be surrounded by these feelings. Even after my formal introduction as a researcher, the local people seemed to have some hidden expectation that my research might provide something good for them in the long-run. However, I could not give them any assurance of this kind.

Obtaining Consent of Participants

I was sincerely conscious of the rights of the participants throughout my fieldwork. Thus the fieldwork was guided by the major principles of the ethical conduct of the research stated in the Code of Ethical Conduct for Research and Teaching Involving Human Subject of Massey University. Prior to going to the villages, my research assistants were carefully trained and guided on the issues of ethical conduct of the research including the rights of participants. I also informed my research participants in the villages about the purpose of research and received their permission for data collection. Most of my research participants at the village level were illiterate or semi-literate. Written agreements were not always possible. In many instances people preferred to provide a verbal consent than to sign a paper. Their perception was that it would be risky to sign a paper, because they might need to provide unnecessary clarifications. Their consents were clearly written in the information sheet on the cover page of the data collection instruments, which basically dealt with their rights to:

- Decline to participate;
- Refuse to answer any particular questions;
- Ask any questions about the study at any time during participation; and
- Provide confidentiality in terms of specific names and places to protect the identity of participants and their family.

In addition, in rural Nepalese culture, privacy and confidentiality are not as important as a tradition of sharing feelings and experiences within a community is. If any problems arise within a family or in a community, they tend to share among each other. It is part of their culture to welcome a guest even if they are unable to provide for them well. It was unlikely that they would refuse to agree to interviews and discussions, even if they were busy. We had to be very considerate and try and fit in with their available time for such purposes.

Rapport Building

The first village we went to was Katunjebeshi, about 23 km from the district head quarters. When we arrived, we walked through the village observing the situation, greeting and talking to people. We were accompanied and introduced by a project staff at district level, thus making it easier to find a place to stay and have our daily meals. There was a small tea shop where they cooked meals for outsiders. This was a place where we had an opportunity to mix with local people, especially men during their tea time in the morning. We chatted with them and learned more about the village. The men then talked to their wives about us, thus making it easier to talk with the women later during the interview stage.

We first invited the local people to draw a social map of their village. Since the group meetings were restricted, because of the state of emergency, I informed the nearest police post about my group work and they allowed us to congregate. Then the local people also felt safe to come together to draw the maps. The map provided a background picture of the village. I took this opportunity to introduce myself to villagers formally, and explained about my stay in the village, the purpose of my research and sought their permission for interviews and discussions.

The local men and women were initially unsure about the map drawing exercise very as they expected me to teach them to draw the map. But, when I explained to the men and women that they were going to teach me about their village, then both men and women truly felt they could tell me more about their village and were actively involved in drawing the map. The similar process of rapport building took place in other villages as well.

Application of Tools

While organizing interviews and discussions with my research participants at the village level, I had to be very flexible so as to fit into their schedules. Sometimes I conducted focus group discussions at night after dinner. Sometimes, I just had to wait an hour or so to get enough research participants for the discussion. Women especially were always busy and it was hard to find a suitable time for long discussions. On the other hand, it was hard to catch men because they would not stay around. I had an exciting time while conducting the focus group discussions with the women's groups. The women were a bit shy initially since their husbands were around, but when the men left after sometime, they were free to talk about whatever they liked. I could not ask the men to go away, since the men would have blocked all discussions. I was very happy to listen to the women, as they had so much to tell us. I did not wish to limit the discussion to my specific research criteria. So, I was flexible as to the direction the discussion took place. I realized that it was more a learning experience than only asking them set questions. I was very pleased to have them share, and express their true feelings on their preferences, likes and dislikes, problems and potentials regarding the rural energy resources and technologies. However, I also felt guilty when involving women in long discussions (two hours) as I was taking them away from their work without providing anything in return except a forum in which they could see that their ideas were of value to someone from outside their community.

When conducting a household survey with women, I had to be very flexible so as to let women continue their work (such as caring for a child, cooking food and winnowing grain), and ask questions at the same time. Sometimes, I could not complete the survey in one sitting and had to go back to the household again, since I could not stick to my questions but listened to their ideas on variety of topics, which was enlightening for me. I felt really guilty when a woman asked "what will you do with all this asking? Will it be of some help to us afterwards? I had to be very honest with her by telling that, the queries were for "research" and not towards her expectations. My answer was disappointing for her. Conversely, some households excluded in my sample survey were keen to be a part of my research, and asked "why did you not come to our house" as if they were offended. I could see the reasons behind it; 1) The people were interested to learn and to share their feelings and experiences with an outsider like us, 2) There were some hidden expectations that interviewed households would benefit in the long run. I was careful as stated above not to fuel their expectations.

While conducting key informant interviews at village level, I had to be very cautious in selecting the participants. I found that the old people were more informative than the village leaders and the individuals affiliated with different local level institutions. Key informant interviews provided me an opportunity to learn about the subject matter in detail.

I had also planned to conduct formal and informal discussions with the representatives of different institutions working in the rural energy sector so as to understand their broader views on policy perspectives, problems in implementation, and other rural energy issues. In practice, it was hard to find people around, especially the government officials, who normally avoided talking with me as I was a student and therefore of no significance in their eyes. Instead, they assigned their secretaries to deal with me. They wanted to show that they were "very important people" and had no time to deal with a researcher. I also observed that they were not confident to participate in discussions. In addition, there was no culture of making appointments in government offices.

On the other hand, it was encouraging to talk with the representatives of research and academic institutions and donor agencies involved in rural energy research, financing and management. They recognized the importance of gender and energy in our context and were happy to participate in my research.

I also used field notes to note down my observations and my personal feelings. Each evening, I recorded my personal feelings and my general observations in the villages. I enjoyed writing such feelings and observations, and when there was no light, I would work with a kerosene light. There was electricity in the villages but most of the time it went off due to technical problems.

A Critical Moment in the Field

In the middle of my research, when I wanted to move to other villages after completing my research in two VDCs, I was stopped. There was an incident in a police post near by my research area: 16 police were killed by the Maoists, and roads were closed. The incident happened on our way to the village. I and my research assistants were so scared to see the truck carrying the 16 dead bodies to the police headquarters in Dhulikhel. After a few days, things normalized again and I felt lucky to be able to continue my work.

Adjusting the Samples

Despite the state of emergency, I was able to carry out my intended research. However, I had to be very flexible in terms of coverage and applying the research tools and methods. Previously, I had planned to take a big sample size for my household survey at least to cover 20 percent of the total population in both project and non-project areas. In the field, however, I had to considerably reduce my sample size due to the existing insurgency problems, which caused difficulties in travel from one area to another. In addition, I was nervous about staying for long periods of time in the villages. I concentrated on only a few villages, where I found it safe. I conducted the household survey with 80 households in the project area and only with 65 households in the non-project area.

Working with Research Assistants

My research assistants were very sincere and supportive. This helped build my confidence to carry out my fieldwork even during the critical stages caused by the civil conflict in side the country. One of my research assistants (a woman) was a new agricultural graduate from Kathmandu. I hired her as an accompanying colleague throughout my fieldwork rather than only as a research assistant. Having the company of a woman friend throughout my fieldwork made it easier for me to travel, and to deal with local people. Two of my research colleagues (male) were from the local area. They were well acquainted with my villages, thus making it easier to establish rapport with the local community. Since they were very experienced with local village problems, they tried to highlight the problems as much as possible through the surveys and interviews. It was a great help to have research assistants to conduct the bulk of survey in the limited time available. While, I had to spend long periods gathering information using participatory research methods. The weakness of having surveys done by my assistants was that I had to monitor the information to make sure that they had got it right. It took me quite a long time to go through their work. In some cases, I found that the information was inaccurate, and I had to explore issues more through focus group discussions and in depth interviews.

Conclusion

As my research was very exploratory in nature, I used triangulation and combined multiple methods of qualitative and quantitative research. As mentioned earlier, my analysis was based on a 'with' and 'without project' situation, so as to see the comparative advantages and disadvantages between traditional and alternative energy technologies. In addition, case studies of AETs were conducted in three VDCs in the project area. Semi and unstructured interviews were conducted with different key informants at village level and also with the key personnel involved in policy planning at national level. Various kinds of participatory research methods were used to obtain the qualitative information as well. They were mainly focused on women's perception s of rural energy technologies, gendered access to and control over resources, gender roles in management of household energy resources, adoption tendency and the level of participation, and participants' preferences in using traditional or alternative energy technologies. A gender analysis matrix (GAM) was used to see the negative and positive implications of AETs on men and women while an activity profile highlighted the workload of women after having access to AETs.

Data obtained from the quantitative and qualitative approaches was cross checked to verify the information obtained from both methods. For instance, accuracy of survey data was verified through the information received from focus group discussions. Especially, when information related to income and expenditure, women were reluctant to provide the factual information. However, during the FGDs, such inaccuracies were checked.

While conducting the fieldwork, I gained a wealth of experience finding out different issues about methodology such as time management, application of tools, ethical issues, rapport building accounting for local people's expectations and so on. Allowing enough flexibility and respecting local norms and values were two important principles of my research, which proved to be particularly important in light of the security situation affecting Nepal during my fieldwork.

Chapter Six
Rural Energy Planning and Policies in Nepal: The Challenges

> If the focus of energy planning is merely on the supply of energy, without scrutinizing the structure of demand, the end-users of energy and the beneficiaries of the energy supply, then whether energy ever reaches the poor to perform the services they need will be largely a matter of chance.
>
> (Goldemberg and Johanson, 1988: 33)

The above quotation from Goldemberg and Johanson highlights the central problem facing rural energy planning in Nepal. This lack of attention to reflecting the needs and priorities of local people, especially of women, who are the direct users and beneficiaries of rural energy is a recurring theme throughout this chapter.

Nepal embarked on periodic planning in 1956. However up to the Fifth Plan (1975-80), the main emphasis was on the physical infrastructure for building a foundation of development in the country. Only after the Fifth Plan did the government give priority to productive sectors such as agriculture, forestry, and human resource development. The Eighth Plan (1992-97) was very distinct from previous plans by placing an emphasis on a market-oriented economy (NPC, 1998). This was a turning point for the development of the country through liberal economic policy. For the first time in history, the effectiveness of the private and non-government sector was emphasized for development. The focus was on sustainable economic growth, poverty alleviation, and the reduction of regional imbalances as its principle objectives. Energy development became a priority in this planning period with an emphasis on alternative energy for economic development.

This chapter elaborates on existing plans and policies for rural energy, reviews the roles of energy sector institutions and their linkages, and the policy issues and challenges that have been encountered in the rural energy sector in Nepal.

Plans and Policies Regarding Rural Energy in Nepal

Rural energy plans and policies in the different planning periods are explained in this section, with an emphasis on recent plans that have placed a specific focus on renewable or alternative energy.

An energy development policy was not introduced in Nepal until the Sixth Five-Year Plan (1980-1985). During the planning period, only the hydropower and forestry sectors received priority. The government started to focus on the development of alternative energy for socio-economic development only in the Seventh Plan. In the Eighth Plan, high priority was placed on energy development, targeting energy needs and giving a great importance to the development of alternative energy technologies. Three major energy policy objectives envisaged in the Eighth Five-Year Plan (1992-97) were: 1. to increase consumption of electricity and support energy intensive industries with the development of hydropower, 2. to develop alternative and decentralized energy resources as a substitute for imported fuel, 3. to ensure environmental protection.

The plan adopted the following strategies to achieve these policy objectives (NPC, 1992 cited in Banskota and Sharma, 1998: 128):

- 'Developing indigenous energy resources in the most efficient manner.
- Cost effective and environmentally friendly energy conservation and demand management practices.
- Financing for the execution of hydropower projects of different capacities.
- Entering into import/export agreements if the net benefit is beneficial.
- Pricing all energy to reflect social costs.
- Addressing environmental problems associated with energy and demand in collaboration with both non-governmental and international agencies.

- Transferring the ownership of government owned energy sector utilities to the private sector in line with the privatization policy'.

Based on the above strategies, there was a greater emphasis on involvement of NGOs and the private sector in the development of hydropower in Nepal in this plan (Bhadra, 1998).

The Ninth Plan (1997-2002) emphasized the development of renewable energy in the overall context of development specifically in view of the rural energy requirements and the need to protect the environment (NPC, 1998). The plan aims to increase the supply of traditional energy sources with minimum negative environmental impact, involve the private sector as well as national and international NGOs to reduce the cost of alternative sources, institutionalize the monitoring system, and emphasize the end use diversification of energy (NPC, 1998). The strategies envisaged to fulfill these aims include promoting energy use efficiency of traditional biomass energy, disseminating smokeless stoves, increasing the supply of energy from isolated power systems (micro-hydro and solar home systems) and providing subsidies for the development of AETs. The Ninth Plan aimed to develop an Alternative Energy Promotion Center (AEPC) as a nodal agency for the promotion and development of alternative energy sources. In this plan, the focus is on increased energy efficiency by adopting new technology for rural energy and minimizing negative impacts upon the environment. There is no mention of socio-cultural concerns which would integrate gender issues. Thus, the fundamental goal of the development of rural energy systems in the Ninth Plan was to develop the country's economic foundation by increasing employment opportunities through the provision of modern energy services (NPC, 1998). In line with neo-liberal stance, an emphasis was given to increase production and productivity by 'compulsory adoption of advanced technology (that helps to reduce foreign trade deficit) in economic and social sectors' (NPC, 1998: 598). Involvement of private sector and international non-government organizations was encouraged for reducing the cost of alternative energy technologies through the provision of subsidies. Although the Ninth Plan focused on the development of alternative energy technologies, large-scale rural electrification was still a priority for the purpose of developing rural infrastructure such as agro-industries, irrigation and cottage industries (NPC, 1998).

The recent Tenth Plan (2002-2007) has the key objective of encouraging community participation in the planning and management of alternative energy development with the purpose of developing a sustainable rural energy system and thereby providing clean and affordable energy, increasing employment opportunities, and uplifting the rural economy. The focus is on strengthening community, government, and non-government organizations for a decentralized energy system (NPC, 2003). The main strategies developed to achieve these objectives are to supply minimum energy needs, provide subsidies, supply domestic energy and other energy for economic activities, and encourage maximum utilization of alternative sources of energy.

In addition to national development plans, specific energy plans have also been developed focusing on a long term perspective. The National Planning Commission (NPC) with the support of UNDP/Nepal prepared the Perspective Energy Plan (PEP) and Renewable Energy Perspective Plan of Nepal (REPPON) as policy documents of His Majesty's Government of Nepal. The perspective energy plan (PEP) was developed in 1995, focusing on the country's energy management using 25 years perspective from a comprehensive viewpoint. Similarly, the REPPON focused on development of RETs in a 20 years time frame. However, these two documents have no official status as being government policy documents.

The PEP's main objectives were to improve the life quality of rural people through rural electrification and to increase employment opportunities at the local level. It also emphasized reducing the drudgery of women and improving their health condition (PEP, 1995). REPPON relates development of AETs comprehensively to general development goals. It links AETs development to rural poverty alleviation, rural employment generation and improvement of the quality of people's lives through integrating AETs with other rural development activities (CES, 2000).

The decentralization of government as underlined in the Local Self Government Act of 1999, which focuses on delivering the services and poverty reduction responsibilities of the government, is another important policy relating to the energy sector (Delucia and CRT, 1997). A decentralized rural energy development paradigm was initiated based on the approach of community participation for rural development. Subsequently, decentralized rural energy development processes (such as REDP initiative of UNDP) were designed to address the overall development of the community through the development of rural energy (Bhadra, 1998). Under the approach of decentralization, UNDP has incorporated the local government agencies such as district development committees (DDCs) and village development committees (VDCs) in delivering energy services effectively.

However, rural energy issues are not well integrated with rural development at present. Individual line agencies address rural energy issues in a non-integrated fashion. There is no coordination between institutions on program intervention, monitoring and implementation (Banskota and Sharma, 1999).

Government policy regarding the development of alternative energy including biogas technologies in the past has been widely criticized for its inconsistency and irregularity (CRT, 1997; Devkota, 1999; Rijal, 1997). The present subsidy policies for alternative energy for example are also said to be highly inconsistent with the broad objectives of social equity, economic growth, environmental concerns, liberalization of the economy, and regional balance in economic development activities (ITDG, 1995). For instance, the subsidy on biogas allows very limited access to the poor since they can not fulfill the collateral conditions of the Biogas Support Program's participating banks. Similarly, the subsidy on solar photovoltaic systems is provided as a complete package, including house wiring, and even the purchase of fixtures, which is less accessible to the poor (WLG/WECS, 1995). The tax policy at present is also not favorable toward the development of AETs. For example, the import duty on alternators for micro hydro plants is 40 percent, while it costs much less to import diesel generators (Amatya and Shrestha, 1998b). The subsidized technologies were only accessible to the richer households, since they were still expensive for the poorer households (Amatya, et al, 1998b; World Bank, 1998a). In addition, the subsidies (prices and capital subsidy) on AETs are attractive from a financial position, however, there is little focus on training, research and development and end-use promotion, on which efficient operation and sustainability of these technologies depends (PEP, 1995). Policies on renewable energy have some negative implications. For instance, the price of fuel wood is determined by market forces, which is above the long term marginal costs. However, the poor are not directly affected by the prices because they rarely purchase firewood. Similarly, subsidies on LPG, kerosene, and diesel have been fixed but are less effective for the poor due to their limited purchasing power to buy such fuel (Delucia, 1994). For development of micro-hydro plants, there is a provision of concessional loans to generate and distribute electricity. However, with an interest rate of 16 percent plus one percent service charge the loan is not very helpful for local people (EDC, 1996). Although rural development initiatives seem to focus on renewable energy systems, the target community is 'the least in the position to carry either the higher costs of this energy source or to take risks innovative technologies inevitably bring' (Heegde, 2000).

Rural energy policies in Nepal are still focused on technology rather than people and on supply rather than demand. Consequently, the energy investment and subsidy program have been ineffective in addressing the issues related to community development and poverty alleviation. As argued by Heegde (2000: 10) the energy supply system is only one aspect of infrastructure as a whole, and thus no direct relationship can be established between energy and development considering the complexity of development conditions. The planners and policy makers have not put proper focus on the needs and priorities of the local community, and they have practically ignored gender issues. Energy sector policies seem to be almost gender blind both from strategic and practical points of view. No priority was given to the specific users (i.e. women) while promoting AETs, nor were women encouraged to participate in planning rural energy programs. Hence, they have not addressed the importance of gender roles in the energy sector and the involvement of women in energy development programs (Delucia and CRT, 1997). The development of energy technologies was based primarily on the needs, as perceived by experts, rather than the needs of the local people especially women who are the direct beneficiaries (Rijal, 1999b). A case study on micro-hydro plant implementation in Nepal showed that separate planning committees were needed to ensure that women felt free to speak up (Misana, 2001).

Recently, there have been major changes in energy sector planning with shifting emphasis being placed on socio-economic and environmental concerns. This paradigm shift in planning is mainly due to international influences such as the donor's interest in energy development and the focus on a market based and liberalized economy for alleviating poverty and achieving economic growth (Amatya and Shrestha, 1998a; Rijal, 1999a).

Overall, rural energy plans and policies in Nepal have not been given enough attention in the national planning framework and the policies have not been that effective in achieving the long term goal of sustainable development. Some initiatives for alternative energy development in different planning periods are yet to be realized, because of a number of factors including allocation of resources, availability of skilled personnel and the local community's interests and priorities.

Rural Energy Institutions in Nepal

There are a number of institutions working with the alternative energy sector in Nepal. It is worth mentioning about the various roles of different agencies contributing to the rural energy sector. The major actors can be divided into five groups; government, financing institutions, non-government, private sector and donor agencies. For instance, the government agencies prepare plans and policies and also play active roles in delivering subsidies. The central level NGOs are mainly involved in a cross-section of issues related to the environment and energy. The local level NGOs focus on promotion and awareness of relatively new technologies such as solar, improved stoves, and biogas in remote areas. The private sector is the primary promoter and implementer of most AETs such as micro-hydro plant, solar and biogas. Lately, government planning is heavily reliant on the participation of the private sector; this sector has been emphasized in subsequent five year plans. The donor agencies support the government both technically and financially. Their support ranges from the macro to micro level and from singular AET initiatives to an integrated development approach (SNV/N, 2001).

The role of different institutions will be reviewed below so as to examine the present scenarios of rural energy planning within the country. Information about these institutions has been obtained from different published and unpublished reports, and formal and informal discussions with the key people in the institutions concerned. Where information was available, the ways in which gender issues are addressed by these institutions, is outlined.

Government Institutions

National Planning Commission (NPC)

The NPC is a national body for economic planning under the government. It is also the authorized body for national energy planning and prepares the overall policy framework. The NPC is responsible for preparing strategic plans and policies and integrating energy development programs into comprehensive national energy planning. The NPC reviews the energy sector programs and projects in connection with the preparation of national five year development plans and annual budgets (Delucia and CRT, 1997). NPC as a government body is directed towards economic development rather than the social development.

The NPC does not yet pay specific attention to gender issues in preparing national plans and policies. However, its emphasis is on strengthening community based organizations and local governance for effective implementation of rural energy programs (semi-structured interview with the chairman of NPC, 2002).

Ministry of Science and Technology (MOST)

This Ministry develops plans and policies and facilitates the promotion of science and technology. The MOST is particularly responsible for promoting all renewable energy technologies (Delucia and CRT, 1997). The Ministry coordinates with donors and INGOs in promotion of small scale renewable energy technologies. The MOST reviews the alternative energy plans and programs prepared by the Alternative Energy Promotion Center (AEPC), prior to submitting them to the NPC. The Minister of MOST is a member of the executive committee of the AEPC.

MOST mentions women's participation in its general policy for science and technology, however this is not specific to the energy sector (semi-structured interview with MOST secretary, 2002).

Alternative Energy Promotion Centre (AEPC)

The AEPC was established under MOST in 1999 as an umbrella organization for all AET initiatives. AEPC is an executing and coordinating agency of AET-related activities of the government sector, but it does not directly get involved in the implementation of AETs. AEPC is a jointly funded by the government and the energy sector assistance program (ESAP).

The AEPC is mainly responsible for preparing and reviewing plans, programs and coordinating with different line agencies of the government. It delivers the subsidies from the government to different energy related institutions to implement AET activities. It annually reviews and monitors the alternative energy plans and programs of the government and jointly approves them with related stakeholders (ITDG, 2000).

The basic objective of the AEPC is to promote renewable energy in order to replace fossil fuels especially with the provision of electricity to increase awareness through television and radio and encourage cottage industries. Its long-term objective is to protect forest and environment and to develop commercially viable alternative energy industries (Vaidya, 2000). There is no mention of gender in any aspect of the AEPC's program, and no emphasis has been put in place to integrate gender issues into the planning and implementation of the program (personal consultation with AEPC's advisor, 2002).

Water and Energy Commission Secretariat (WECS)

Prior to the establishment of the AEPC, the WECS was fully responsible for energy policy formulation, analysis and planning, and for recommending short and long term development strategies to the government for the energy sector. The WECS includes representatives of all Ministries and is mainly involved in the investigation of national water and energy resources, studies of national water and energy requirements, conservation, development and utilization of water and energy resources, and preparation and coordination of short term and long term plans for water and energy development (Delucia and CRT, 1997). After the establishment of AEPC, WECS has concentrated more on research and development in the energy sector and provides energy-related information to the respective department and ministries for assisting in formulating plans and policies. WECS has conducted some research studies focusing on gender issues (WECS, 1995b).

Financing Institutions

Financing institutions play a crucial role in the development of the rural energy sector not only in terms of financing, but promoting rural energy technologies through their rural network. Prior to 1995, the Agricultural Development Bank of Nepal (ADB/N) was the major institution to provide loan and subsidies for AETs such as biogas, solar, micro hydro and improved water mills and so on. Over the past five years, the commercial banks also became involved in financing AETs with their priority sector lending program.

Micro-finance institutions are doing especially well in financing AETs, since they are accessible to poor rural households and to women (SNV/N, 2001). Micro finance institutions are widely dispersed around the country and have a high potential to develop the rural energy sector through financing small energy schemes and the end use activities. The micro-financing area in Nepal involves mainly the participation of the private sector although government institutions such as Nepal Rastra Bank have been involved in the promotion of micro-finance through commercial banks.

International Donor Agencies

Many donor agencies are also involved in the promotion of AETs by providing technical and financial support. Donors support the rural energy programs both at the micro and macro levels. For instance, the United Nations Development Program (UNDP) has contributed significantly to the promotion of micro-hydro plants through the Rural Energy Development Program (REDP). The Danish International Development Agency (DANIDA) has been highly involved in the promotion of solar photovoltaic systems and improved cooking stoves (ICS) through AEPC. For instance, DANIDA has provided 50 percent subsidies on the solar photovoltaic system, and has supported the ICS training and developing awareness about the advantages of ICS through local and national media, and newspapers or bulletins. The Netherlands Development Organization of Nepal (SNV/N) plays a very important role in promotion of biogas plants through the Biogas Support Program (BSP). The SNV/N support the biogas program through providing subsidies mainly to enable small farmers to use biogas technology. The long-term objectives were to reduce the use of firewood, and improve the health and sanitation of the rural population, especially the women (SNV/N, 2001).

Donors, especially UNDP have recognized the gender implications of rural energy technologies and integrated gender issues in their plans and programs. For instance, REDP is a program supported by UNDP, which emphasizes gender issues. Lately, SNV/N has also encouraged BSP to integrate gender concerns into their plans and programs and BSP included gender mainstreaming activities in its annual plan 2001. DANIDA has not yet explicitly mentioned gender issues in their plans and programs.

Private Sector

The role of the private sector in the development of renewable energy technologies has been emphasized since the Eighth Five Year Plan in which the government adopted neo-liberal policies. The private sector works as an important vehicle for the promotion of alternative energy technologies in Nepal. This particular sector is very active in providing quality services to meet the expectations of customers through its dense network covering most of the country (SNV/N, 2001). For instance, private biogas companies and solar companies provide products and services to the customers in rural areas. Their roles become particularly significant, when customers are generally unaware of the product and services, which is a threat to the customers as well as to the new technology. The companies have yet to strengthen their services in repair and maintenance.

Non Government Agencies

Different non-government agencies are involved in the promotion and implementation of AETs. Their roles in the rural energy sector are manifold. NGOs are especially important in promoting new technologies in remote areas. Some key NGOs involved in the promotion and implementation of AETs are described below. Among the different NGOs, the Rural Energy Development Program (REDP) is described in detail as my research is focused on rural energy programs implemented by the REDP. It is one of the largest NGOs, which is extensively involved in implementing rural energy programs in different districts of Nepal.

Rural Energy Development Program

The REDP was started by the joint initiatives of the United Nation Development Program (UNDP) and His Majesty's Government in August 1996 with the aim of improving rural livelihoods through the promotion of rural energy systems, primarily with micro-hydro systems as an entry point (REDP, 1999). At the same time, REDP has promoted other alternative rural energy technologies such as biogas with toilet-attached plants, solar photovoltaic systems and improved cooking stoves. REDP has adopted a holistic approach that includes natural resource management, institutional development, community mobilization, demonstration schemes, human resource development and research and development.

REDP considers community mobilization essential for promoting sustainable rural development. The six basic principles of community mobilization adopted by REDP – organization development, capital formation, skill enhancement, environment management, technology promotion and women's empowerment are reputed to motivate the community members to undertake community development initiatives by themselves (REDP, 1998).

As a process of community mobilization, REDP helps to form the community organizations (COs) with the help of support organizations. COs are basically organizations of male and female members. A male and a female member of each household must be members of the male COs and female COs respectively. The COs are responsible for savings mobilization, adult education, and other development activities at the village level. The COs hold weekly meetings to collect the money saved, and discuss its productive use, and other community development activities. From the savings, credit is disbursed to the group members with some interest so as to enable them to carry out small income generating activities (REDP, 1997).

The COs largely take part in community development activities, such as road construction, canal construction, toilet construction, drinking water scheme, and so forth (REDP, 1998). REDP assigns different tasks for such development activities to different COs as functional groups. The groups coordinate with each other to perform these tasks. The COs members are also provided with skill development training to be involved in different social and economic activities, such as training on adult literacy, health and sanitation, forestry activities, vegetable farming and small handicraft activities (REDP, 1997).

REDP, with the help of its support organizations (NGOs), conducts participatory workshops in the initial phase of project period mobilizing the community organizations (COs) to make the local people aware of the relationship between AETs gender, environment, health and sanitation issues and thereby increasing active participation of both men and women in rural energy programs (REDP, 2000). The COs are responsible for continuing the awareness activities at later stages. REDP's experience in different districts has revealed that women have demonstrated the change in their decision making capability with their involvement in COs and initiation of various social and economic activities (REDP, 1998:11).

One of the major activities of REDP is to link rural energy planning with district development planning. The REDP conducts energy review meetings each year at the district level attended by VDC and DDC leaders and concerned authorities. In these review meetings, each VDC presents their energy situation and requirements. REDP makes a preliminary study of VDCs based on information in the review meetings and the secondary information available at DDC level and then identifies possible areas of intervention. A pre-feasibility study of ten or fifteen VDCs is conducted and the ranking of those VDCs is submitted to the DDC, which finally makes the selection of a few VDCs where the rural energy program will be initiated (ITDG, 2001).

Biogas Support Program (BSP)

BSP was set up as a joint venture between the Agriculture Development Bank/Nepal. (ADB/N), recognized biogas companies, and the Netherlands Development

Organization of Nepal (SNV/N) to support the biogas program through subsidies and quality control. The overall goal of BSP is to develop and disseminate biogas as an indigenous and sustainable energy source in rural areas of Nepal (SNV/N, 1999). It aims to promote the use of biogas as an environmentally friendly technology, so as to reduce the use of firewood. While programs are designed at the national level, there are a number of local actors such as local promoters, and local farmer's groups involved in the implementation of biogas activities. BSP directly monitors biogas installation and subsidies with the coordination of AEPC.

There is some mention about gender mainstreaming in BSP's annual program document. However, no special effort has been made to address gender issues of biogas planning in practice. There is some documentation which shows that in some areas, women masons were trained and that women were adept at promoting the biogas plant (SNV/N, 1999). However, this account is very insignificant on a national scale.

Centre for Rural Technology (CRT)

The CRT was initially established as a private organization to generate and promote the use of renewable energy technologies. Later it changed its status into an NGO and has been actively involved in the promotion and dissemination of AETs throughout the country with the assistance of different donors.

The CRT has worked independently and also jointly with different government agencies in promoting AETs. Its major interventions are improved cooking stoves, improved water mills and solar photovoltaic systems. CRT has based its approach on local capacity building and the utilization of local resources for the promotion of AETs (CRT, 1999).

The CRT has addressed gender issues in dissemination of AETs although the primary objective of the CRT is to conserve biomass and provide an efficient energy supply. It implements the promotion of AETs through the Women Development Division

(WDD) under the Ministry of Women Children and Social Welfare so as to involve more women in AET activities. For instance, more women were trained in using ICS and a few women masons were also trained in building ICS.

In the year 2002, the CRT coordinated a national workshop with the support of ENERGIA (International Network on Gender and Sustainable Energy) to establish networking on Gender, Energy and Water (GEW) in Nepal. Consequently, a national network has been established on GEW involving key stakeholders (government, NGOs/INGOs, research organizations and individuals). The network will hopefully lead to an effective gender mainstreaming mechanism including the policymaking level to the implementation of energy programs (GEW, 2003:1).

Intermediate Technology Development Group (ITDG)

The ITDG is an international NGO based in the United Kingdom. It established a branch in Nepal in 1989 and has been involved in policy advocacy, end use promotion and the introduction of new technology (ITDG, 1998). The ITDG for instance, organizes conferences inviting government, other INGOs, NGOs, and donors involved in the rural energy sector for policy lobbying so as to increase the access of rural energy for the poorest of the poor. It works for the promotion and development of alternative energies for the sustainable development of rural communities (ITDG, 2000).

The ITDG has been recently working on pilot testing for a small wind energy technology in order to see its viability in Nepal. Prior to introducing any new technology, the ITDG conducts impact studies, reviews others' interventions in the area, identifies gaps and then makes appropriate interventions aimed at increasing access of rural energy to rural people. The ITDG has presently adopted the following three strategies; "technology promotion, policy lobbying and capacity building" (semi-structured interview with advisor of ITDG, 2002).

Gender issues are not integrated in the ITDG's program and plans, though all the rural energy technologies introduced by the ITDG have gender implications. Its focus is more on technology than the implications of technologies and it has not yet recognized the importance of gender issues in the promotion of the technologies.

Center for Environment and Agricultural Policy Research (CEPRAD)

The CEPRAD was established in 1990 as an NGO at the national level and works for economic development and community health initiatives. The CEPRAD as a health promotion strategy, has integrated ICS activities into its program with the support of the Center of Canadian Cooperation International (CECI/Nepal). CEPRAD has implemented ICS activities in 12 VDCs and one municipality of the far western district.

The need for ICS was identified as a health promotion measure through a baseline survey. The CEPRAD provides training to the local promoters including women to construct ICS and also the construction materials. Training to the different users group is also provided for creating their awareness on the use and implications of ICS during pre and post construction (semi-structured interview with chairman of CEPRAD, 2002).

International Center for Integrated Mountain Development (ICIMOD)

The ICIMOD is an international research institution based in Kathmandu. ICIMOD's activities are concentrated on the promotion of mountain development. ICIMOD has been actively involved in renewable energy development programs, through research and development, capacity building and providing management support to the implementing institutions. The present focus of ICIMOD is an drudgery reduction, capacity building and community based energy planning activities, in order to improve the quality of life of mountain people, especially of women. ICIMOD has highlighted gender mainstreaming activities through its different programs. In the renewable energy sector, a considerable effort has been made to influence policy and decision makers, to integrate the gender issues in the dissemination of renewable energy technologies through workshops and seminars (Rijal, 2002).

Center for Energy Studies (CES)

The CES was established as a research and training unit in an institute of engineering with an aim to provide technical education in the field of the energy sector so as to develop skilled human resources able to promote quality energy services. CES also provides education and awareness for large masses, including planners and policy makers, school teachers, DDC/VDC leaders, representatives of different institutions and the local people.

The CES organizes short term workshops and training to provide awareness to different groups of people on technical, institutional, financial, and socio-cultural aspects of AETs. The CES also conducts research and impact studies on AETs and disseminates information and case study results to different stakeholders (CES, 2001).

CES encourages women participants in its training and workshops organized for rural energy technologies, so as to make them more aware of the use and implications of such technologies (Semi-structured interview with Director of CES, 2002).

Community Awareness Development Center (CADC)

The CADC was established in 1997 to disseminate information about appropriate technologies with a realization that there was a huge information gap among the users of AETs. Prior to this, no organization was involved in purely disseminating information about AETs. The main avenue of the CADC for educating rural people is through a newsletter. The target population of this newsletter is high school students, teachers, and local NGOs, who can again inform the rural masses about the use and implications of AETs.

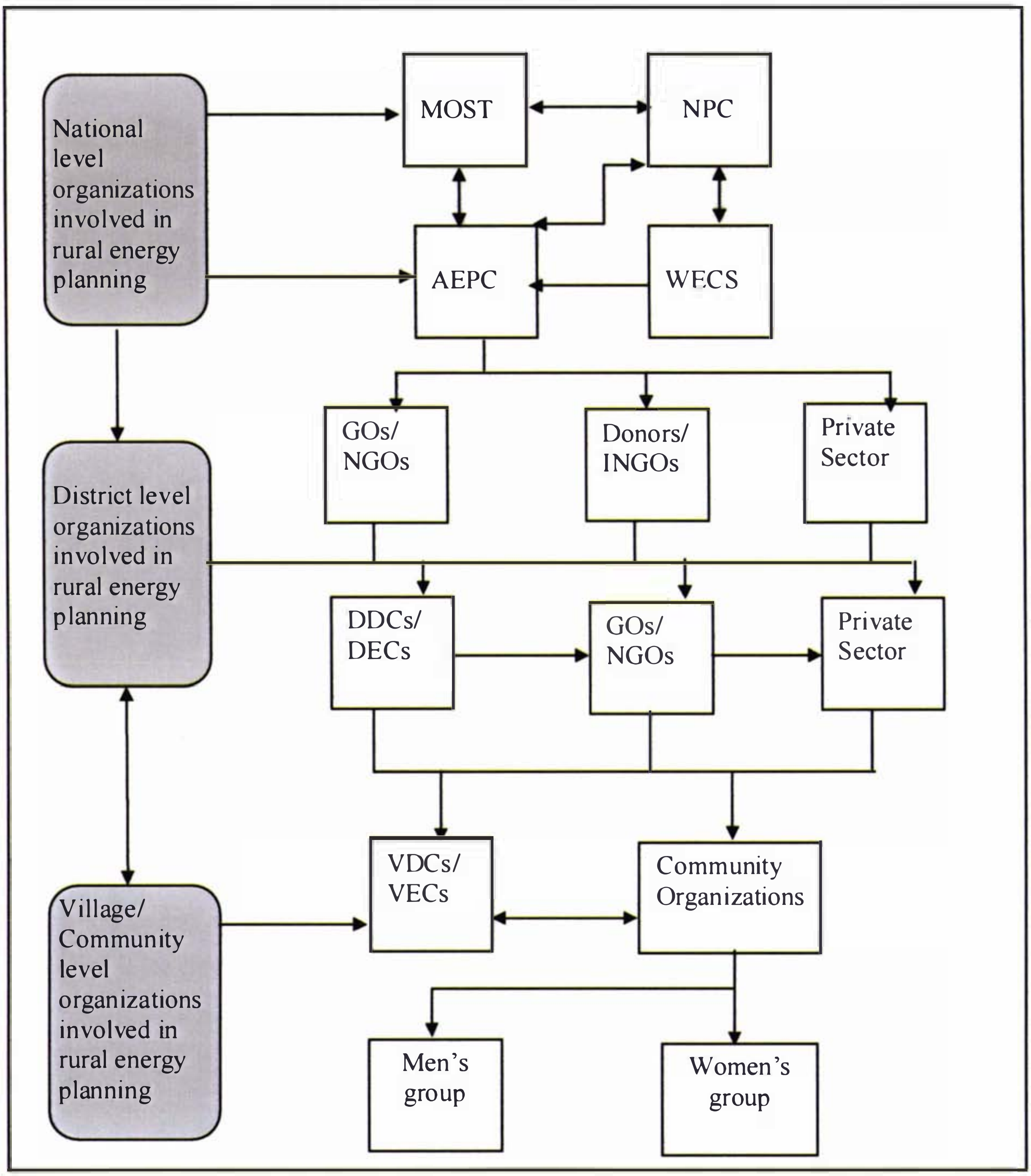
CADC's newsletter "Appropriate Technology" introduces different technologies with a focus on micro-hydro plants. It provides information on subsidies, explains benefits and uses, and also discusses the positive and negative implications of AETs and shares success stories.

The different institutions mentioned above have contributed to the rural energy sector in one way or another. However, they have to strengthen their capacity and coordinate their plans and programs in order to provide better integrated rural energy services. While considering the institutional concerns of gender issues, it has been found that the government agencies have almost ignored gender roles in the planning and management of rural energy. The research institutions and a few donor agencies such as UNDP, have advocated for gender issues be integrated into rural energy plans and programs. Similarly some NGOs, such as REDP and CRT, have integrated gender concerns in the promotion and dissemination of alternative energy technologies.

Relationship and Linkages between Existing Energy Institutions

Figure 6.1 presents the linkages and relations between different institutions involved in rural energy planning. The institutions involved in rural energy planning and policies are categorized into three levels; national level, district level and village level. At present, the AEPC is a government institution responsible for preparing plans and policies concerning renewable and alternative energy. However, the AEPC does not have a standard agenda for preparing overall plans and relies on individual programs prepared by different government and non-government organizations. The AEPC is more involved in managing the donor's funds and organizing subsidies. Till now, the NPC prepares energy planning and policies as sectoral planning based on the information provided by MOST, AEPC and WECS. WECS as a research unit under the Ministry of Water Resources also gathers and provides the information related to rural energy to the AEPC, and the NPC. The central level organizations prepare their own energy plans and programs within a broader policy framework of the NPC.

Figure 6.1: Relationship and Linkages between Rural Energy Institutions



Key:
NPC = National Planning Commission, MOST = Ministry of Science and Technology, GOs = Government Organizations, NGOs = Non Government Organizations, INGOs = International Government Organizations, DDCs = District Development Committees, DECs = District Energy Committees
VDCs = Village Development Committees, VECs = Village Energy Committees,

The district level institutions are mainly involved in implementing rural energy programs, based on guidelines from the central level institutions. The government (financing institutions) and non-government institutions at the district level prepares their energy plans in coordination with District Development Committees (DDCs) and District Energy Committees (DECs). However, the district energy plans based on district energy problems, are not integrated into national level plans, since the central planning system follows a top-down structure. At the local level, the district energy institutions review the rural energy problems involving the village level institutions and prepare plans accordingly within a framework of central level planning. However, there is no coordination between institutions at national and local levels to provide better energy services.

At the village level, the VDCs and Village Energy Committees (VECs) are involved in implementing rural energy programs through men's and women's community organizations. Although the VDCs are not very active at present, the community organizations are directly guided by facilitators from different government and non-government institutions at the district level. Similarly, the private sector is directly involved in providing services through community organizations. The village level problems are less reflected in rural energy plans and policies, since there is no exercise at the national level to integrate such problems. There is no clear focus on research and development or monitoring and evaluation of the rural energy activities at national and local levels.

Rural Energy Planning and Policy: Issues and Challenges

Most energy planning activity in Nepal has been either resource-specific or project-based planning. As shown in the above discussion there is no single institute or department established for rural energy planning to direct the overall policy framework. Individual agencies are involved in rural energy planning in a non-integrated fashion. There is no coordination between institutions involved in program intervention, implementation or monitoring (Delucia and CRT, 1997). Gender based rural energy planning rarely exists either at a macro or micro level except for a few institutions advocating gender concerns in their plans and programs recently.

I had discussions with the representatives of different institutions involved in the rural energy sector so as to get an overview of the overall policy issues, challenges and perspectives in this sector. The main issues identified regarding rural energy planning and policies are categorized into macro and micro levels as follows.

Macro Level Planning and Policy Issues

Macro level issues are those related to the broader policy framework at the national level which are strategically designed to achieve the long-term goal of the sustainable development of rural energy.

Institutional problems for rural energy planning

As mentioned earlier, there is no separate department or ministry in Nepal that is solely responsible for rural energy planning. There is no authorized institution that plans, reviews and monitors the rural energy activities of donors, government and civil society. In the absence of a national institute focusing on the rural energy sector, no clear policy framework and standard guidelines exist to follow in implementing rural energy programs. All the individual institutions involved in the energy sector prepare their individual plans and programs in their own way without any clear policy guidelines. As mentioned earlier, NPC plans and policies include energy only as a sectoral plan based on the information and data available from WECS. Although the AEPC was recently created under the MOST to prepare, review and monitor renewable energy plans and programs, its role is not very clear. So it seems that rural energy is not a priority sector but rather only a subsidiary unit of the poverty alleviation program.

Top down planning

Although recent developments in rural energy planning are focused on a bottom up approach so as to follow the pattern of decentralized governance, the planning practices still remain top down. While, 'local level planning', and 'people's participation' are the important jargons in all aspects of the development planning in Nepal including rural energy, there has not been real change in planning systems. For instance, the AEPC prepares the plans and programs for AETs according to the support of government and donors, and not based on regional and community needs. In the rural energy sector, "there is no clear policy document that could be integrated with an action plan, and no tools to interlink plans and policies with implementation so as to be more transparent at the local level" (semi-structured interview with NGO chairman, 2002). Similarly, different institutions involved in the rural energy sector prepare their individual plans and programs based on the donor's support while ignoring the socio-cultural and economic needs of the local people. For instance, the solar photovoltaic system promoted by AEPC was mainly based on subsidies available from DANIDA, even though it was not affordable to the low income households. Similarly, the biogas plants promoted by BSP, with support from SNV/N, are considered to be one of the successful technologies in Nepal, however they are less popular in hilly regions of the country especially among the low income households (personal observation, 2002).

Information and knowledge

Interviews with different officials revealed that, in the rural energy sector, there is no proper database system on how much energy is consumed and how much production is needed, and gender based information is non-existent. In addition, there is no energy institute that keeps a database and disseminates the information on rural energy to the public. The WECS while involved in doing research and case studies in the energy sector, but has very general and limited information on AETs. Concomitantly, such information can only be accessed by the ministries and departments. Information on AETs is very limited and the majority of the consumers are not aware of the multiple uses of services (semi-structured interview with NGO representatives, 2002). There is no networking among rural energy institutions through which information on rural energy can be shared and linked. However, the national network on Gender Energy and Water (GEW) has been recently established in Nepal to increase coordination and share the information between the institutions involved in gender, energy and water (GEW, 2003).

Gender based planning

Since there is no gender based data on the rural energy sector such as how much energy is produced by men and women, who uses energy and who benefits from rural energy programs, rural energy plans and policies are totally gender blind. Interviews revealed that some of the representatives of rural energy institutions (especially from research institutions and donors) realized and acknowledged the importance of gender based rural energy planning, while most of the others ignored it. Although, women were the most effected group by rural energy alternatives, the planners and policy makers (especially from the government) ignored gender issues in rural energy planning and policies. In addition, I also observed, that there were very few people who were knowledgeable and could apply gender tools in their plans and programs. Those available as gender specialists in a few institutions were mainly focused on women's issues in general and not on gender issues in specific areas like energy.

Coordination and cooperation between the sectoral agencies and among the energy institutions at the national level

Various energy institutions at the central level were in conflict with each other instead of working together to provide better energy services to the rural population (semi-structured interviews with NGO representatives, 2002). Additionally, no coordination was established with the line agencies in order to facilitate integrated services for the overall development of the rural poor. For instance, AEPC as an umbrella organization of the government has not coordinated well with other private and government agencies in ensuring efficient rural energy services. The AEPC stopped the Agricultural Development Bank/Nepal (ADB/N) from delivering subsidies through its rural network, which created difficulties for the majority of people to access AETs. On the other hand, energy sector institutions at the central level have only focused on rural energy not integrating their plans with other line agencies such as livestock, agriculture, forestry, finance, and education. This has created a barrier to the development of AETs while limiting the overall socio-economic development of the communities.

Research and development

There was little emphasis on research and development in the rural energy sector. Some institutions involved in rural energy research focused more on accomplishing their own research objectives than researching the project independently (semi-structured interview with representatives of research institutions, 2002). For instance, consultants hired by BSP or REDP are biased towards the program itself rather than revealing the real project situation. There are a few institutions like RECAST (Research Center for Applied Science and Technology), and ICIMOD involved in renewable energy research, however, have not been extensively involved in researching this sector. The WECS is the only unit under the Ministry of Water Resources that is involved in gathering rural energy information and conducting small research and case studies. However, its main function is to provide information to the ministries and departments. No institutions were motivated and encouraged to carry out independent research.

Micro Level Planning and Policy Issues

Micro level issues are those directly related with project level planning that should be designed to achieve the project goals within the specific time period. Such issues become barriers for the effective implementation of rural energy programs.

Community based energy planning

There is no community based energy planning in practice, though a few implementing agencies like REDP are involved in local level participatory planning. An interview with the REDP's manager at district level revealed that the REDP limits its energy planning activities only to the district level by involving the representatives of VDCs and DDCs and district level organizations in identifying the energy needs and priorities of different VDCs (semi-structured interview, 2002). However, the REDP has not yet introduced a community level exercise in identifying the rural energy needs and priorities and potentials of local men and women. Although the REDP has strongly mobilized the community in order to involve the local people-both men and women-in its rural energy program, this is mainly related to the implementation of the program.

In the absence of community based energy planning, the diffusion of AETs such as biogas plants and solar photovoltaic systems was mainly based on the promotion of the technologies and the availability of subsidies rather than considering the socio-economic and cultural needs and priorities of local people. Only rich households can afford such subsidized technologies. As a result, there is a possibility of creating larger socio-economic gaps within small communities.

Involvement of local government

Local government institutions, especially DDCs and VDCs have not been mobilized properly for the successful implementation of the rural energy program. The DDCs and VDCs are important wings in local development, which can effectively contribute to the development of rural energy. They can motivate the local community to participate in the alternative energy movement and provide some financial support as well. At present, the REDP has valued the attributes of the local government when implementing rural energy programs by seeking the active participation of DDCs and VDCs in preparing local energy plans and programs (semi-structured interview with representatives of NGOs, 2002). However, this is not the case with other institutions such as BSP and AEPC involved in the rural energy sector.

Coordination between implementing agencies, donors and the line agencies

Different institutions working on the rural energy sector have no coordination with each other. The plans and programs prepared by the implementing agencies and donors were not coordinated, for example, to address regional inequities: some agencies/donors are focused in one or other district, while many other districts (especially the remote ones) are ignored. Similarly at a community level, no effort has been made to avoid the duplication of activities. For instance, different agencies are involved in group formation and a number of groups exist in a community using the same group of people (interview with village leaders, 2002). There may be a livestock group, forestry group, vegetable groups, and so forth and such groups can become overburdened with the administration process. Instead, the different agencies could use an existing group for carrying out their activities.

In addition, the rural energy institutions at local level did not coordinate properly with other line agencies so as to provide integrated services for the overall development of the community through sufficient extension services. For instance, there was very little effort made by REDP to provide access to training and education, credit, and the market through establishing the linkages with sectoral agencies at national and local levels, which would help to increase income and social opportunities for local people especially women. Similarly, the rural energy programs are not well integrated with community forestry programs, neglecting the potential firewood resources, which are still a great need of the rural population.

Gender participation in rural energy plans and programs

Rural energy institutions at the local level have not provided enough attention to women's participation in their programs and plans. There is no clear focus on central level planning and policies for integrating gender issues, and in addition, local level staff are poorly trained for such purposes. There has also been a very limited effort to create a conducive environment for women to participate in such programs. For instance, there are very few programs designed for the local men and women to sensitize them to gender issues, and the importance of women's participation in programs and their development. The REDP is the only institution which has explicitly encouraged women's participation in rural energy programs, while most other institutions are silent on this aspect. Even the REDP has not been able to capitalize the role of women and their potential in planning rural energy programs but it has involved them in the implementation of activities. Women's involvement in decision making processes such as technology installation, and the location of plants is still very low.

Monitoring and evaluation

Monitoring and evaluation have been very weak aspects of rural energy plans and programs. There is not enough emphasis on regular monitoring and evaluation activities so as to ensure the better implementation of programs. Some evaluation studies conducted by private consultants hired by the implementing agencies were biased towards specific programs rather than reflecting the real situation. None of the institutions were seriously involved in the monitoring aspect of the program activities which pinpoints the positive and negative aspects of such programs. For instance, interviews with a few key people revealed that the community mobilization process of REDP was very effective initially with the support from its extension workers; however, the local men and women in some of the villages became inactive once the extension workers left. I also observed that there was no regular supply of power and that the powerhouse was not managed properly in Katunjebeshi. These problems were not monitored by the REDP. The adoption of technologies and the success of the programs were taken for granted, without foreseeing the aspect of sustainability.

Overall, the rural energy sector faces big challenges at present in the absence of a proper institutional framework, clear policy measures and practical implementation strategies.

Conclusion

Throughout the different planning periods in the past, rural energy did not get enough attention. The focus was on large scale energy investments such as big hydro projects. Only in the Seventh Plan and since has due consideration been given to alternative energy for the socio-economic development of the country. The present plan (Tenth Plan) has a special focus on community participation in the planning and management of alternative energy technologies. Although the private sector and NGOs were highly involved in promotion and implementation of AETs, their focus was on increasing productivity of rural people by providing access to modern energy services as in line with the neo-liberal policy emphasized in the Ninth Plan.

While rural energy planning came under a decentralized planning framework, the practice was still top down as the central level institutions developed the plans and policies based on the subsidies available from donors. There was no institution responsible for preparing clear policy documents and guidelines. Energy sector institutions at the national and local level were not properly linked to have better quality services. On the other hand, there was no coordination between the rural energy institutions and other line agencies to provide the integrated services for rural development. Community level energy planning was not yet practiced, and thus women's energy needs and priorities were not taken into account. There was no emphasis on research and development and monitoring plans which hindered obtaining the necessary input for strengthening the rural energy activities.

Chapter Seven
Rural Energy Programs in Practice: Lessons from Case Studies

> People living in poverty must have their say in the prioritisation of energy options and services if energy policy and services are to meet their needs and provide long term solutions.
>
> (Coventry, 2002: 22)

In line with Coventry (2002) poor people, especially women rarely have any say on the selection of energy plants and services in Nepal as is reflected in this chapter.

This chapter describes how rural energy programs have been implemented in practice and the positive and negative implications of these rural energy technologies on both men and women. I conducted case studies focusing on four types of technology. The major tools used for case study analysis were social mapping, focus group discussions, preference ranking, activity profiles and a gender analysis matrix. All of these tools are described in Chapter Five. I selected the tools according to the suitability of each case study. Table 7.1 summarizes the type of AETs studied, location of case studies, and the tools of analysis used.

Table 7.1: Summary of Case Study Areas and Tools Used

Types of AETs	Case Study Area	Tools of Analysis
Micro-Hydro Plant	Nayagaon VDC, Pokharichouri VDC	FGD, GAM, PRM, Activity Profile,
Biogas Plants	Nayagaon VDC Mahadevsthan VDC	FGD, GAM, PRM, Activity Profile
Improved Cooking Stoves (ICS)	Nayagaon VDC	FGD, GAM, PRM
Solar Photovoltaic System	Nayagaon VDC	FGD, GAM, PRM

Note: FGD=Focus Group Discussion, GAM=Gender Analysis Matrix,
PRM= Preference Ranking Matrix,

Activity Profiles were used in three VDCs representing two ethnic groups and the users of micro-hydropower scheme and biogas plants. I did not develop separate Activity Profiles for the ICS and solar photovoltaic system, since the user groups from different ethnic groups were already represented in previous two case studies.

The following chapter (Chapter Eight) also elaborates on socio-economic implications of AETs from a gender perspective, however, it is more based on statistical data in making a comparison between project and non-project areas. Thus, the next chapter integrates the qualitative findings as information complementary and supplementary to the household survey, while this chapter (Chapter Seven) is based more on descriptive analysis, and information specific to each technology. While, it might seem logical to present the general information on socio-economic implications first, the case studies are presented first in order to demonstrate how rural energy programs are implemented in practice.

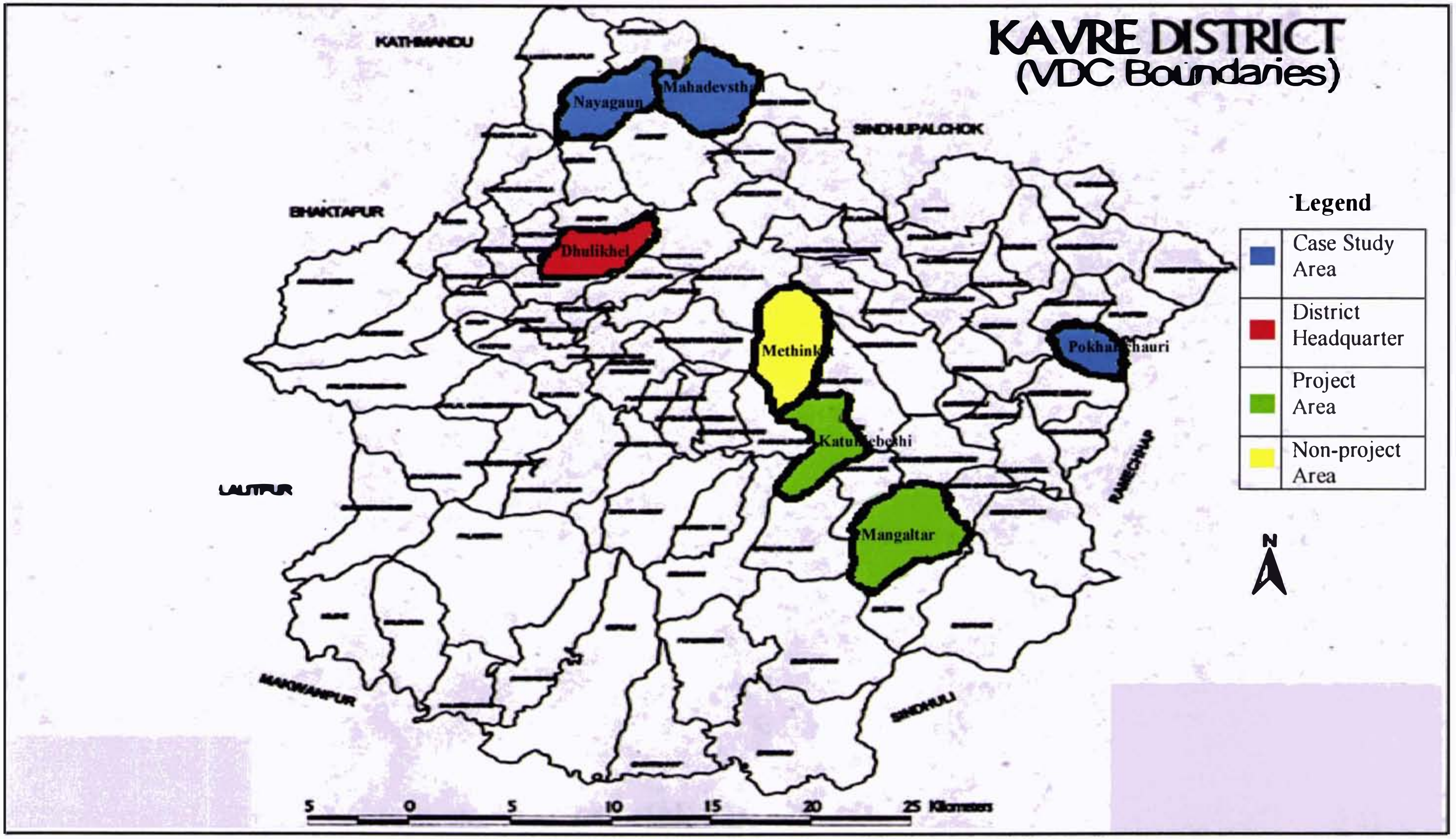
Background of VDCs

This section comprises a brief introduction of each VDC where case studies were conducted. The case study villages are indicated in Figure 7.1.

Nayagaon

Nayagaon is one of the VDCs lying in Kavre district, about 16 kilometers north from district headquarters at Dhulikhel. The journey by foot is about two and half hours from the local bus station at Kuntabeshi. This VDC borders Mahadevsthan in the east, and Baluwapati in the west (Figure: 7.1). There is only a gravel road and no public transport is available to reach this VDC. Only a few vehicles came to this area to collect dairy milk during the winter season, when village roads are not muddy.

Figure 7.1: District Map indicating Case Study Areas, Kavre



Source: GIS Unit, PDDP NEP/95/008, 1999

The total population of this VDC is 5117 (male: 50.3%; female: 49.7%) and the average family size of 6.5. Agriculture is the predominant occupation and livestock keeping supplements the household economy. The major source of cash income is milk production. The major farming crops are paddy rice, maize, wheat, mustard and potato. The community in this VDC are a mixture of *Tamang (46%), Brahmin/Chhetri (37%)*, and the low caste group (17%) like *Kami, Sarki* and *Bishwokarma*. The literacy rate of the village population is 68.2 percent, quite a lot higher than the district average of 39.6 percent (DDC,1998).

The Rural Energy Development Program (REDP) implemented the rural energy projects in this VDC with an aim to provide an efficient energy supply integrated with overall community development activities. There is one micro hydro scheme, 18 solar photovoltaic systems, 416 biogas plants and 75 improved cooking stoves (ICS).

Pokharichouri

Pokharichouri is one of the remote VDCs in the district, located 59 kilometers east from the district headquarter. This VDC borders with Majhipheda in the east, and Gothpani in the west (Figure 7.1). The travel distance is 6 hours by bus from Dhulikhel. There is a gravel road from Dolalghat, which is about four hours drive to reach the village. However, it can be used for transport only during the winter, not during the rainy season. The walk takes one and a half days. The total population in this VDC is 3540 having a sex ratio of 54:46 for males to females. The average family size is 6.6. The major occupation of the population in this VDC is agriculture as in other parts of the district. However, with the majority of upland areas being in drought, agricultural productivity was not to the satisfaction of local people. Their agricultural activities are mainly based on rain irrigation.

The villages in this VDC were located up and down hills which were spread over a wide area. The community in this VDC was composed of one ethnic group

(*Brahmin/Chhetri*) and thus was very much united, though political conflict among the community members seemed to still be existent in this area.

Pokharichouri is one of the VDCs, where REDP has supported rural electrification through establishing a micro hydro plant (MHP) scheme. There are very few households, which have installed solar photovoltaic systems, and ICS. This VDC was selected for a case study analysis because of the fact the micro hydro scheme operating in this VDC was more successfully operated than in other VDCs.

Mahadevsthan

Mahadevsthan is one of the biggest VDCs in Kavre district lying 24 kilometer north from the district headquarter, Dhulikhel (Figure 7.1). This VDC lies on the highway to Tatopani and has good access via road. The district consists of 1657 households and the average family size is 5.9. The total population is 9684 having a sex ratio of 51:49 males to females. The population is ethnically mixed including *Brahmin/Chhetri, Newar, Tamang Magar*, and *Kami, Damai* and *Sarki*. The majority of the population (49%) belongs to the higher caste group.

Agriculture is the major occupation of the village population and the major crops are paddy, wheat, corn, potato and mustard. Milk production is the second most important occupation of the local people, as the area has a good climate for livestock keeping. There are three dairy cooperatives in this VDC, which collect milk from individual farmers and send it to the chilling machine located in a village. People are also involved in small shops and business activities, being near the highway. This VDC is considered as one of the more developed in the district.

I selected this VDC for a case study of biogas plants, though this VDC was not supported under the REDP program. I developed my interest in looking at this VDC, since the local people informed me that the biogas plants implemented in this VDC were the most successful in the district. The biogas plants in this VDC were directly supported by the biogas support program (BSP) funded by the government of the Netherlands. Different companies, such as All Nepal, and Public Gobar Gas Co. were involved in the promotion of the biogas plants in this VDC. The private companies supported by BSP contacted the VDC leaders and initiated an interest in installing the plants.

Introduction to Case Studies

Case studies done of rural energy technologies specifically micro hydro plants, biogas plants, ICS and solar photovoltaic systems, are introduced in this section. Most of the technologies studied were located in Nayagaon VDC and two other VDCs were included to see the best schemes; a MHP scheme in Pokharichouri, and a biogas scheme in Mahadevsthan.

The user groups for different technologies represented different castes and ethnicities: *Brahmin/Chhetri*, *Tamang* and *Kami* and *Sarki*. The ethnic variation among the user groups has a great influence on the management of resources and adoption of AETs. For instance, *Brahmin/Chhetri* women are often restricted from participating in public, thus affecting their involvement in the management and development of water and energy sectors (Earth Consult, 1995). Hence, ethnic variation has been taken into account along with gender when making detailed investigation on the use and implications of AETs.

Micro-Hydropower Plants (MHP)

In order to initiate rural electrification, a number of MHPs were installed in different villages of Kavre district with the support of REDP. I conducted a detailed case study analysis of two micro hydro plants considering the positive and negative aspects of such plants. One was located in Nayagaon and the other was located in Pokharichouri VDC. Since MHPs were installed at the community level as the entry point of a sustainable rural energy program, the detailed planning and management processes is also described.

Chakhola MHP, Singhe Nayagaon

The Chakhola MHP scheme was constructed in the year 2000 using the Chakhola river source lying to the north of the village. This MHP scheme produced 16 kilowatts of power and provided electricity to all 125 households in Singhe ward no.2 and 3. A household normally uses 50 watt bulbs in two rooms. Fifty percent of the total investment was provided by REDP/UNDP, 30 percent came from His Majesty's Government of Nepal, in the form of a loan and subsidy and 20 percent from the local community and the local government (district development committee and village development committee). The contribution from the local community was mainly in the form of labour and materials. However, they owe money for the loan (around NRS[1]. 400,000) to the Agricultural Development Bank/Nepal. Out of 125 households in the area, only 42 households could provide their land as collateral. This is because most people are tenants on other people's land, and in some cases, the land was already used as collateral.

Chourikhola MHP Pokharichouri

The Chourikhola MHP was also installed in the year 2000 using the Chourikhola river located in the village. The total capacity of the plant is 23 kilowatts. The MHP scheme has provided electricity in two wards of this VDC covering 205 households, and the power to a village micro-mill. A typical household uses four bulbs of 25 watts each. (in this community, the households used fluorescent light, which was brighter). Among the total amount invested for MHP, REDP provided a 50 percent subsidy in terms of electrical and mechanical equipment. The rest of the amount included a loan and subsidy from the Agricultural Development Bank of Nepal, funds from local

[1] [1]NRS stands for Nepalese Rupees. The exchange rate of 1 US$ was equivalent to NRS 76 at the time of my fieldwork

government (contribution of VDC and DDC) and a contribution from the local community. The community contribution was in the form of labor and local materials. In Pokharichouri, the community had already paid back the bank loan at the time of my field work (2002).

Planning and implementation of MHPs

The need for the micro-hydropower scheme was identified by the district development committee (DDC) based on requests of VDCs knowing the activities of the REDP located at district level. On the basis of DDC's proposal to the REDP, the REDP conducted a feasibility study to see if water resources were sufficient for such a scheme and to find out about the local community's interests and capacities. An agreement was made between the REDP and the local community to construct the MHP scheme clarifying the responsibilities of the two parties. Thus a few project staff from the REDP stayed in the village and facilitated the community mobilization process as a major focus of rural energy development. A micro hydro scheme was thus not a standalone project: it was introduced as an entry point while trying to promote overall development activities of the village. The aim was to empower the community and to institutionalize the rural energy program to promote the sustainability of rural energy alternatives (REDP, 1998).

REDP encouraged women's participation from the very beginning by forming community organizations (COs) of male and female groups inviting one male and female head from each household to participate. In each CO, one promoter was trained to mobilize group savings and other community activities such as conducting literacy programs, constructing village roads, water taps, and wells, dairy collection and so on. During the construction phase of the turbine, each CO was assigned different responsibilities such as carrying stones and sand, digging canals and so on. Initially, both male and female groups were effectively mobilized for local savings and community activities with support from REDP staff. The representatives of different groups were trained in different income generating activities, such as poultry farming, mushroom and cardamon cultivation, and goat keeping. Plants were distributed to the groups for nursery establishment.

In Pokharichouri, being a very remote area, it took a long time to mobilize the community and convince them of the benefits they would receive from installing micro-hydro electricity. Once the MHP was installed, the community became more confident and used the plant to its full potential. In Nayagaon, by contrast, being close to the district centre and having access via a gravel road, motivating the community was relatively easy as was installing the plant, but it was not utilized to its full potential. It was observed that once the REDP discontinued their staff at the village level, the COs became inactive in Nayagaon. The groups seemed to be reluctant to have regular meetings for savings and for other community activities. The monitoring system for group activities was found to be non-existent. In Pokharichouri, however, the group remained strong and active even after discontinuation of REDP's direct involvement. This community regarded the importance of electricity highly and assumed ownership of the micro-hydro plant and used it to its full benefit. This was the reason the community could pay back the bank loan in a short time.

Operation and management of MHP

An executive committee known as village energy committee (VEC) was formed for both MHPs through involving representatives of each CO. Each CO selected one member from among themselves who was active and sincere to represent it in the VEC. Both men and women were equally represented in the committee. This committee calls general meetings every 6 months, which all the members of COs may attend. The VEC is responsible for continuously monitoring the MHP scheme and CO's activities, collecting electricity charges and managing funds, and solving any energy related problems in the village.

In Nayagaon, the VEC seemed to be very inactive at the time of fieldwork. This committee was not able to collect the regular electricity charges from each household, since they did not put much effort into penalising the households unwilling to pay the charges on time. Hence, the repayment of bank loans for the MHP scheme was delayed. The charges for electricity were just enough to pay the salary of the operators assigned for running the turbines, since the micro-hydro power was not used for any other activities. There were two operators; one working the day shift and the other working the night shift. The power was used exclusively for electric lighting in the households, though the unit production would have been sufficient to run a power mill or other small enterprises.

In Pokharichouri, the executive committee was very dedicated and responsible in ensuring effective management of the MHP scheme. The MHP was managed by three people: two operators and one manager. The operators alternated their day and night shifts, and were responsible for the proper supply of power and maintaining the canal and power house. The manager was responsible for collecting charges for electricity. The total amount collected from the charges of electricity from the two villages was NRS. 20,000/month. This money was deposited and used for the payment of salaries to the operators and managers and any forth-coming expenses needed for the power plant. The power plant and the electricity scheme were well managed in Pokharichouri.

Apart from providing electricity in two villages, the MHP in Pokharichouri supplied electricity to a power mill, which included one huller, one cellar, one expeller and one grinder. The power mill was owned by a group of people in the village paying fixed charges for power. The funds collected from the mill were around NRS. 4000 to 5000/month.

Biogas Plants

Biogas plants have been extensively promoted in the Kavre district through different government and non-government agencies, with an aim to reduce firewood use. The REDP has been successfully involved in promoting biogas plants subsidizing the toilet costs and mobilizing the community for contributing labor in constructing the plants.

Public and private companies provide subsidies for biogas plants up to NRS. 10000 (US $132), which include GI gas pipes, rods, and biogas stoves. The households have to provide their labour, and materials such as sand and stones. Altogether it costs around NRS. 25000 (US $329) to complete construction of a biogas plant.

Two cases were taken from two different VDCs, one in Nayagaon supported by the REDP and the other in Mahadevsthan supported by the Biogas Support Program (BSP) in order to see the practical applications of such plants in two different areas. In Mahadevsthan, the biogas plants were promoted as a package program with good support from the VDC itself.

A case study was conducted with biogas user groups in different villages of Nayagaon VDC focusing on different ethnic groups. Out of the total number of biogas plants (416) installed in this area, the highest number belonged to *Brahmin/Chhetri* (72%), followed by *Tamang* (22.3%) and others (6.4%) belonging to the low caste groups. Wards 2, 3, and 6 within the VDC were selected for the case study. These villages have a large number of biogas plants, they were the combination of both new and old plants and the villages included people from all ethnic groups. Ten to twelve households using biogas plants were selected in each village for a case study analysis.

In Mahadevsthan VDC, I selected 10 households randomly from one village using biogas plants for case study analysis. These households belonged to the *Brahmin* group.

Improved Cooking Stoves (ICS)

The REDP motivated the local community to install ICS in different VDCs of Kavre district for the purpose of reducing the use of firewood and eliminating smoke in houses. It trained a few men and women with the help of its support organization at the district level. The trained personnel were supposed to motivate and assist the local people to construct ICS in their houses, charging each client a certain amount (NRS.

150: US$1.97) for their wages. The idea was to develop entrepreneurship of men and women having obtained the skills in ICS construction, while promoting the technology. I observed that unlike biogas stoves, promotion of ICS was not emphasized enough although they seem to be best possible technologies (due to least cost, and locally available materials) for cooking.

Out of 80 households in the village Singhe (ward 3) of Nayagaon VDC, 14 households had installed improved cooking stoves (ICS). These households belonged all *Tamang*. The stoves constructed in this area were called *Tamang* Chulo. The stoves had two holes and a chimney made of mud and bricks. A village man was trained and assisted in building the stoves in each household for a fee.

Both males and females from all 14 households were included in the case study analysis. These households were identified through discussions with local people.

Solar Photovoltaic Systems (SPV)

The REDP has promoted the SPV for lighting in one of the villages (Timilsana village) in the Nayagaon VDC, where the community has no access to water resources to install a MHP. The REDP assisted this community to install SPV in their households with support from the Altemative Energy Promotion Centre (AEPC) and solar companies. The REDP provided 19 quotas initially for installing SPV in Nayagaon. Among the total cost for the solar panel (NRS. 31,000: US$ 402), 50 percent was subsidized by AEPC and the individual households paid the rest of the amount to the supplier (solar companies) on an instalment basis. A few well off families (9 out of 62 households) installed the solar electricity, but other households were reluctant or unable to pay the higher cost at once. All the fitting of wires, bulbs, and solar panels was done by the companies. After seeing the solar lighting in some of the houses, a few other households were also motivated to adopt the technology, but the subsidies were decreased down to 26 percent. These households did not want to pay the higher amount for solar lighting, and they did not put it in.

Although only a limited number of households have been able to install this technology, they have rightly perceived the benefits of solar lighting. These households were better off in the community and wanted to have electric light and TVs in their households. All nine households were included for a case study analysis.

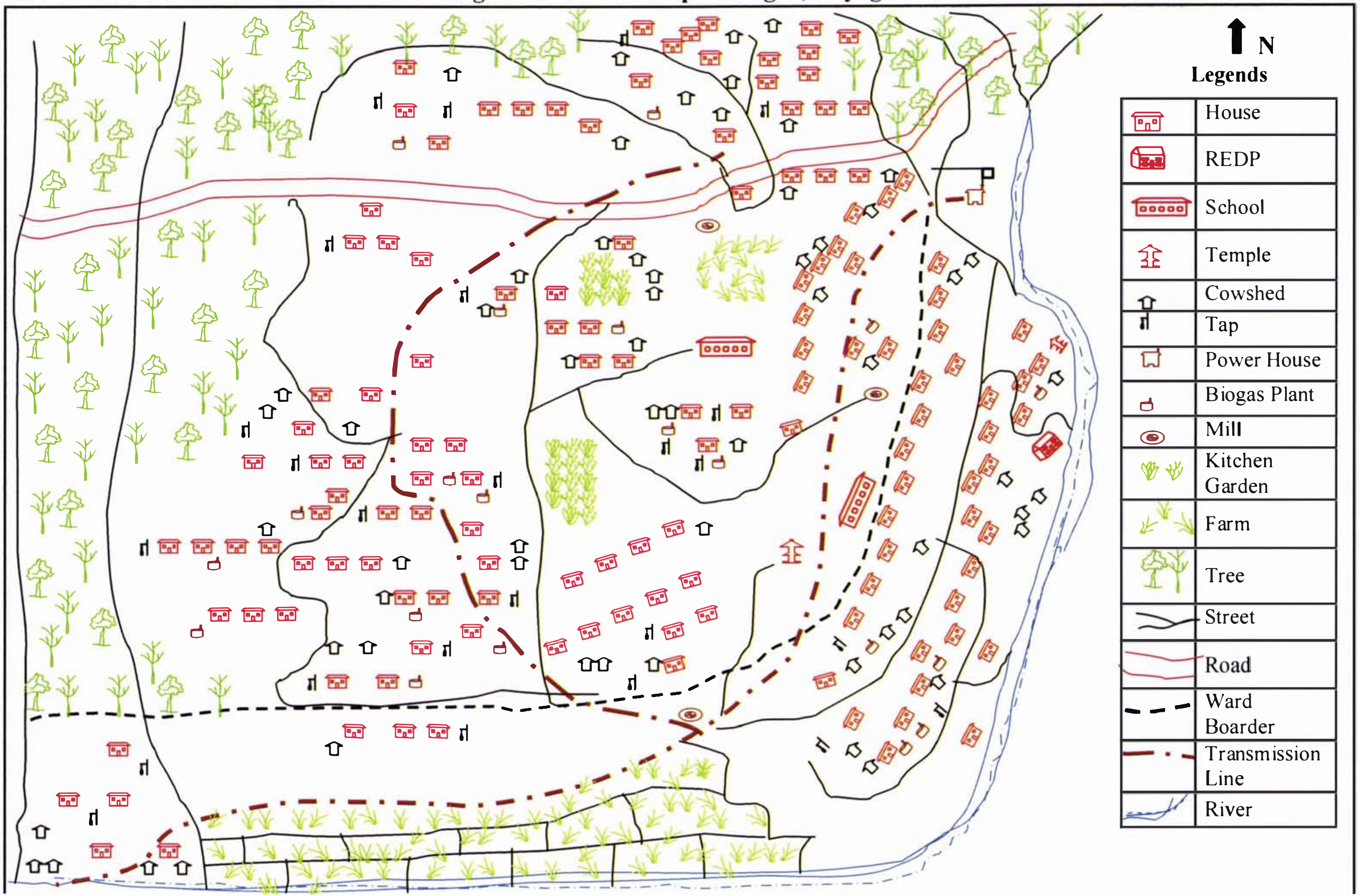
Descriptive Analysis of Case Studies

Different case studies mentioned above are analysed in detail in this section using various tools and techniques as indicated in Table 7.1. This analysis attempts to gain intensive knowledge and understanding about the process and practice of AETs, advantages and disadvantages, preferences and priorities of men and women towards AETs and their positive and negative implications for men and women, households and communities.

Social Mapping

A social map was drawn in Nayagaon, covering two villages (Singhe, ward no. 2 and 3) that benefited from a MHP (Figure: 7.2). This was an initial step in my research to get to know the people and the village, as well as gaining information about the resources of the villages of direct relevance to my research. I invited the local people to draw the map indicating the village resources, (rivers, forests, roads, mills, electric lines) households, service institutions and other related information. This was done after I had briefly introduced myself and explained my purpose for being in the village. Both men (18) and women (12) participated in drawing the map, while I mostly worked as a facilitator. A large piece of ground was used to draw the map. Local materials like coal, chalk, coloured powder, and sticks were used for drawing. Small pieces of paper with drawings on them were used to indicate different objects such as houses, taps, mills, temples and so forth. This social map provided a background

Figure 7.2: Social Map of Singhe, Nayagaon VDC



Source: Field Survey, 2002

picture of the two villages. It also indicated the households having access to electric lines through MHP and the households with biogas plants.

Out of 125 households in the area, only 21 households had access to biogas plants but all households had access to micro-hydro electricity. Biogas plants were not very effective for most of the households who had installed them. Thus the rest of the households were not motivated enough to install such plants, due to their lack of awareness of the benefits of such plants and worries about their cost.

After the map was completed, I copied it into my notebook and also verified the information with two young men who seemed to have adequate information about their village. More information was collected from them regarding household status, access to technology in each household and access to income generating activities.

I could not do a social mapping exercise for Pokharichouri and Mahadevsthan VDCs because these were the Maoist sensitive areas, where the local people did not feel safe to come together as they were closely watched by the local administration. Information about these villages was obtained through general observation and walking through villages.

Focus Group Discussions (FGD)

FGDs were carried out with men's and women's group separately in all areas covering each technology. Altogether six group discussions were carried out representing all ethnic groups (*Brahmin/Chhetri, Tamang, and Kami and Sarki*). In Pokharichouri, there was only one ethnic community (*Brahmin/Chhetri)*, while in Nayagaon and Mahadevsthan the community was a mixture of *Brahmin/Chhetri, Tamang* and *Kami* and *Sarki*. The group participants included members from each CO and also members from the executive committee.

The major points raised during the focus group discussions conducted under each case study are summarized below.

Process of intervention of AETs

Both men and women from the *Brahmin/Chhetri* group were well informed about how the REDP came to work in their village, while *Tamang* men and women were not so well informed. I observed that the *Brahmin/Chhetri* as the elite community members, had more interaction with REDP officials. For MHP, the REDP conducted a feasibility study after getting the proposal from the DDC and made an agreement with the villagers to provide electricity in the villages proposed as per the capacity of water resources. In those areas, where there were no water resources, the REDP initiated the solar electrification program and encouraged the community to install the solar system available with 50 percent subsidy. In case of the biogas plant, the REDP officials motivated the villagers in Nayagaon to install a biogas plant subsidizing toilet costs, and made a link with different companies installing the plant based on subsidies. In Mahadevsthan, the Agricultural Development Bank/Nepal (ADB/N) promoted the biogas plant initially providing a loan to the farmers so as to promote livestock development and reduce the use of firewood. REDP also trained a few men and women from different VDCs about building ICS so as to motivate the households to install ICS.

Advantages of alternative energy technologies (AETs)

The men and women felt very confident after having access to different types of AETs especially with MHPs and solar electricity. The *Tamang* men in Nayagaon found night mobility easier after having electricity in the village, though this supported their leisure rather than productive activities. Some *Brahmin* men talked about the reduced risk for children studying in the night time with electric lights unlike with kerosene lights which can fall down onto the bedding. The men's groups in both ethnic groups appreciated that electricity enabled them to have a good time watching television and listening to the radio. Women also felt good about having access to radios and televisions, although they did not really have time to be entertained by these mediums. The women found it easier to work in the kitchen and in the livestock shed with the lights. It was interesting to note in Nayagaon that threats from leopard to their buffaloes and cows were minimized because of the electric lights. In Pokharichouri, local women benefited greatly from the micro hydro mill available in their village. They had less work and more time that could be used for other productive activities.

Biogas plants with attached toilets were very popular in Mahadevsthan. The local people used such plants to their full potential because they faced a real scarcity of firewood in this VDC. Interestingly, a few women in Nayagaon mentioned that "sometimes our husbands and our sons also prepare tea with the biogas stoves which would not have been the case with firewood cooking" (FGD, 2002). There was however a difference between *Tamang* and *Brahmin* communities in this respect. In *Tamang* communities, sometimes men would even prepare day snacks with firewood, when their wives were busy. Women in all areas found the biogas stoves very convenient for cooking, as they reduced their eye irritation and saved their time in cleaning activities because of the absence of smoke. The local people felt the toilets attached to biogas plants were important for the purpose of sanitation. ICS was also reported to be very convenient for cooking, since women did not have to face the fire directly and it was not smoky like traditional stoves.

Disadvantages of AETs

Despite many advantages of AETs, the women's groups, who were the main users of AETs, still found them to be only complementary to traditional technologies. For instance, biogas stoves and ICS could not fulfil multiple cooking requirements and substitute for traditional stoves. Women did not feel they could use the biogas stove for cooking *dhindo*, popping and roasting corn (most common traditional food), because of its low intensity of heat as compared to firewood. In addition, biogas stoves and ICS were not convenient for cooking big meals during festivals and rituals, when there

Figure 7.3: Woman Cooking Dhindo with Traditional Stoves

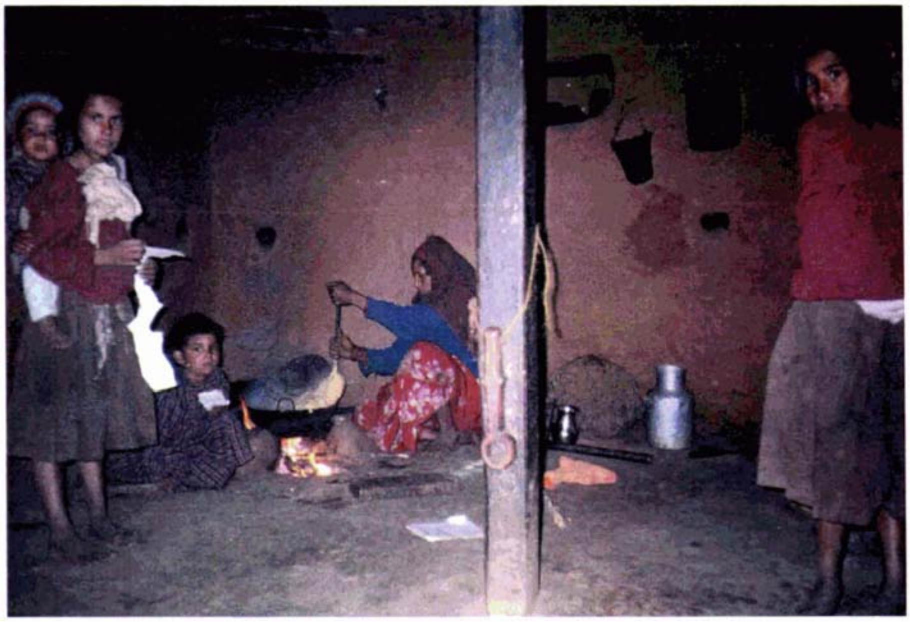
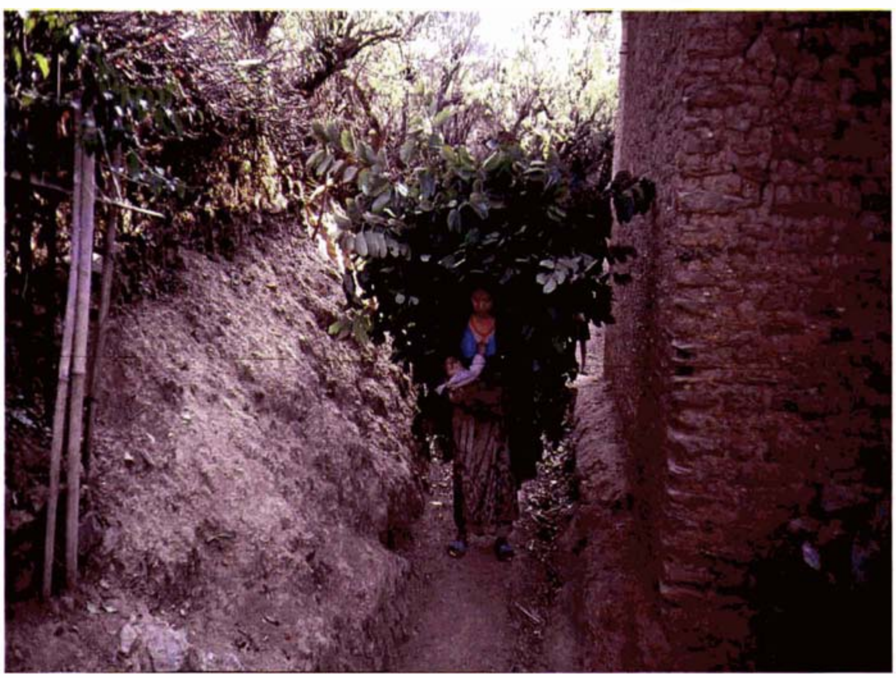


Figure 7.4: Man Cooking Vegetables with Biogas Stove

Source: Field Survey, 2002

Figure 7.5: Women Carrying Grain to the Water Mill

Figure 7.6: Woman Carrying Fodder Grasses



Source Field Survey, 2002

were big family gatherings. A few women mentioned that biogas cooking is more troublesome, because the gas was frequently turned off during the winter due to inadequate gas production. Sometimes, rice would be uncooked ruining the taste. In addition, they could not stay in the house during winter without using firewood, which has the dual purpose of keeping the house warm. Also, women felt that they needed to burn firewood, to heat their hands after using cold water in the early morning. Women also reported the usefulness of keeping food warm with firewood, which is not possible with the biogas stoves. They also dry grains in the ceiling by using wood stands in the upper part of the firewood stoves.

Brahmin women did not use biogas stoves for heating/boiling milk due to their perception that milk heated with biogas stoves would be impure (and they have to prepare pure ghee (butter) to use for ritual and some festivals). But, *Tamang* women did not mind boiling milk on the biogas stoves.

With the ICS, the women's group found it troublesome to clean the chimney since this had to be done frequently (once every two weeks). In addition, some women complained about the ICS, since the smoke seeped back instead of going out due to some technical problem. The women's groups also reported that the frequent breakdown of electricity caused them trouble as they would then have to search for their kerosene light.

Knowledge about repair, maintenance and sustainable use of AETs

Women in both ethnic groups mentioned that they knew very little about the safe use of electricity and its maintenance. They just knew how to turn the light on and off. This was especially the case among *Tamang* groups, who were quite wasteful in their use of electricity. For example they never turned off the lights even during the day. Even lights on the street remained on during the day light hours. According to one woman, "By having light on during the day, we will know if the power supply is on" (FGD, 2002). The radio remained on the whole day since the local people wanted to have full benefit of the charges they paid. People listened to music while in the field as well. But in Pokharichouri, being situated in a remote area, local people realized the value of electricity and they used it in an economical way.

In the case of the biogas plants and ICS, women were aware of operation and management of the stoves. However, the lower caste women were not aware of the right mix of water and dung for producing the biogas. Women using solar lighting in Nayagaon were also not aware of economic and efficient use of lights. The women's groups were not able to repair wires or lights, or biogas plants, if something went wrong, though they could use these technologies for their benefit. Women received just one day of training in the use and implications of biogas technology, which was not enough for learning in detail about composting of slurry and about minor maintenance they could do. They had to rely on male members of the family to repair any kind of damage to lights plants. There was a male technician in the villages, who would come upon request and repair any damages to such plants. But a few women mentioned that the technician was not easy to find at the time he was needed and they had to wait a few days to have the plant repaired. On the other hand, women on their own could fix anything wrong with the kerosene lights and the traditional stoves. In such a way, there was a shift in control over technology from women to men after having access to AETs.

Potential income opportunities

Both men's and women's groups felt the need for some income earning opportunities in the village. Although a few women and men received training in income generating activities, such as poultry, mushroom and cardamon cultivation, they were not effectively motivated to carry out such activities due to lack of capital, insufficient knowledge of the market, and the related activities. A few women had done mushroom cultivation in Nayagaon but they did not find it profitable due to the lack of a market and so they did not continue. A few women in Pokharichouri were involved in incense-making and soap-making at business level after getting training on the same from the

REDP. It was observed that there was good potential for a chilling centre in Nayagaon which has an added value for livestock production. There was sufficient power supply (16 kilowatt) from the Chakhola MHP scheme to carry out such processing at village level. The charges for electricity would have been lower if the villagers could use the power for establishing a chilling centre or a processing mill as in Pokharichouri. There were more opportunities for both men and women to carry out small business activities in Mahadevsthan as it was close to the market centre and had a good road network.

Cost and risk

Despite many advantages of electricity, its cost in relation to kerosene lamps was seen in a negative fashion by women in Nayagaon. They not only had to pay the higher electricity charges (the charge was 90 paisa per ward: and one household would have 2 to 4 50 watts bulbs but also changes of bulbs were regularly required due to the frequent breakdowns. On average, one household spends NRS. 100 (US$1.30) per month for electricity except some who spend around NRS. 200 (US$ 2.60) for using additional bulbs. The cost of kerosene per month was reported to be around NRS 60 per month. In Pokharichouri, women do not mind paying a slightly higher charge for electricity, since they feel it is very convenient to have electric light. Similarly, with the power mill established in the village, the rate was cheaper than in the diesel mill. For instance, they have to pay 6 pathi rice for hulling 20 pathi rice in the power mill, while they had to pay 8 pathi rice for hulling the same amount of rice in the diesel mill. In addition, carrying grain to distant villages to use a diesel mill inflated costs above the actual milling price.

In the case of the biogas plant, the construction materials were subsidized by the biogas companies and the toilet cost was subsidized by the REDP and VDC itself. The local people had to pay for the labour and materials like sand and stones, which was still costly if they could not manage on their own. The men's group of *Kami* ethnicity mentioned "We have to spend our valuable time and labour during construction of the plant while leaving our ethnic profession (making iron)" (FGD, 2002). Solar panels were subsidized at 50 percent but were still expensive (NRS. 15000: US$ 195) for local people as mentioned earlier. The cost of having ICS is only the technician's wages (NRS. 150) for constructing the stoves, since it can be constructed with local mud and bricks.

The women's group in Nayagaon complained that there is a risk of mice eating through wires. Because of the house structure of the villages, there is also a high chance of exposing wires to the rain. Similarly, with solar panels, there was a risk of children being exposed to high voltage electricity in the battery box. ICS was also risky during summer, due to the possibility of being exposed to fire when there are strong winds. The men's groups did not seem to be aware of such risk factors.

Overall, FGDs conducted with groups of men and women using different AETs revealed that AETs have been beneficial to both men and women, but especially to women in terms of saving their labour and time in household energy activities. Women, particularly, benefited through milling, based on hydro-electric power. However, these AETs have been used as complementary to the traditional ones due to number of limitations as mentioned above. For instance, women feel more comfortable to use the indigenous technologies such as *dhiki* for hulling small quantities of grain.

Gender Analysis Matrix (GAM)

A GAM was carried out as another means of assessing the positive and negative implications of rural energy projects for men and women. It was carried out with one group of men, one group of women and one mixed group. There were 10 to 12 participants in each group. From discussions in these three groups, a single matrix was developed to show the positive and negative implications of different technologies for men and women. The following GAM (Table 7.2) was developed with the micro-hydro user groups in Pokharichouri.

Table 7.2: Gender Analysis Matrix: Micro-Hydro Groups, Pokharichouri

Project Objective: To have efficient energy supply and integrated development of the village

	Labour	Time	Resources	Culture
Women	+ Reduced workload for processing (rice hulling and grinding grains) + Reduced work for lighting kerosene in every room	+ Saved time for rice hulling and grinding grains + Saved time for filling the kerosene and lighting + Increased time for rest and leisure	+ Access to income generating and social activities (incense making, and adult literacy, poultry keeping)	+ Positive change in women and men 's attitude for women's mobility + Eradication of gambling and drinking habits of men
Men	No change in men's work	+ More time for chatting and gatherings with electric light	+ Possibility for income generation eg. saw mills and poultry farming + Access to information through radios and televisions	+ Increased gatherings and entertainment - Young men hanging around radios and televisions
Household	+Saved women's labour for other activities	+ Saved women's time for other activities	+ Possibility to increase income + Possibility for irrigation - Decrease in labour from young men	+ Positive attitude of men and women on women's mobility, sanitation, girl's schooling

+ and - indicates the positive and negative implications of the project on men and women.
Source: Field Survey, 2002

Looking at the Gender Analysis Matrix (GAM), it could be observed that the MHP has positive implications for all people, but especially for women in reducing their labor and time spent in processing activities. It also indicates that women have more time for rest and leisure with access to micro hydro mills. Since women did not need to fill up the kerosene lantems and light them in each room, their time and work was reduced. However, it was also observed that women's work has increased in the moming and nights with the availability of electric light. Women have achieved access to some income generating and social activities like incense making and adult literacy with the lights. For instance, adult literacy classes are usually conducted with electric lights in the night. Similarly, there was a positive change in women's and men's attitude for women's mobility and participation in development activities with the awareness program supported by the REDP. Such awareness activities also provided women the strength to control the gambling habit of men thus having a positive implication on women and their culture.

There was no change in men's work but lighting made it easier for them to have social gatherings and chatting with their friends in the evenings. Men also recognized the possibility of eaming more income through establishing saw mills and poultry farms using the hydro-power. There was a positive implication for men's knowledge through getting information from radio and televisions. With the electric lights, men have been motivated to increase social gatherings and enjoy entertainment such as listening to the radio and watching televisions. However, young men seemed to be idle with radios and televisions and reluctant to go to work which was seen by older people as having negative implications on their culture and their lives.

There was a positive implication of the MHP for the households in terms of saving women's labor and time. This time, however, was used for additional household chores rather than undertaking any social and economic activities. With increased possibility of irrigation, and income eaming opportunities of men and women, people felt income and resources of the household may improve. Similarly, there was a good family atmosphere in many households due to the positive attitudes of men and women towards women's mobility, empowerment and development. The negative implication of the MHP scheme for the household was that the labor resource was decreased due to the tendency of young boys to hang around radios and televisions.

Table 7.3: Gender Analysis Matrix: Biogas Groups, Nayagaon

Project Objective: To provide efficient energy and to reduce the use of firewood

	Labour	Time	Resources	Culture
Women	- More work with frequent break-down of biogas + Less work for collecting firewood and cleaning utensils and house	+ Less time needed for cleaning and collecting firewood - Long time to cook big meal - More time in water collection for mixing with biogas and to use in toilet	+ Possibility of increasing income	+ Good practice of using toilet + Acceptance of biogas cooking by elders
Men	+ Less work for cutting trees	+ Less waiting time for tea and snacks	No change in resources	+ Positive attitude to use of the toilet
Household	+ Saved women's work in collecting firewood and cleaning	+ Saved women's time in cleaning and collecting firewood - Women's time in plant operation (additional water collection, mixing biogas and dung)	- Increased cost of repair and initial investment + Less use of firewood + Using slurry for compost + Possibility of increased income through using saved time	+ Positive attitude of men and women towards sanitation

+ and - indicates the positive and negative implications of the project on men and women.
Source: Field Survey, 2002

The GAM (Table: 7.3) was developed with *Brahmin* men's and women's groups in Nayagaon in order to see the positive and negative implications of biogas technology on men and women.

The GAM indicates that the biogas plants have more positive implications for men and women than negative ones. There was a reduction in women's work in collecting firewood and cleaning work after having a biogas plant and at the same time they saved their time in performing these tasks. However, a few women found more work with the biogas stoves, since they had to carry more water to mix with dung and to use in the toilet. In addition, some women felt it took a longer time to cook their meal with biogas stoves than the traditional stoves, since they stay in a big joint family and biogas stoves are only good for cooking light meals. Women also faced more problems when the biogas stoves turned off frequently due to inadequate gas production during the winter. However, there was a possibility for women to be involved in income generating and social activities, with the possibility of time saved in cooking and cleaning with the use of biogas stoves. Women have developed good hygiene habits in using the biogas attached toilets which they feel safe, sanitary and convenient instead of walking to the fields and forest. Men also felt it was very convenient to use such a toilet and developed positive attitude to installation of toilets. People's acceptance of cooking on biogas (from a toilet attached biogas plant) especially the elders, has made women's work easier. These findings confirm the discussions from focus groups.

In terms of labor and time of men, the changes were not significant. However, men's work in cutting trees was reduced after they used biogas stoves for cooking. In addition, men did not need to wait a long time for tea and snacks, which could be prepared within a short time with biogas stoves. There was no change in men's resources, however there was a great potential to increase household resources, in terms of needing less firewood, using slurry for composting and increasing income opportunities. There were good positive implications for the household by saving women's labour and time in cooking and cleaning tasks that could be used for other household and productive activities. On top of everything else, the household and village sanitation was very effective after having toilet attached biogas plants.

The GAM (Table 7.4) was developed with men's and women's groups in order to see the implications of ICS on men and women.

Table 7.4: Gender Analysis Matrix: Improved Cooking Stoves Group, Nayagaon

Project Objective: To provide efficient energy through Improved Cooking Stoves

	Labour	**Time**	**Resources**	**Culture**
Women	+ Less work for cleaning house, clothes and, utensils - More work for cleaning chimney	+ Less time for cleaning house and utensils - More time in cleaning chimney - Slow in cooking	+ No change in use of firewood	+ Positive change in men's and women's attitude to use ICS
Household	+ Saved women's work in cleaning activities	+ Less time in cooking and cleaning	- Need to pay for technician + No change in use of firewood	- Not good to remove traditional stove for cultural purpose + Positive change in attitude to use ICS

+ and - indicates the positive and negative implications of the project on men and women .
Source: Field Survey, 2002

From the GAM in Table 7.4, it can be observed that the ICS has provided positive implications for women in terms of having less work and less time for cleaning houses and utensils. The utensils cooked in ICS were easy to clean and there was no need to clean the walls and ceilings frequently with the absence of smokes around the kitchen. But there was also more work and more time needed for frequently cleaning the chimney. There was no change in the use of firewood, though a few men explained that there was a saving of firewood. However, the women's group were reluctant to accept the same but they feel it was convenient to use ICS in absence of smoke. Women feel happy about people's positive attitude to using ICS instead of traditional stoves. Initially, people were reluctant to destroy the traditional stoves with their feeling that the traditional stoves preserve the house god. Later on they gave up this thinking, considering it convenient to use ICS. There was not any implication of ICS on men's work, time, or resources. Neither men's nor women's groups expressed any positive and negative implications on men. However, the men's group accepted the positive implications of ICS on women.

Saving in women's labor and time for cleaning activities was a positive implication of the ICS on the household. Similarly, with the changed attitude of local people to using the ICS, the households benefited in terms of getting away from smoke. Some of the households have kept both stoves: one for cooking main meals in the upper kitchen (ICS) and one for preparing snacks and livestock feeding in the lower kitchen. They did not like to remove the traditional stoves with the idea that it would be removing the house god. Others have removed the traditional stoves thus saving space in the house work. The negative implication of the ICS for the household were that the small cost of building the ICS. Some households did not mind paying for the technicians while others were reluctant to to pay for the technicians since they were not fully convinced of the benefits of ICS. There was no direct implication of the ICS on men and thus none of the group mentioned it.

The following GAM (Table 7.5) developed by men and women's groups indicates the positive and negative implications of solar lighting on men and women.

Table 7.5: Gender Analysis Matrix: Solar Group, Nayagaon

Project Objectives: To provide lighting and develop sustainable energy system

	Labour	Time	Resources	Culture
Women	+ Less work for cleaning (having no smokes from kerosene light)	+ Less time in cleaning clothes and house	+ Possibility of engaging in handicrafts with the light	+ Positive attitude of men and women towards women development
Men			+ Possibility of engaging in handicrafts with the light	+ Increase awareness through radio and television
Household	+ Less work in cleaning clothes	+ Less time in cleaning dishes and houses	+ No regular charges - High initial cost + Reduced use of kerosene	+ Increase knowledge and awareness on environment, gender and sanitation issues

+ and - indicates the positive and negative implications of the project on men and women.

Source: Field Survey, 2002

It can be observed from the GAM in Table 7.5 that solar lighting has positive implications for women, requiring less work for cleaning the house and clothes because it provides an alternative to kerosene which leaves a black film when it burns. Similarly, less time was needed to perform the same tasks. In addition, with an awareness program supported by the REDP, the local people were more aware of gender and environmental issues. This has helped local men and women to develop the positive attitudes towards women's participation in development activities. There was not any implication for men's labour and time, however, they were exposed to information and knowledge after having access to radios and televisions with solar power. In terms of resources it was seen as positive that men and women could do some local handicrafts in the night such as weaving mattresses, baskets and so on. It was mentioned in the discussion that a *Tamang* man was actively involved in basket making at night with solar lights. Both men and women feel that solar lighting has positive implications on household resources, as they do not need to pay regular charges for solar lighting or purchase kerosene. However, the initial cost was high. With increasing awareness of men and women on gender, environment and sanitation issues, there were positive implications for the household.

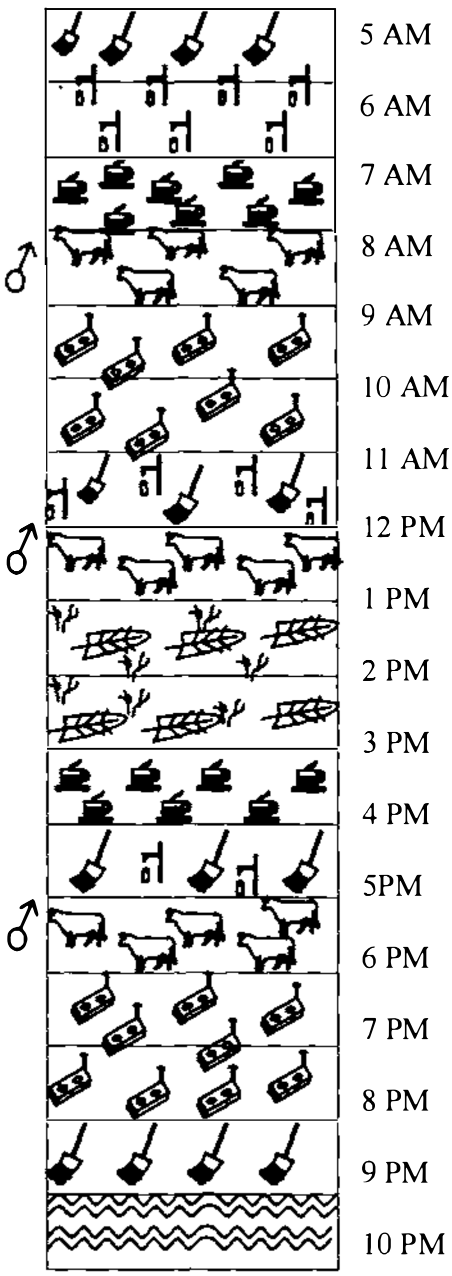
Overall, GAMs prepared for different technologies indicate that the rural energy technologies have more positive implications for women than men, since women were the ones managing the rural energy systems.

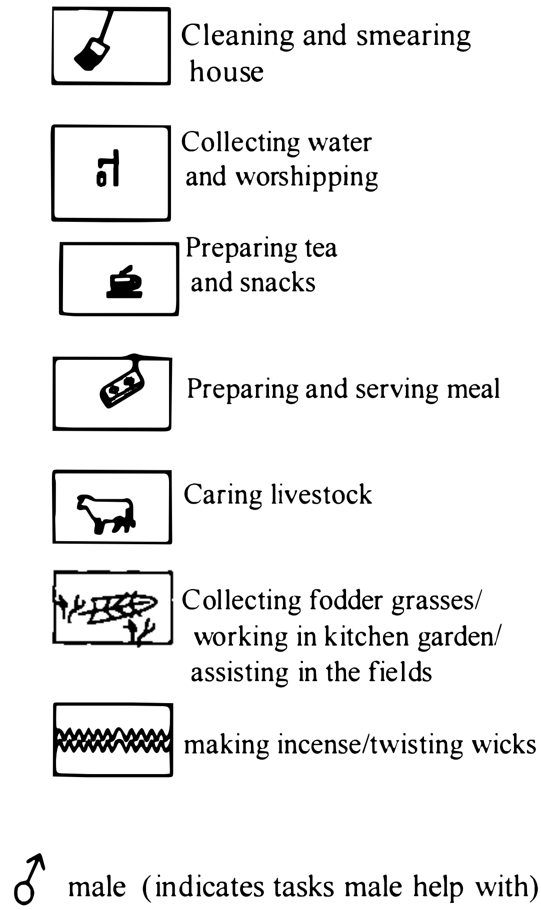
Activity Profiles

Activity profiles were developed with different women's groups in order to get an idea of women's daily workload and the time they spend on different tasks after having access to AETs. The activity profiles also compared the daily activities of *Brahmin* and *Tamang* women using biogas technology. These profiles specify women's activities and the respective time they take for each activity. Women's daily tasks were calculated in a group which reflects the similarities with individual households, and the extra activities apart from the regular daily activities were calculated so as to get an idea of the real workload of women. In addition, multiple tasks were categorized into one times lot for the sake of simplicity. For instance, collecting water, and worshipping (early morning activities) were categorized into one, though worshiping is only done among *Brahmin* family. Hence, the time for a particular activity such as cooking is not distinguished clearly from serving meals, but the average hour is calculated as an aggregate.

The following activity profile (Figure 7.7) was prepared with a women's group in Pokharichouri, who have access to micro-hydro electricity and a micro-mill.

Figure 7.7 Daily Activity Profile of Women in Pokharichouri Micro Hydro User's Group





<u>Extra Work for Women*</u>

1. Collecting firewood - 4 hours/week
2. Going to water mill - 2 hours/month
3. Going to power mill - 1 hour/week
4. Working in fields - 4 hours/day for 3 month (during heavy agricultural season)
5. Washing clothes- 4 hours/week

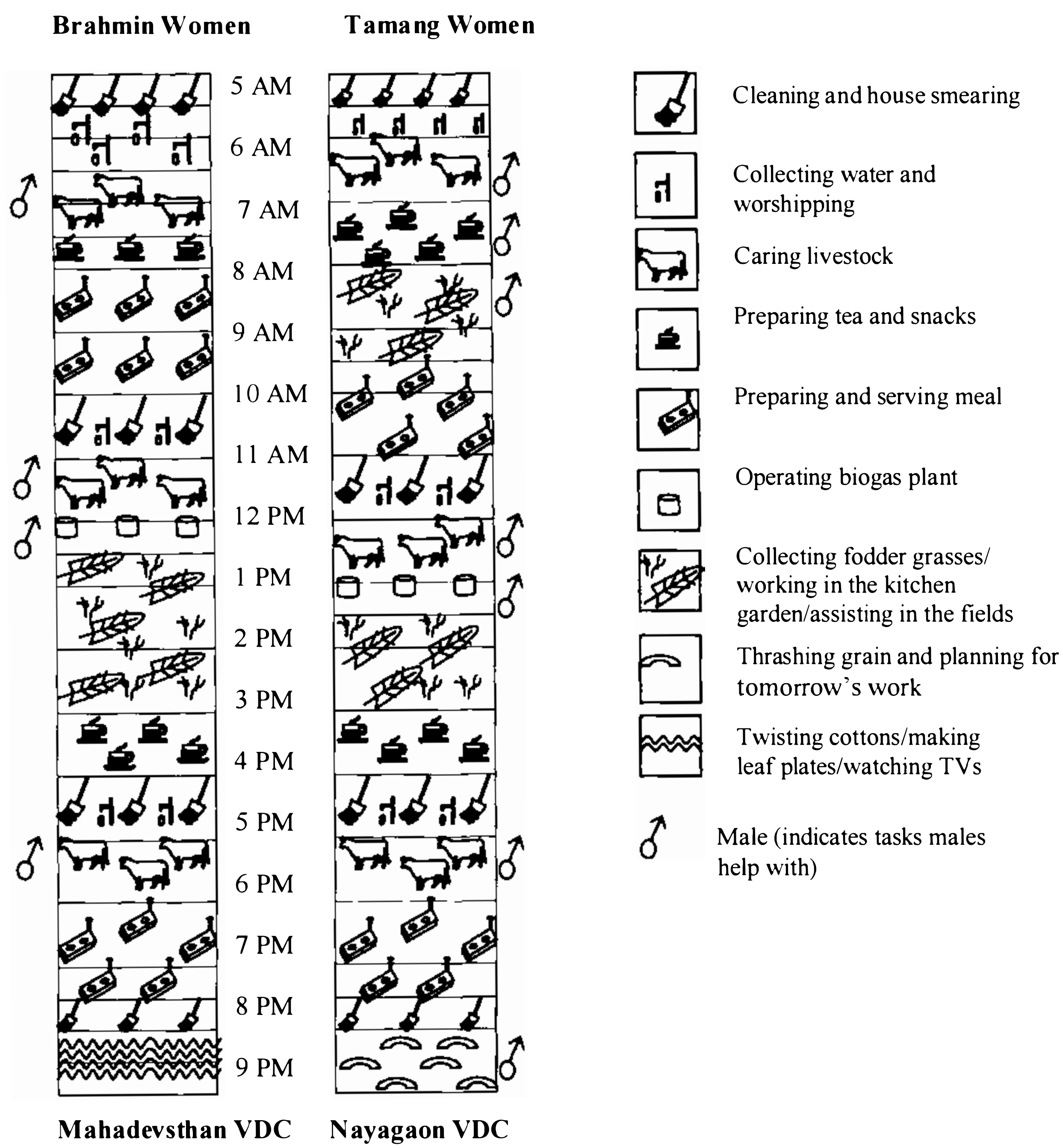
* Refers to tasks not conducted everyday, but which nevertheless contribute to women's overall workloads.

From the Figure 7.7, we can observe that women have to work 17 hours per day on average even after having access to lights and processing mills in the village. The grain processing ceased to be a daily activity with access to the power mill. The time for processing grains was reported to be around 2 hours per day before the installation of the micro-hydro mill has now been considerably reduced. However, women were occupied with other household activities, even with the saved time in milling activities. Drinking water was a big problem in the village and women spent around three hours per day in collecting water. Since this group belonged to the *Brahmin* caste, their culture is to smear some part of the house (kitchen and verandah) every morning for the purpose of purification. This takes time. They also spend time (around 20 minutes) in worshipping. In addition, as women have no access to biogas plants in this village, they spend more time in cooking and cleaning as well. In a *Brahmin* family, women had to wait long time to serve meals for men and elders, unlike in *Tamang* families among whom the meal is served to all family members at once.

As indicated in Figure 7.7 some of the work like caring for livestock is also shared by male members of the family. It was noticed that men sometimes carried grain to the power mill near their houses, although women were the ones to carry grain to the water mill most of the time in the past. Sometimes, women bring grain to the water mill a considerable distance from the village, and this is rarely done by men. However, it does not show child care activities. These are not reported separately because they are performed together with other activities. The extra work consumes considerable time of women, such as collecting firewood adds to the regular work burden of women. However, usually there was more than one woman member in a family so they could take turns doing such extra work. In most cases, young girls take turns helping their mothers with household chores, by staying off school.

Figure 7.8 presents another Activity Profile which was prepared with biogas user's group of women from different ethnic groups in two VDCs.

Figure 7.8: Daily Activity Profile of Women: Biogas User's Group



Extra Work for Women

	Mahadevsthan	Nayagaon
1. Collecting firewood -	x	4 hours perweek
2. Going to power mill -	1 hour per week	2 hours per week
3. Going to Water mill-	x	4 hours per month
4. Using Dhiki and Janto-	x	6 hours per month
5. Working in fields - (during heavy agricultural season)	4 hours per day for 3 weeks	4 hours per day for 3 months
6. Washing clothes-	4 hours per week	4 hours per week
7. Preparing alcohols-	x	4 hours per week

Figure 7.8 shows that it has been observed that *Tamang* women in Nayagaon worked for 16 hours daily excluding their occasional and seasonal activities. Since women used the gas plant, they did not have to go to the forest to collect firewood regularly like they did in the past. However, they still collected fodder grasses every day for feeding livestock and used the residue as firewood. Since the forest was not so far from this village, the fodder grasses were collected twice a day. In this ethnic group, men and women share the work at home as well as outside the home. Men were also involved in fodder grass collection and caring for the livestock. In the afternoon, women also worked in the kitchen garden or in the fields, when they did not need to go to the forest. Among *Tamang* families, serving meals took only about half an hour, whereas, *Brahmin* women spent around an hour doing the same activity. I observed during the field visit that a man in the household where we stayed was regularly involved in curry cooking with a biogas stoves, which is not common especially among *Brahmin* families. This reflects a change in gender roles due to access to technologies like biogas stoves.

The extra work women perform apart from their regular daily activities includes going to the forest once in a week to collect firewood. Similarly, *Tamang* women spent considerable time in making alcohol twice a week for household consumption. During the heavy agricultural season, such as when growing paddy, women go to the fields either from early morning to afternoon or from afternoon to evening. During this time, they still do housework as well as farm work sometimes engaging their young daughters (taking them out of school) to do household chores.

Similarly, women often go to mills for processing activities, although sometimes this work is shared by men. However, grain processing through *dhiki* and *janto* is mostly done by women who still use these traditional processing techniques for hulling grain and grinding pulses. Though the processing activities were not done on a regular basis, they consumed a considerable amount of women's time. child care activities and socialization are not listed separately in this profile since the women do not have separate time for these activiites but perform them together while undertaking household chores.

In Mahadevsthan, the *Brahmin* women also spent 16 hours daily doing work excluding occasional and seasonal activities. Women in Mahadevsthan spent more time in water collection, since they had to travel longer distances to access drinking water. In addition, they worship in the morning, which takes up time. Similarly, these women spent more time in cleaning than the *Tamang* women in Nayagaon since they had to wash all the water jugs and utensils and smear some part of the house (kitchen and verandah) in the morning. It was interesting to learn that *Tamang* men and women sit together and plan the following day's work, and do some work at the same time, and which was not the case for *Brahmin* women, although they stayed up late at night twisting wicks for praying. Women spent long time periods in collecting fodder grasses in Mahadevsthan, since they mainly relied on their fields as they had no forest around them, unlike in Nayagaon. Women also worked in the kitchen garden or in the fields, especially when there were other women household members sharing work such as collecting fodder grasses. In this group, men only shared women's work with respect to caring for livestock.

The extra work *Brahmin* women performed in Mahadevsthan, was less as compared to the *Tamang* women in Nayagaon. In Mahadevsthan, women mainly relied on agricultural residue and fodder sticks for fulfilling minimum firewood requirements, as their main cooking was done in biogas stoves. The processing tasks were all performed in the diesel mill located near by the village and the traditional processing techniques were not used.

The cooking and cleaning time has been reduced with the use of biogas plants in Mahadevsthan For instance, they used to take around one hour to prepare morning snacks and cleaning dishes and the house after a meal with the use of firewood, but this has been reduced to half an hour after using the biogas stoves. However, this was not the case in Nayagaon, where, women used biogas stoves only for light cooking. Work sharing is very limited at household level in Mahadevsthan, unlike in Nayagaon, where men shared many of women's tasks. This is because of the cultural difference between the two ethnic communities.

Given the timeframe for women's activities, women have very limited time to be involved in social and economic activities that help to increase their socio-economic status. I observed during the meetings with groups that women were rushed to go back to their work. This could be the reason women do not always concentrate during meetings and training, even if they manage to attend the same. They have little motivation to undertake new activities. In such a situation, women can not be expected to participate effectively in any development activities. However, if men share the household activities, this could provide women more time to be involved in social and economic activities.

Overall, activity profiles provided a general idea of women's workload after having access to micro hydro and biogas plants. While the activity profiles show just the average daily workload of women the extra work recorded for different time periods provides a closer look at women's workload.

Preference Ranking Matrix

The Preference Ranking Matrix was prepared with a different group of men and women in order to show their preferences for different technologies based on standard criteria. Each technology is scored according to a set of criteria, so that if kerosene was seen as less costly than electricity, kerosene would receive a '2' and electricity a '1' for cost. The technology with total highest score represents the highest preference of men and women towards one technology over the other.

Table 7.6 shows a preference ranking matrix developed with a mixed group of men and women in Nayagaon to see their preferences when comparing kerosene and electric light.

Table 7.6: Preference Ranking Matrix: Electricity and Kerosene Light

Criteria	Kerosene light	Electricity
Cost	2	1
Health	1	2
Ease of use	1	2
Access/availability	1	2
Risk/danger	1	2
Total	**6**	**9**

Source: Field Survey, 2002

From the above ranking matrix, it can be inferred that local people preferred to have electric light with its total score of 9 as compared to 6 for kerosene light. Though having electricity was bit more costly than kerosene light, all other positive implications of the electricity outweighed the cost.

The Preference Ranking Matrix was also prepared to show the preferences of women for different technologies for processing grain.

Table 7.7: Preference Ranking Matrix: Janto, Ghatta and Diesel Mill

Criteria	Janto	Ghatta (Water mill)	Diesel Mill
Labor	1	2	3
Time	1	2	3
Easy to use	1	2	3
Cost	3	2	1
Risk	3	2	1
Tasty and nutritious	2	3	1
Durable flour	3	2	1
Total	**14**	**15**	**13**

Source: Field Survey, 2002

While comparing the three processing alternatives for grinding grain, there was not a strong overall preference for one technology: each has its strength and weaknesses. G*hatta* (traditional water mill) got the highest score (15) as compared to the diesel mill (13) and *janto* (14). It is obvious that women prefer *ghatta* for grinding grain, since it is most economical and does not consume a lot of labor and time as is case for *janto*. In addition, flour ground in *ghatta* was reported to be tastier and to have a longer storage life because of the natural way of processing. Although the workload and time was reduced with the diesel mill, and it was easier to use, the higher charges and the higher risk (the possibility of accidents) involved with it moderated those advantages.

The ranking matrix was also carried out with a group of women in Nayagaon to see their preferences for *dhiki* and the diesel mill since most of the households in this *Tamang* community still used *dhiki* for rice and millet hulling. As mentioned earlier, the power produced through the MHP schemes in Nayagaon is more than enough (16 kilowatts) to operate small mills at the local level, which would therefore reduce the cost of processing as well as the cost per unit of electricity to individual households, but until now the electricity has only been used for lighting. The results are shown in Table 7.8.

Table 7.8: Preference Ranking Matrix: Dhiki and Diesel Mill

Criteria	Dhiki	Diesel Mill
Labor	1	2
Time	1	2
Cost	2	1
Risk	1	2
Taste and nutrition	2	1
Total	**7**	**8**

Source: Field Survey, 2002

These women like to use *dhiki* as it was less costly and they felt rice from *dhiki* was tastier and more nutritious, but a mill was perceived as having advantages such as saving labor and time. Thus, the local women in Nayagaon would have preferred to use diesel mills even with the higher cost.

In the *Tamang* community, I observed that women preferred to use *dhiki*, as long as they had time to do so, because the diesel mill was far away from their village as compared to the *Brahmin* village. For grinding grain, they brought grain to the diesel mill since *ghatta* was farther than the mill. In the *Brahmin* community, women preferred to use the diesel mill for rice hulling as well as for grinding grain, since the mill was near their village. However, if the local people were able to use the micro-hydro power for processing mill, they would not have to pay the higher charges as with the diesel mill.

A preference ranking matrix was also developed with a women's group in Nayagaon for assessing their preferences for traditional versus biogas stoves. As shown in Table 7.9 women saw advantages in both traditional and biogas stoves.

Table 7.9: Preference Ranking Matrix: Traditional Stoves and Biogas Stoves

Criteria	Tradition Stoves	Biogas Stoves
Less time to cook	2	1
Good for health	1	2
Less work for cleaning	1	2
Financial burden	2	1
Easy to use	1	2
Less risk	2	1
Resource use (firewood)	1	2
Total	**10**	**11**

Source: Field Survey, 2002

For instance, the biogas stove consumes less firewood, less time and is good for health. However, biogas stoves were reported to be more costly and risky than traditional ones.

Traditional and improved cooking stoves were also compared using a preference ranking matrix (Table 7.10). Ranking for the traditional stoves and ICS are similar. While, the ICS was good in terms of requiring less work and resulting less smoke, and less use of firewood, in terms of time taken, risk and the cost, the traditional stoves got the highest score. Thus overall, there was only a slightly higher preference for the ICS. It was observed that the existing ICS model in the village did not fully substitute the traditional stoves because women feel comfortable using the traditional stoves to do some traditional cooking. In addition, with the people's belief in preserving the traditional stove (which is supposed to have a god), local women still prefer to keep the traditional stoves, even if they have the ICS.

Table 7.10: Preference Ranking Matrix: Traditional stoves and ICS

Criteria	Traditional Stoves	Improved Cooking Stoves (ICS)
Less time to cook	2	1
Good impact on health	1	2
Less work	1	2
Use of firewood	1	2
Low financial burden	2	1
Easy to use /less smoke	1	2
Less risky	2	1
Total	**10**	**11**

Source: Field Survey, 2002

Kerosene lights and solar lights were also compared (Table 7.11).

Table 7.11: Preference Ranking Matrix: Kerosene and Solar Light

Criteria	Kerosene Light	Solar light
Cost	2	1
Health	1	2
Convenience	1	2
Risk	1	2
Total	**5**	**7**

Source: Field Survey, 2002

It is revealing that the men and women have preferences for solar light as compared to kerosene light. Solar lighting was best for men and women in aspects such as health, easy of use, and risk; only the initial cost got the lower ranking. Though the households have to pay NRS. 15,000 (US$195) initially, they did not need to pay any regular charges for having lighting in their houses.

Overall, the matrices indicate that men and women generally prefer alternative technologies over the traditional ones although there was not a strong preference and in most cases traditional technologies were still valued. Thus women still used the traditional technologies for number of reasons and AETs became complementary technologies rather than alternatives.

Summary of Case Studies

Micro-Hydropower Plants

The MHP has been a good source of power for electrification and for operating the power mills in the two VDCs of Kavre district studied. Electricity has made women's lives easier and more comfortable when working both in and outside the house. Women's workload for processing activities was considerably reduced after having access to the power mill in Pokharichouri. Having electricity in the villages increased the confidence of local people in terms of the possibility to increase their income. Social gatherings and other entertainment like listening to the radio and watching televisions provided the opportunity for local men and women to learn about news and events around the community, nation and the world.

Women's participation in rural electrification with the micro hydro plant has been more in terms of labour contribution in the construction of the plant, though they were actively involved in community organizations (COs) for mobilizing the group savings and credit activities allow them to start small income generating activities. Women's involvement in decision-making activities was not significant. Even though they were represented on the rural energy board and at village meetings.

Among the two MHP schemes studied, the MHP in Pokharichouri was found to be the best since there was good management and operation of the plant. The community in this VDC was very economical and efficient in their use of the electricity. The MHP was used not only for household lighting but also for operating a mill in the village, and thus the community has received more benefit from the plant compared with Nayagaon, where electricity was only used for lighting.

Biogas Plants

The adoption rate of biogas plants in Nayagaon was very low even with full subsidies. The household contribution was materials like sand, stones and their labour for construction. Only around 30 percent of the total households have been able to install biogas plant due to the lack of information, capital and awareness of the benefits and proper usage of such plants. The biogas stoves were used as a complementary means of cooking, since they could not fulfil the variety of cooking needs of local people, and could not substitute for traditional stoves, even though they were very convenient.

In Mahadevsthan, local people adopted the biogas plant as their best alternative to replace scarce firewood, which would otherwise be more costly to buy as is kerosene. Since this village was close to the market center and had access to the highway, the people were more profit oriented than those in other communities and their food habits had changed, which led to the successful implementation of biogas technology.

In general, the use of biogas stoves has had a positive implication on women especially in terms of saving their labour and time both with relation to cleaning the house and collecting firewood. However, the biogas plant was not used to its full potential, since local women were not aware of using biogas slurry for making compost to use on their farms, as there were very limited extension services.

It was found that this technology was not a success among the low status ethnic groups in both Nayagaon and Mahadevsthan. Since these groups of people were not aware of sanitation activities, they were not motivated to use the toilet attached to the biogas plant. Among the *Brahmin* community in Mahadevsthan, by comparison a large motivation in constructing the plant was not only for fulfilling cooking needs, but also for having a toilet at the same time. I observed that the biogas plant being subsidized was a more user friendly technology for the richer households. However, the poorest of the poor were left out from accessing this technology, since the resources required for this technology excluded them. For instance, the poorest of the poor did not have land to install the gas plant and neither did they have enough cattle to supply the dung.

Improved Cooking Stoves (ICS)

ICS were one of the best and most affordable technologies for rural households in Nayagaon. They did not involve any big investment, and could be built with local materials. Mostly men were trained in ICS construction. The charges involved in construction of such stoves were only the wages for a technician, which was minimal. However, it was observed that some households destroyed the ICS, since women did not feel it was convenient to use due to some technical problems. For instance, smoke came back inside instead of passing out from the chimney. But most of the women felt very comfortable using ICS, since they did not have to face the fire directly and the cooking pots were less blackened. Consequently women's work in cleaning activities was reduced. The ICS also helped to reduce women's problems caused by smoke such as eye irritation and headaches. However, some women found it troublesome to clean the chimney frequently, and more risky during summer due to the possibility of fire. Despite the good potential of ICS for replacing traditional stoves and reducing domestic air pollution, I observed that ICS was not extensively promoted by the REDP unlike other AETS.

Solar Photovoltaic Systems (SPV)

The SPV has been a good source of lighting for some rural households in Nayagaon. Local people, especially women and children have benefited from such lighting, although men were the main decision makers in installing the SPV. Women found it easier to work in and around the house at nights with the lights and children had more time for study. However, women were not informed about how to repair lights and fix bulbs.

The solar lighting has very limited coverage, since this is an expensive technology for the local people even with a 50 percent subsidy. Thus only a few households benefited from solar electrification. Consequently, the socio-economic gaps became highly visible within a small community.

Conclusion

AETs have positive implications for the community, especially for women in terms of convenience, reducing work in collecting firewood, and less work for processing activities. In addition, there was a change in attitude of men and women in regard to women's development and empowerment than in the past due to the awareness activities initiated by the REDP, though this could be strengthened by institutionalizing the mainstreaming activities. Women's participation in implementing rural energy projects occurred through their involvement in community organizations (COs) formed by the REDP and their representation in rural energy boards.

The adoption of AETs was primarily based on the decision of a few leading men in the community and they rarely consulted women household members thus ignoring their needs and priorities. Low caste women especially were not aware of proper use and implications of AETs, causing problems in adoption. Similarly, as women were not trained in repair activities, they had to rely on male members of the family to do any small repairs. Hence, there was a shift in control over such technology as traditionally women could repair the indigenous technologies.

Women had very limited time to be involved in any socio-economic activities as the activity profiles point out that they still work about 16 hours per day. However, it was observed that if men share the household work, women have more time available. For instance, among *Tamang*, *Kami* and *Sarki*, household work including energy management was also shared by men, unlike among the *Brahmin/Chhetri* families.

Elite groups in the communities studied had benefited more from the implementation of rural energy technologies. For instance, only the richer households could access solar lighting and biogas technology even with subsidies, thus widening the socio-economic disparities within communities. On the other hand, those who had access to AETs only used them as complementary technologies, since they did not replace the traditional ones. For instance, biogas stoves and ICS were not suitable for house warming during winter and not very convenient for heavy and traditional cooking.

The above findings derived from case studies have been integrated with the findings of the household survey, and other participatory research methods presented in the next chapter.

Chapter Eight
Gendered Implications of Rural Energy Technologies

> Women are at the very center of rural life in the provision and use of household energy, yet tend to have very little voice in how things might change.
>
> (Nizumia, 2001:3)

In this chapter, the socio-economic implications of rural energy technologies are discussed based on research findings derived from the household survey, combined with the qualitative results discussed in Chapter Seven. As mentioned in Chapter Five, data for this study was collected using different methods of participatory research, as well as key informant interviews and a household survey. Household survey data provided quantitative information and this is supplemented by the qualitative information obtained from the different techniques, which is used to crosscheck the overall survey results.

This chapter is divided into three key sections; the first looks at socio-economic characteristics of sample households, the second looks at gender and the household energy systems, and the final section considers AETs as a means of achieving empowerment of women.

Socio-Economic Characteristics of Sampled Households

This section summarizes the socio-economic status of sampled households based on information obtained through household survey interviews, as well as participatory research methods like focus group discussions, social mapping, general observation and key informant interviews. Results from the surveys include characteristics of the survey respondents and their households, resource endowments and household income and expenditure. Different participatory research techniques provided insights into the perceptions and understandings of the communities and their attributes. Social maps produced by the community in a very participative way indicate access to physical resources, infrastructure, and technologies. Such information is documented below.

Demographic Characteristics of the Sample Households

The household survey conducted in both project and non-project areas aim to compare two situations: those with and those without rural energy project interventions.

Table 8.1: Household Characteristics of Sampled Households

Characteristics	Project Area N=80	Non-Project Area N=65	Overall N=145
Household Size			
Male	3.81	3.09	3.49
Female	3.51	3.21	3.38
Total	**7.32**	**6.30**	**6.87**
Adults per household (No.)			
Male	2.29	2.00	2.17
Female	2.04	2.20	2.10
Total	**4.33**	**4.20**	**4.27**
Dependents[1] per household (No.)			
Male	1.52	1.09	1.32
Female	1.47	1.01	1.28
Total	**2.99**	**2.10**	**2.60**

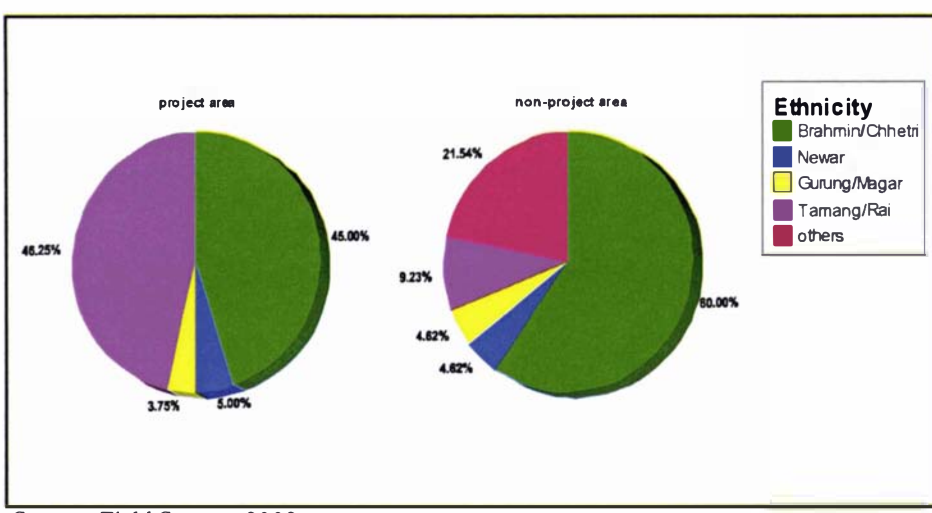
Note: The given values are averages.
Source: Field Survey, 2002

[1] The population under 15 and over 64 years of age groups is considered as dependents (CBS, 1997).

As table 8.1 shows, the average family size is higher (7.33 as against to 6.31) in the project area than in the non-project area, since the average number of adults followed by dependents is proportionately higher in the project area than in the non-project area.

The research area comprises different castes and ethnic groups, such as *Brahmin/Chhetri*, *Newar*, *Gurung/Magar*, *Tamang/Rai*, and *Kami*, *Damai* and *Sarki*. The following pie diagram shows the composition of ethnicity in the two different areas. It can be observed that *Brahmin/Chhetri* occupies the highest percentage (45% and 60% respectively) of sampled households in project and non-project areas (Figure 8.1). *Tamang/Rai* is the second largest sample population (46.25%) in the project area, and in the non-project area, the low caste groups (*Kami, and Sarki*) comprise the second largest sample (21.4%).

Figure 8.1: Ethnic Composition of Sampled Households

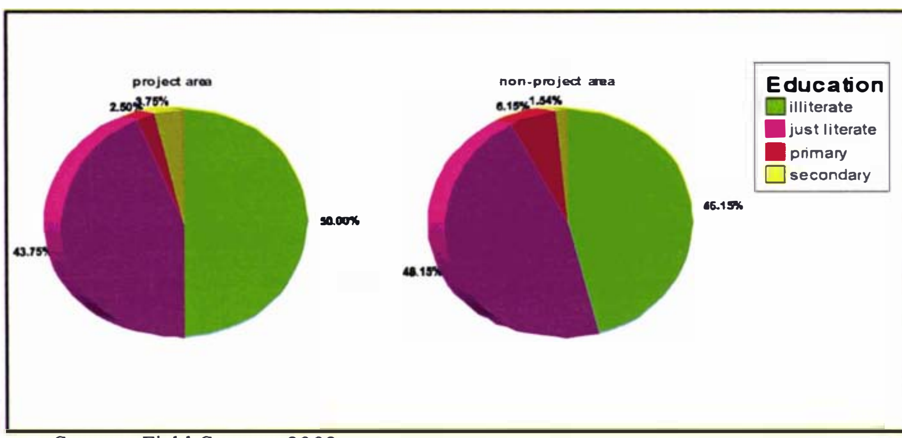


Source: Field Survey, 2002

Education and Occupation

The literacy rate of Kavre district is 39.6 percent, with female literacy at 28.8 percent as compared to male literacy, which is 50.2 percent (District Profile, Kavre: 2001). Under each Village Development Committee (VDC) there are primary schools in each village and one secondary school. Among the women from sampled households, almost 50 percent of the respondents[2] were illiterate in both project and non-project areas (Figure 8.2). The second highest percentage of respondents was just literate. Very few respondents have received primary and secondary education. The project area has a slightly higher percentage of respondents attending secondary education than in the non-project area. This is because in the project area, relatively more households have access to the secondary school as it is located in the village itself.

Figure 8.2: Education Status of Sampled Respondents (Women)



Source: Field Survey, 2002

It was observed that girls' education was not a priority. In many cases, the female children did not continue after primary education, either because the parents did not want their daughters to go to a school far away from home, or because they wanted the girls to look after their younger siblings or help them at work, and/or because the parents could not afford to pay for fees and stationery. Only a limited number of girls who have access to secondary education in their own village and parents who were conscious of the importance of their daughter's education, had continued their schooling. A few households, which were fairly rich and had access to the cities, have sent their daughters to college to continue their education.

[2] The respondents were all women, though men were also involved in initial data collecting process so as to get their support to conduct the survey with women.

Agriculture is the predominant occupation for the majority of people in Kavre district. Among the sampled women, 79.3 percent were involved in household work as well as farming as indicated in Table 8.2. This is slightly higher in the non-project area than in the project area. Since the respondents were all women, the vast majority were involved in household work. Only 1.4 percent of the respondents reported that they were only involved in farming. Almost 16 percent of the respondents were involved in only household work; this group of respondents was comprised of older females. Very few respondents were involved in trade and wage labor, since women have very limited time and opportunities for such involvement.

Table 8.2: Types of Occupation of Sampled Respondents (Women) (Percentage of respondents)

Occupation	Project Area (N= 80)	Non-Project Area (N=65)	Total (N=145)
Farming only	1.3	1.5	1.4
Wage labor other than paid employment	2.5	1.5	2.1
Trade	1.3	1.5	1.4
Household work only	17.5	13.8	15.9
Farming and household work	77.5	81.5	79.3
Total	**100**	**100**	**100**

Source: Field Survey, 2002

It was observed during the field visit that the community mainly relied on farming activities for their livelihoods. However, for most of the households, farming was only at subsistence level. The men in these households typically also worked as wage laborers in the nearest cities. Secondary activities included dairy farming, which was the main source of cash income. A few men and women in one village were also involved in Thanka production (indigenous painting), as a supplement to their farm income.

Resources and Economic Status

Resources and income were varied in the project and non-project areas. The major physical resources were land and livestock. Almost all sampled households have some land (either owned or from tenancy) for farming and they have kept livestock as an integral part of their farming activities. The average land-holding in the project area is smaller than in the non-project area (Table 8.3).

Table 8.3: Average Physical Resources Endowments of Sampled Households

Types of Resources	Project Area N=80	Non-project Area N=65	Total N=145
Total land area (hectares)	0.54	0.78	0.65
Land Registered in the name of women (hectares)	0.13	0.07	0.10
Large Ruminants: Cows, Buffaloes and Oxen (No.)	2.78	3.12	2.94
Small Ruminants: Goats, sheep, (No.)	4.64	3.78	4.25
Small Non Ruminant: Pigs (No.)	.29	.61	.44
Poultry and Ducks (No.)	1.62	1.86	1.73

Notes: Given values are averages.
Source: Field Survey, 2002

However, there seems to be a high variation in land-holding among the sampled households in the non-project area. It was observed that the high caste households like *Brahmin/Chhetri* owned more land than the low caste households. Women owned more land in the project area than in the non-project area. This is because a few women-headed households in the project area owned land in their own names, while no such cases were found in the non-project area. Average ruminant-keeping was higher in the non-project area than in the project area, however, the households in the project area own more goats and sheep than in the non-project area. The households in the non-project area keep more buffaloes and cows, because they are more involved in dairy farming having easier access to the road and thus market for dairy products than in the project area. The average number of small non-ruminants is also higher in the non-project area than in the project area, because the low caste households in the non-project area keep pigs. The upper caste *Brahmin/Chhetri* does not keep pigs, as they feel pigs are dirty. Almost all households keep poultry but only in limited numbers.

Annual income and expenditure patterns

Annual household income varies significantly variations in the project and the non-project area as shown in Table 8.4.

Table 8.4: Estimated Annual Income, (NRS/year)

Sources of income (in NRS)	Project Area N=80	Non-Project Area N=65	Total N=145
Income from cereal crops	13368.75	9714.06	11744.44
Income from vegetables	11706.25	4648.44	8569.44
Income from livestock and livestock products	14618.75	13653.97	14193.71
Income from off-farm employment	24606.25	16221.54	20847.59
Income from remittances/pensions	1360.76	498.46	971.53
Other sources	2151.90	569.23	1437.50
Total annual income	**55287.00**	**43934.00**	**50197.00**

Notes: given values are averages.
Source: Field Survey, 2002

Incomes were derived from six main sources; cereal crops, vegetables, livestock and livestock products, off-farm employment, remittances and pensions. The average annual household income was reported to be NRS 55287 in the project area, and NRS 43934 in non-project area. Agricultural products and off-farm income were the major source of household income in both project and non-project areas. The average income is higher in the project area than in the non-project area because the project area has a good irrigation system with canals constructed for micro hydro turbines that have led to increased agricultural production. However, it was observed that there is a large variation in the income within the sampled households in the project area. In the non-project area, water and irrigation was a big problem leading to low agricultural productivity. There were enough water resources in the non-project area but they were not tapped. Additional income was generated through pensions and remittances, and selling livestock and milk products and small business activities such as small tea shops.

As for annual household expenditure, households in the project area indicated higher average expenditure than in the non-project area (Table 8.5). The major spending was on food items and on education. The expenditure on farm equipment was relatively lower than the other expenses since these expenses were incurred only occasionally. The higher spending in the project area can be explained on the grounds that the households in the project area have a higher average income than the non-project area. In the project area, the second highest percentage of sampled households belonged to the *Tamang/Rai* ethnic group who spent more for rituals and festivals. There were high variations in expenditure within the sampled households.

It was reported that expenditure would always exceed income in households in almost all cases, although the household survey did not reflect this fact. This discrepancy most likely occurred is because people hesitate to give the actual figures for income and expenditure. Only a few households, which have more farmland than the rest, have some savings, which could be used for emergency purposes.

Table 8.5: Estimated Annual Expenditure, (NRS/Year)

Expense Items (in NRS.)	Project Area N=80	Non Project Area N=65	Total N=145
Total spending for education	7571.25	4401.54	6150.34
Total spending for religious activities	4535.00	2638.46	3684.83
Total spending for food items	14831.25	10533.85	12904.83
Purchasing of farm equipment	1653.75	1039.23	1378.26
Purchasing of farm inputs	4341.25	3363.07	3902.76
Purchase of animal feeds and health	2787.34	3226.15	2985.42
Total medical expenses	3527.85	2890.77	3240.28
Total annual expenditure	**35178.00**	**29022.00**	**32399.00**

Notes: Given values are averages.
Source: Field Survey, 2002

Decision Making Structure of Sampled Households

During the field visits, I observed that men were the major decision makers at the household as well as the community level, though women were involved in the decision making process. In the few women-headed households, women were the sole decision makers.

Table 8.6 provides the decision-making structure for sampled households.

Table 8.6: Decision-Making Structure of Sampled Households (Percentage of respondents)

Decision Activities	Project Area N=80	Non-Project Area N=65	Total N=145	Sig.
Holding and managing crop income:				
Women	28.6	12.5	21.6	
Men	69.0	87.5	77.0	
Both	2.4	0.0	1.4	
Chi square (d.f)			5.54 (2)	0.155(NS)
Holding and managing livestock income:				
Women	30.3	17.2	24.2	
Men	54.5	67.2	60.5	
Both	15.2	15.5	15.3	
Chi square (d.f)			3.73 (2)	0.223(NS)
Decision on Planting fodder trees:				
Women	11.1	31.3	19.5	
Men	62.2	40.6	53.2	
Both	26.7	28.1	27.3	
Chi square (d.f.)			3.00(2)	0.062(NS)

Note: NS refers to the chi square testing of independence of gender decisions by project is not significant at 5 % level of probability.
Source: Field Survey, 2002

It can be inferred that both in project and non-project areas, men were dominant decision makers in household activities such as holding and managing crop and livestock income and planting fodder trees. In the non-project area, a higher percentage of men (87.5% vs. 69 %, 67.2 % vs. 54.5%) was solely responsible for holding and managing crop and livestock income as compared with the project area. On the other hand, the percentage of women involved in holding such income was higher in the project area than in the non-project area. The reasons attributed for such decision-making patterns are that, in the project area, a large number of the respondents belong to *Tamang/Rai* and the gender gap in this community is relatively lower than among

Brahmin/Chhetri. For instance, among *Tamang/Rai*, men share the household work and the daughters are treated equally as the sons in terms of food, clothing and education.

In planting fodder trees, a higher percentage of men are involved in making decisions in the project area than in the non-project area. Conversely, more women were involved in making such decisions in the non-project area than in the project area. This could be attributed to the fact that the higher percentages of respondents in the non-project area belong to *Brahmin/Chhetri*, and women in this ethnic group were highly perceptive towards firewood problems. Women in the non-project area being more experienced in forest resources, were more concerned about the management of possible resources and relatively more involved in making decisions on fodder trees.

An independency test (X^2) was also carried out to find out if gender roles in decision-making are dependent on project category. It showed that the gender roles in household decision-making are non-significant ($P < .05$) and thus not dependent on project category. However, the chi-square test carried out to see the gender roles in planting fodder trees is only slightly higher (.062) at 5 percent level of probability, and thus is close to significant.

Community Attributes

The community attributes were assessed using social mapping techniques, interviews and observation. Two social maps were produced for two different communities in the project area. Other communities in the project and non-project areas were assessed through key informant interviews and general observation.

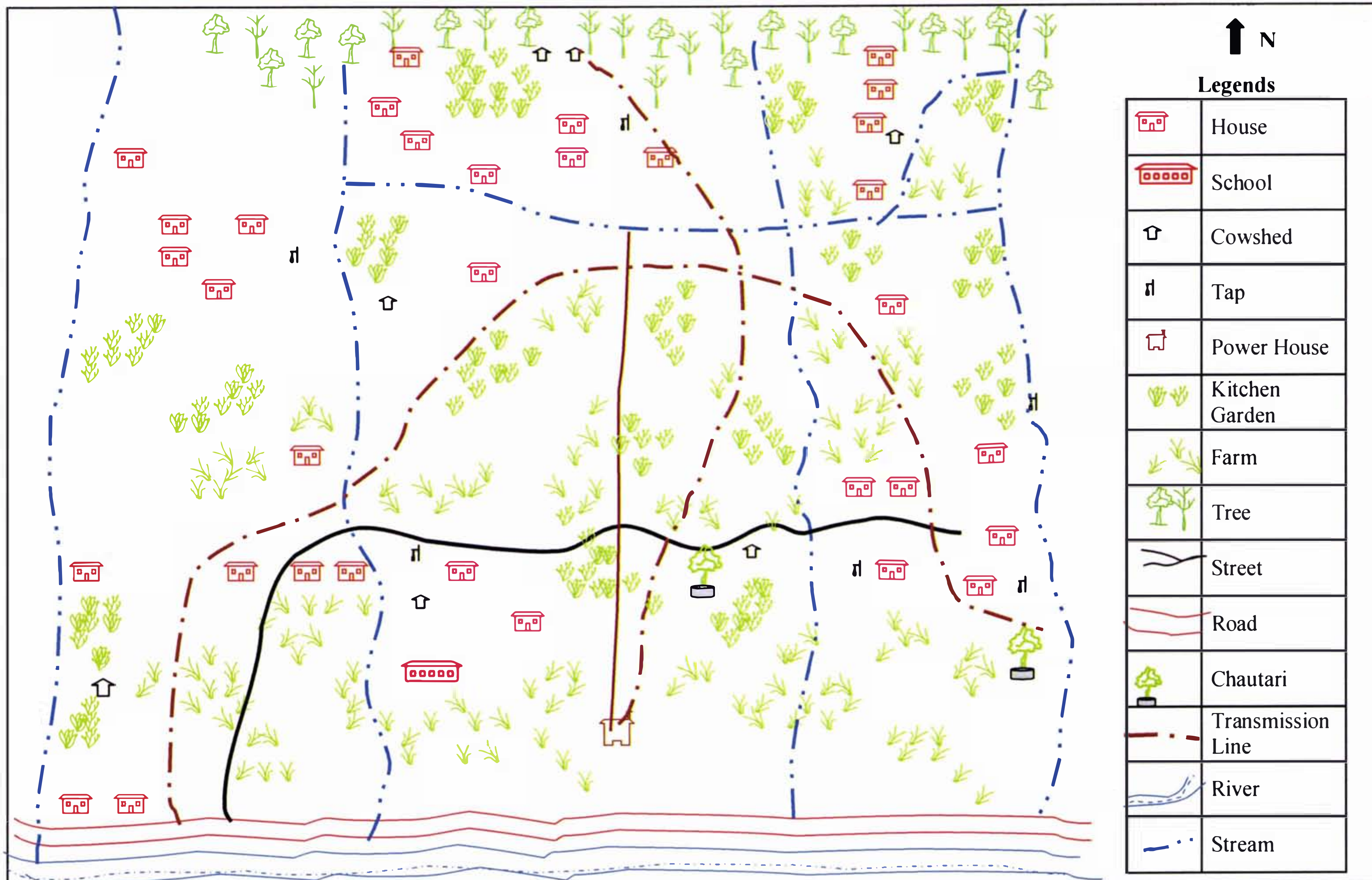
Katunjebeshi VDC

The social maps of two communities of the project area (Katunjebeshi VDC) are presented in Figures: 8.3 and 8.4 respectively. The social maps depict information on

Figure 8.3: Katunjebeshi (Ward No 1)

Source: Field Survey, 2002

Figure 8.4: Katunjebeshi (Ward No 7)



Source: Field Survey, 2002

road networks, location of schools, VDC offices, health posts, electricity lines, power houses, diesel mills, forestry offices, temples, forest areas, rivers, households indicating access to tap water and toilets, livestock sheds, farm and kitchen gardens. The maps reveal the settlement pattern and access to different resources. For instance, in ward no. 1 of Katunjebeshi VDC, the Newar community was located near the highways while the *Brahmin/Chhetri* community resided in the upper part of the village, which was close to forest and farming areas. In this village, the communities closer to highways were more involved in the market economy, and they looked for profit-oriented activities rather than concentrating on subsistence or community development activities at the village level.

These communities have closer access to the diesel mills but are distant from the water mill. In this village, traditional processing like *dhiki* and *janto* were occasionally used. Out of 65 households in this village, only 45 households were covered by rural electrification through the MHP scheme and 17 households had installed a biogas plant. Some of the households did not use electricity because they could not afford to pay regular charges, while other households could not contribute labor during the construction of canals. For the biogas plants, some people were waiting to see the benefit from others using them, while others were unable to met the high initial investment (installation cost). A few people also mentioned that they did not see any real benefits of having a biogas plant.

In ward no. 7 of Katunjebeshi VDC, there were only 32 households and all had access to micro hydro electricity. Only two households had installed a biogas plant in this community. In this community, there was a powerhouse and one primary school. This village was relatively further from the Banepa-Bardibas highway, which is about an hour's walk away. The women were less exposed to outside activities being away from the road network unlike in the other village (ward 1). Farms and forests and water mill were not far from this village, however, the women were far away from the diesel mill, for which they had to go to ward 1.

Mangaltar VDC

In Mangaltar VDC the community attributes were assessed through general observation and key informant interviews. Two communities (Pinthali with micro hydro electricity and Mangaltar with solar electricity) were studied.

Pinthali is located in the east of the district. It is about two hours drive from the district headquarters and one hour's steep walk from the local bus station. In Pinthali, there were 118 households and all of them had access to electricity. This community was of *Tamang/Rai* ethnicity and was all Buddhist. The Buddhist Stupa on the hilltop on the outskirts of the village is an expression of the spirituality of the community. There is one lower secondary school, a few health volunteers, a forestry office, one power mill (huller, grinder, and oil expeller) and one diesel grinder. The water supply system in the village is not yet well established although there are a few taps built into the canal water sources. The canal water has been well used for operating the power mill as well as for irrigating the farms, which has increased vegetable production, especially garlic. The community forest is at an early stage of development and the local women need to walk a long way to collect firewood.

Mangaltar village is located near the market center. Twenty-nine out of 150 households in this community had installed a solar energy system, which was 50 percent subsidized by the distributors. This village is comprised of *Tamang/Rai* and *Brahmin/Chhetri* groups with *Brahmin/Chhetri* in the majority. About 15 households in this village have installed bio gas plants and a few households have also constructed improved stoves but they were destroyed them since they proved to be inconvenient. There is one secondary school, and one diesel mill in the market center near the village.

Methinkot VDC

Three villages of Methinkot VDC were selected as a non-project area, where there has been no rural energy intervention until recently. The villages in this area are a mixture of *Brahmin/Chhetri*, *Newar*, *Tamang/Rai* and a low caste group (*Sarki*). There were primary schools in each village, one diesel mill located near the market center and one secondary school. The water supply system was built near the market center, but in remote villages, the community had to rely on their original wells for drinking water. Though Methinkot had good access to the nearest road network, infrastructure was still in a poor condition. There was no irrigation facility in this area and local farmers had to rely on rain irrigation. Tomato cultivation and sales were popular income earners among the wealthier farmers who had access to the road network. Milk production and sales provided additional income. In this community, *Brahmin/Chhetri* were heavily involved in religious activities attending *puja* and *bhajan*[3] every day in addition to their farming activities.

The socio-economic characteristics explained in this section provide background information on the sampled households focusing on comparisons between project and non-project areas. As suggested in different tables, there is no significant difference in household size, educational status, and economic status, resources and the decision making structure of sampled households between project and non-project areas. This has two implications. First, the minimum socio-economic differences between project and non-project areas provide a good basis to see the implications of AETs as compared to traditional technologies. For instance, the reduced workload of women in the project area might be attributed to the access of AETs. Second, the low socio-economic differences between project and non-project areas can also be attributed to the fact that AETs have very limited implications on the socio-economic status of rural households. For instance, the average income of households in the project area is just a little higher than in the non-project area, due to the irrigation facilities available in a

[3] *Puja* and *bhajan* are the religious activities that take place in the household and in the community. Such religious activities consume considerable amount of time (2-5 hours) and expenditure.

few villages of the project area through micro hydro canals. However, there was a big variation in average income between the sampled households.

Gender and Household Energy Systems

As I discussed in Chapter Three, women are especially involved in household energy management in developing countries. The remainder of this chapter results from my examination of women's roles in the energy sphere and their involvement in Alternative Energy Technologies (AETs) in Kavre district, Nepal. Gender roles in household energy management were analyzed in terms of problems in using and managing energy resources, access to and control over resources involvement in different energy-related activities, and gender needs and potentials regarding AETs.

Problems and Potential of Traditional Energy Resources

The local women in rural areas primarily depend on biomass (mainly firewood) for fulfilling household energy requirements. I observed that only around 30 percent of households in the project area have access to technologies like biogas and improved stoves. Local women experienced different kinds of problems in managing firewood resources and in cooking with biomass resources.

Table 8.7 presents women's perceived problems in managing firewood. Majority of the respondents feel that they need to travel long distances to the forest to collect firewood. A higher percentage of those sampled in the project area, as compared to the non-project area, need to walk long distances to collect firewood. Women from one village in the project area, need to walk up to 6 hours to reach a forest which belonged to another community. The community forest[4] had just been started in their own village and it was too early to be able to collect firewood. However, in the non-project area the

[4] A community forest is a forest protected by a local community and is open to the community related.

Table 8.7: Problems in Collecting Firewood (Percentages of cases)

Problems	Project Area N=80	Non-project Area N=65	Total N=145
Long distance to walk	86.2	67.9	77.5
No time to go to forest	34.5	62.3	35.1
Lack of firewood (long time to collect)	48.3	20.8	47.7
Risky (falling down from trees, paying penalties)	34.5	20.8	27.9
Costly to buy	15.5	15.1	15.3
Other	13.8	5.7	9.9

Source: Field Survey, 2002

community forest near the villages was more developed and the local people could collect the fallen dry firewood. The public forest[5] was further from the village, however. The second highest percentage of respondents in the project area mentioned that there was a lack of firewood in the forest. The reason was that the community forest in one of the project areas was not protected and the people from other villages used to steal the firewood. A higher percentage of respondents in the non-project area mentioned that they have no time to go to the forest. The reason was that women in the non-project area were more occupied with the heavy household chores and farm work due to the lack of a water supply, irrigation facilities and a processing mill. Other problems mentioned were that there was a risk associated with stealing firewood from private forests and from the community forest, including financial penalties. It was also costly to buy the firewood from private forests[6] and from the market. Apart from problems in collecting firewood, there were other problems, which were attributed to the use of biomass resources (Table 8.8). As indicated below, the highest percentage of

[5] A public forest is a forest protected by the government and is open for use by the general public

[6] A private forest is a forest owned by individuals and there is no access to the non-owners.

Table 8.8: Problems with Firewood Cooking (Percentage of cases)

Problems	Project Area N=80	Non project Area N=65	Total N=145
More smoke	98.7	98.4	98.6
Dirty utensils	75.9	90.6	82.5
Dirty house	62.0	51.6	57.3
Hard to blow	44.3	7.8	28.0
Eye irritation	46.8	1.6	26.6
Long time to cook	7.6	0.0	4.2
High heat during summer	5.1	0.0	2.8
Other	3.8	0.0	2.1

Source: Field Survey, 2002

respondents in both project and non-project areas were concerned about problems caused by smoke from biomass cooking, followed by dirty utensils and dirty houses. Other problems mentioned were those that REDP officials had brought to women's attention including the physical effort of having to blow hard to get the stoves going, eye irritation, the long cooking time and the high heat during summer. These problems were not mentioned in the non-project area, since the local women were not as sensitive to these problems as in the project area.

These problems were also mentioned during FGDs as pointed out in Chapter Six. However, it was interesting to learn that cooking with firewood was seen as having some advantages. For instance, the wood ceiling was less susceptible to insects because of firewood smoke, and the ashes were very useful as they could be used in the kitchen garden as a good fertilizer.

While talking about processing problems, it was reported that women had to spend long hours in grinding and hulling the grain with traditional processing like *dhiki* and *janto* and this caused backaches and problems with their legs. When the water mill was far away from the village, it was not so convenient for local women for regular processing activities. On the other hand, they seemed to like flour ground in the water mill claiming that it is tastier than flour ground in the diesel or power mill as pointed out in previous chapter. The women's group further reported that they preferred to use *dhiki* and *janto* for small quantities of grain, and for grinding spices.

Gender Roles in Managing Household Energy Activities

It was found that women were the ones who managed the energy resources in most cases, whether biomass or other indigenous fuels. Only in some cases with *Tamang* households, were men also involved in collecting firewood and in processing grains.

Table 8.9 presents gender roles in household energy management. The highest percentages of respondents explained that men alone are responsible for cutting trees in both project and non-project areas. This is because women are not considered to be strong enough to do this work. However, in the project area, women are also considerably involved in tree cutting, because almost half of the community belonged to the *Tamang* caste, among which the gender gap is very small. The chi-square (X^2) test shows that gender roles in cutting trees are dependent on the project category, since they vary considerably in project and non-project areas.

I observed that in *Brahmin/Chhetri* communities, men cut the trees most of the time. However, women were more likely to be involved in cutting trees in low income households. Among *Tamang/Rai,* both men and women were involved in tree cutting, though men were more involved in such activities. Among low caste people like *Kami* and *Sarki*, both men and women were involved in cutting trees. In the non-project area, the second highest group of respondents belonged to the low caste group, which may explain why 35.4 percent of these respondents mentioned that both men and women were involved in cutting trees.

Table 8.9: Gender Roles in Household Energy Management (Percentage of respondents)

Activities	Project Area N = 80	Non-project Area N = 65	Total N = 145	Sig
Who cuts the trees?				
Women	35.0	16.9	26.9	
Men	43.8	44.6	44.1	
Both	21.3	38.4	29.0	
Chi-Square (d.f)			8.031 (2)	0.018*
Who collects the firewood?				
Women	65.0	60.0	62.8	
Men	5.0	4.6	4.8	
Both	30.0	35.4	32.4	
Chi-Square			.475 (2)	0.789(NS)
Who stores it?				
Women	71.3	61.5	66.9	
Men	2.5	6.2	4.1	
Both	26.3	32.3	29.0	
Chi-Square (d.f.)			2.117 (2)	0.347 (NS)

Note: * refers to statistical significance at 5 % level of probability based on the chi square of testing of independence of gender participation in energy activities by project. NS = Not significant

The highest percentages of respondents in both project and non-project areas explained that women were responsible for collecting firewood. In addition, about 30 percent of respondents reported that both men and women were involved in collecting firewood. This is because *Tamang* men and women in the project area and low caste men and women in the non-project area more inclined to share the work at the household level. The gender roles in collecting firewood were not dependent on the project category, since they were almost the same in both areas.

With regard to management and storage of firewood, the highest percentage of respondents in both project and non-project areas explained that women were responsible for this job. Once again, around 30 percent of the respondents mentioned that both men and women were involved in storing firewood. The chi-square test (X^{2}) revealed that gender roles in storing the firewood were not dependent on project category.

However, it was observed that in most of the cases it was women who collected and stored the firewood. Young girls were equally involved in collecting firewood, while young boys would spend their time roaming around the village. In a focus group discussion, a *Tamang* woman mentioned that the men of the household would also go to collect the firewood, if they had a friend to play cards with in the forest. This is because the men were not allowed to play cards in the village by the women's group who were supported by REDP's awareness program.

Thus, while the survey results suggest that men are somewhat involved in collection and storage of firewood, they mostly assist with these tasks intermittently. There may be a social benefit for women from collecting firewood as revealed in one FGD. For instance, it was reported that women enjoyed the company of friends when going to forests, as it was then they could share their feelings, grief and pain with each other.

Gender roles in energy related activities among different ethnicities are depicted in Tables 8.10 and 8.11 for project and non-project areas. Table 8.10 shows that among *Brahmin/Chhetri*, women were highly involved in activities like cooking meals, preparing snacks, rice hulling, grinding grain, going to the mills, collecting dung, and grasses for stall feeding. The girls were also highly involved in such activities like collecting firewood, carrying grain to the mills, mixing dung with water and water collection. While, boys were also involved in carrying grains to the mills, mixing dung with water and collecting grasses as were girl children, they were not involved in other activities such as cooking and grain processing. The men were also involved in mixing

Table 8.10: Involvement in Household Energy Activities by Gender and Ethnicity (Project Area)

Activities	Brahmin/Chhettri				Newar				Tamang/Rai			
	W	M	G	B	W	M	G	B	W	M	G	B
Cooking meal	**	o	*	o	**	*	*	o	**	*	**	*
Preparing snacks	**	o	*	o	**	*	*	o	**	*	**	*
Rice hulling	**	o	*	o	**	o	**	o	*	*	*	*
Grinding grains	**	o	*	o	**	o	**	o	*	*	*	o
Collecting firewood	**	o	**	o	**	*	*	o	**	*	**	*
Going to the mills	**	*	**	**	**	*	*	**	**	**	**	**
Mixing dung and water	**	*	*	*	**	**	o	*	**	*	*	*
Carrying water for mixing with dung	**	*	*	*	**	*	**	o	**	*	*	*
Collecting dung	**	*	*	*	*	**	*	*	*	**	*	*
Collecting grasses for stall feeding	**	*	*	*	**	*	*	*	**	**	**	**

Notes: W=Women, M=Men, G=Girl, B=Boy,
**=high involvement, *=low involvement, o = no involvement
Source: Field Survey 2002,

water with dung, dung collection, going to the mills, and collecting grasses but their involvement was not as high as women's.

Among the *Newar* caste, both women and girls were highly involved in major energy-related activities like collecting firewood, processing grains and collecting water for mixing with dung. Men were also occasionally involved in cooking activities, when women were not allowed to cook once a month during menstruation, and there were no other women family members. The boys were mainly involved in carrying grains to the mills.

Among *Tamang/Rai*, men shared many of the household activities, for instance, in firewood, water and dung collection, though their involvement in such activities was low. The men and boys were equally involved in carrying grain to the mills and carrying grasses for stall- feeding.

Gendered involvement in household energy-related activities in the non-project area by ethnicity is presented in Table 8.11. This table excluded the last four activities in Table 8.10, because they were related with the biogas plant in the project area.

Table 8.11: Involvement in Household Energy Activities by Gender and Ethnicity (Non-Project Area)

Activities	Brahmin/Chhetri				Tamang/Rai				Low Caste groups			
	W	M	G	B	W	M	G	B	W	M	G	B
Cooking meal	**	o	**	o	**	*	**	o	**	*	**	*
Preparing snacks	**	o	**	o	**	*	**	o	**	*	**	*
Rice hulling	*	o	*	o	*	o	o	o	*	*	*	o
Grinding grains	**	o	**	o	**	o	*	o	**	*	*	o
Collecting firewood	**	o	**	o	**	o	**	o	**	o	**	o
Going to the mills	*	o	**	*	*	o	*	o	*	o	**	*

Notes: W = women, M = men, G = Girl, B = Boy,
** = high involvement, * = low involvement, o = no involvement
Source: Field Survey 2002.

Among *Brahmin/Chhetri*, women and girls were highly involved in cooking meals, preparing snacks, grinding grains, and collecting firewood. In processing activities, both women and girls were involved in rice hulling, while both boys and girls, and women were involved in going to the mills with girls playing the strongest role. Since there was a diesel mill in the village the women did not have to be involved much in hulling activities, but were very involved in grinding due to the fact that they preferred to use the flour ground from *janto* and *ghatta* (water mill*)*, because it is tastier than that processed by the power or diesel mill.

Among *Tamang/Rai,* women and girls were heavily involved in cooking meals and snacks and in collecting firewood. Men also shared the cooking activities but the boys were never around to do their share of this work. Among the low caste households, women and girls were highly involved in cooking and grinding but were less involved in hulling. In this group, the men and also the boys shared both cooking and processing tasks. Among the low caste and *Tamang* ethnic group, sharing of work between males and females was well practiced.

Gendered Access to and Control over Energy Resources and Technologies

While in the field I observed that rural women had access to all kinds of energy resources such as firewood, diesel and power mills, and also to alternative cooking technologies such as biogas stoves and improved stoves available at the household and community level. Women had no or limited control over AETs. In addition, only a limited percentage of households owned AETs such as biogas plants, ICS, and the solar photovoltaic systems as mentioned in the previous chapter.

Table 8.12 presents women's access to firewood resources. The sampled households have different access to firewood in both project and non-project areas. The highest percentage of respondents in the project area had access to firewood in their own fields and the forests. The availability of fodder grasses in their own fields fulfilled their fuel needs as well, since they used the fodder sticks as firewood, while the grasses were used for livestock feeding. As mentioned previously, the community forests were not well developed in the project area whereas, in the non-project area, the highest percentage of respondents collected firewood from their own and community forests.

Table 8.12: Women's Access to Firewood
(Percentage of respondents)

Access to Firewood	Project Area N=80	Non Project Area N=65	Total N=145
Public forest	6.3	1.5	4.1
Own field/forest	37.5	18.5	29.0
Community forest	13.8	24.6	18.6
Own and community forest	18.8	47.7	31.7
Stealing in other's forest/field	23.8	3.0	15.2
Buying trees from other's field/forest	0.0	4.6	2.0
Total	**100**	**100**	**100**

Source: Field Survey, 2002

In the project area, a large percentage of respondents admitted that they stole the firewood from private forests far from the village, because they did not have their own forest. In the non-project area, this was not the case since the majority of people have access to community forests. A few of them also mentioned that they bought firewood from private forests.

Both men and women then have access to firewood resources, and women are well represented in community forest groups. Women also have a say in firewood management, collection and forest clearance. However, men were the major decision makers in determining whether or not to sell firewood from the forests and managing the community income. I also observed that women in the project area had access to technology like electricity, biogas stoves, solar lighting and improved stoves and many used such technology, although they had no control over it, having no knowledge of repair and maintenance work.

Table 8.13 presents information regarding the repair of AETs.

Table 8.13: Ability of Women to Repair AETs (Percentage of respondents)

Repairability	Brahmin Chettri	Newar	Tamang Rai
Yes	14.3	18.0	7.3
No	85.7	82.0	92.7
Total	**100**	**100**	**100**

Source: Field Survey, 2002

A few women from different castes reported that they could do minor repair activities such as mending leakages in gas stoves, while others relied on technicians (all male) or other male members of the family to carry out such repairs. The majority of respondents could not do the repairs and had to wait for a technician who was hard to catch when he was needed. In this way, control over technology has shifted away from women since they have to rely on men. A woman in a focus group reported that if the power house operator (male) was not around they would have no electricity at the night, since the operator in the powerhouse controls the power supply.

Gender Needs and Potential with Regard to AETs

Women and men have different kinds of needs, interests and potential with regard to AETs. Recognition of women's needs, and potentials could help to achieve successful implementation and development of AETs and self-enhancement of women as well. From discussions with men's and women's groups, their needs have been identified and categorized into two broad groups, based on Moser's (1989) model of practical and strategic gender needs.

Practical gender needs

Women wanted to access different alternative technologies for fulfilling basic energy requirements at the household level to help reduce their drudgery. For instance, most women feel comfortable using ICS and biogas stoves for cooking despite some limitations with these technologies. Women needed to collect less firewood for cooking when using biogas, and they do not have to stay in front of the fire and smoke, so they find it preferable to using traditional stoves. Similarly, women felt relieved of some of their workload through having access to a power mill, since they did not have to carry the grain far from the village and do not need to use the traditional processing methods using their own energy. Only occasionally, do women use *dhiki* and *janto* for grinding and hulling grains and spices. Women also mentioned that they have more time for processing activities, which have become less arduous. Men wished to have AETs because they feel access to AETs is a sign of high social status. They also acknowledged that AETs helped women in their work, when I asked men to provide their views about implication of AETs on women.

Strategic gender needs

Many women expressed a wish to be involved in some income generating and social activities at the local level. However, there were very few opportunities for involvement in such activities. For instance, a few women were involved in poultry keeping, soap-making and incense-making. There is a good potential for development of small enterprises based on power from the local micro-hydro plants. These enterprises could include chilling industry, small bakeries, and handlooms for weaving. This could help both men and women to increase their involvement in more income generating activities and lead towards the self-enhancement of women.

Women also stressed the importance of social activities for building up a group's strength to create a pressure group in order to control injustices or undesirable behavior in the community such as stopping gambling in the village. Community mobilization through saving and credit groups was a good strategy in the social enhancement of women. Similarly rural electrification through micro-hydro plants facilitated adult literacy programs because lighting was available in the evenings. In a few villages such classes have helped the local women not only to be able to read and write but also to be aware of environmental health and gender issues because the adult literacy classes also focused on such issues. Women seemed to be very interested in participating in such programs. Men placed more importance on the entertainment option available through micro hydro electricity, such as watching television and listening to radios and getting news and information from around the world.

Potentials

Based on the results of Focus Group Discussions (FGDs) with women, I have classified women's potential with regard to AETs into three categories.

Wider knowledge in managing energy resources

Local women were very much aware of how to manage energy resources such as biomass effectively, and of the selection of firewood materials. For instance, women had knowledge about which firewood burns properly and which does not. As a survival strategy, women use biomass resources very economically and are supportive of protecting community forests. On the other hand, they are very conscious that although diesel or power mills reduce their workload and time in processing activities, they are costly to use. The women sometimes refused to utilize these mills for processing small quantities of grain, saying it would be uneconomical.

Community mobilization skills

Women have demonstrated good skills in mobilizing the community, which was a good strategy to motivate them in the adoption of AETs. By their involvement in saving and credit groups initiated by REDP, women were able to motivate others in the group to be involved in construction of micro-hydro canals, for installing biogas plants and ICS and so on. In a group of women, one individual is able to convince others to install plants for their convenience. Women would then talk to their husbands about the need for such plants and in some cases they were able to convince them to support this idea.

Interest in participating in management of AETs

It was observed that local women were very interested in participating in AETs, though they have very limited spare time for such participation. They were curious to know about the proper use of AETs and also were interested in knowing how to make small repairs, so they would not have to depend upon either technicians or other members of the family. The women's interest in participating in AETs proved they had a good potential for the development of these technologies.

Table 8.14 shows the different interests of women in participating in management of AETs.

Table 8.14: Women's Interest in Participating in Management of AETs (percentage of cases)

Interest category	Brahmin /Chhetri	Newar	Tamang/ Rai
Personal interest	50.0	0.0	46.4
To know proper usage	83.3	100.0	75.0
To be able to conduct maintenance work	50.0	0.0	50.0

Sources: Field Survey, 2002

The highest percentage of the respondents in all ethnicities wanted to participate in AETs in order to learn proper usage of such technologies. Almost half of the respondents among *Brahmin/Chhetri* and *Tamang/Rai* expressed a personal interest in participating, while among the *Newar* caste, 100 percent of respondents wanted to know about proper use of AETs as the main user of such technologies. These interests demonstrate that women could be seriously involved in the planning and development of AETs.

It was also observed that local women could potentially play an important role in the development of AETs, which has been neglected at present. For instance, women could prove to be good technicians in constructing and promoting improved cooking stoves. This might help increase the adoption of such stoves among women. However, in most cases, men were trained for such purposes and women have had difficulties in using them in practice. Similarly, involving women in deciding on the location of the biogas plant, where they must perform a number of tasks in operating the biogas plant, such as mixing water and dung, and collecting water and dung, would have reduced women's workload and encouraged them to adopt the biogas technology. It is the same with the location of micro-hydro mills, where women often travel to the mills for processing activities. Women will make better use of the AETs if they consider them convenient. Similarly, women should be aware of the safety measures in using AETs, since they are the one who primarily stay around the house and supervise their children.

Overall, women have different needs and potentials from men relating to AETs, which if tapped properly could enhance women's self-esteem and lead to the successful implementation of AETs as well.

Relationship between AETs and Empowerment of Women

AETs have different kinds of socio-economic implications for men and women. For instance, they have been able to reduce women's workloads and save their time and energy. AETs have also provided different kinds of opportunities for men and women in terms of being exposed to new technologies, although there have been very limited opportunities for women to be involved in social and economic activities for their self-enhancement and empowerment.

There were some negative implications of AETs as well. This section explores the various positive and negative implications of AETs for both men and women but especially focuses on women's labor and time saved, and their participation in different social and economic activities including the rural energy projects. This, in turn, helps to enhance the socio-economic status of women enabling their empowerment.

Changes in Workloads and Time for Women

It was found that there was a change in women's workloads after having access to biogas plants and micro-hydro mills. In general, there was a reduction in the use of firewood especially after the introduction of biogas stoves as mentioned earlier in Chapter Seven. There was a considerable reduction in processing time after having access to micro hydro mills. For instance, women used to wake up very early around 4 am in the morning and use *dhiki* and *janto* for at least two hours of grain processing which required their own physical energy. Now women spend only around half an hour on processing activities excluding travel and waiting times, which comprise around one hour. Since most of the energy related activities are carried out by women, this analysis focuses on women's work.

The work burden on women in project and non-project areas is presented in Table 8.15. The work burden was measured on a scale ranging from 1 to 3 as presented below.

Work burden	**1**	**2**	**3**
Amount of work	Light	Average	Heavy
Convenience of work	Easy	Average	Difficult
Consumption of labor	Low	Average	High
Consumption of time	Less	Average	More

Table 8.15: Comparison of Work Burden of Women

Work Burden	Project Area N=80	Non-Project Area N=65	Sig
Amount of work	1.80 (0.64)	2.67 (0.51)	0.000*
Convenience of work	1.18 (0.44)	2.62 (0.58)	0.000*
Consumption of labor	1.71 (0.58)	2.68 (0.53)	0.000*
Consumption of time	1.78 (0.67)	2.69 (0.56)	0.000*

Notes: Given values are averages and figures in parenthesis represent the standard deviations.
* refers to the difference between means of two groups is highly Significant ($p<.0005$)
Source: Field Survey, 2002

Table 8.15 compares women's workloads in project and non-project areas. The mean score for the amount of work in the project area is close to two (1.80) which means that the workload of women is only average as compared to the non-project area, where the workload is close to three (2.67) which means that their work is heavy. The mean score for convenience of work is close to one in the project area and close to three in the non-project area, which suggests that the women feel their work is easier after having access to AETs, while the women in the non-project area feel their work is difficult. Labor consumption is also close to three (2.68) in the non-project area, whereas it is only average in the project area. Similarly, in the project area, women spend only an average amount of time (1.78) on energy related activities while more time (2.69) is spent in the non-project area.

The given standard deviations explain that there is not a high variation within the mean score in both project and non-project areas. The ANOVA test was done to measure the variance in work burdens of women in the project and non-project areas. It shows that there is a highly significant difference between the means of the two groups, since the

P value is less than .0005. Overall, the work burden of women in the non-project area was higher compared to the project area.

The issue of time and workloads was also brought up during focus group discussions in both project and non-project areas. The women's groups in the project area felt that though their workload was less in terms of collecting firewood, as well as cleaning and processing activities, they needed to spend more time in caring for livestock such as feeding, collecting dung, and water. The water taps were not near by the house even though there was a water supply system in the village. As for processing activities, most of the households in the non-project area had access to the diesel mill (although it was still far away) and they did not feel there was as much work expended for processing activities as in the past. However, in those households, which were furthest from the diesel mill, women spent more time traveling to the mill and they had to give up a whole day's work for this one activity. In such households, women planned their trips to the mills when they needed to go to market or to visit some relatives near the market center where the diesel mill was located. In the non-project area, there was no irrigation facility in the village unlike in the project area and women's heavy work on the farm seemed to be less productive. It was also observed that women had to spend more time in water collection in the non-project area in the absence of a proper water supply system.

Table 8.16 presents the average time used for energy related activities before and after introduction of AETs. The average time spent for energy-related activities has been reduced when compared to the past. For instance, average cooking time per meal after using biogas stoves and ICS, has been reduced from 1.08 hours to .75 hours. Similarly, cooking time for morning and afternoon snacks has been reduced from .85 hours to .59 hours. There has been a significant reduction in average processing times, which used to be 4.31 hours (for hulling and grinding 30 kgs. of grain) with traditional processing techniques like *dhiki* and *janto*. This has come down to 1.09 hours with micro hydro milling, which includes the travel as well as waiting time. The waiting time was mentioned to be very short, because of the speedy processing activities unlike with the

Table 8.16: Women's Time Used for Energy Related Activities

Energy related activities	Average time used (in hours)	
	Before AETs	After AETs
Cooking meals	1.08 (0.93)	0.75 (0.64)
Cooking snacks	0.85 (0.79)	0.59 (0.58)
Hulling and grinding grain (30kg.of grain)	4.31 (1.24)	1.09 (1.48)
Time to go to mill	2.78 (0.74)	0.29 (0.27)
Collecting firewood per month	28.03 (23.9)	24.0 (23.45)

Notes: Figures in parenthesis represent the standard deviations.
Source: Field Survey, 2002

traditional water mill. The time to go to the mill was also calculated separately because, local women sometimes used to go to diesel mills or water mills far away from their villages for hulling and grinding activities.

The average time for walking to the mill (a return journey) has been calculated to have been 2.78 hours, which has been reduced to.29 hours with access to micro-hydro milling. The average time for collecting firewood was calculated in a different way, because the time required for collecting one *bhari*[7] of firewood was the same but the amount of firewood used after having access to biogas stoves and ICS was reduced. The above figures for collecting firewood represent the average time spent per month for collecting firewood. Since, only around 30 percent of households have access to such technology, there was not a big change in firewood collection time.

[7] *Bhari* is a Nepali language to express a bundle of firewood

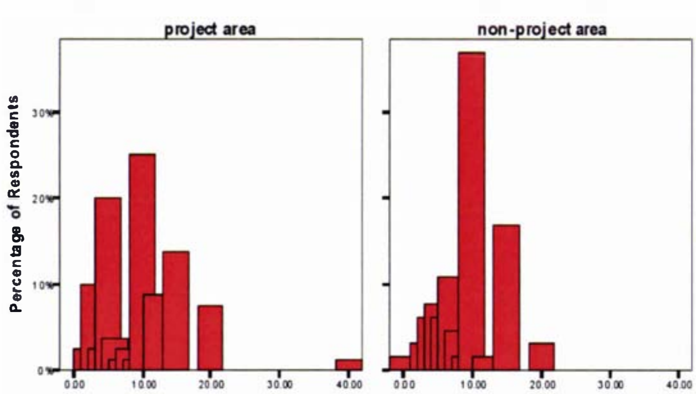
Changes in Resources

During the field visits, I observed that there had been some changes in local resources following access to AETs. For instance, the micro hydro canal provided an irrigation facility which supported an increase in agricultural production especially vegetable production in Pinthali village. Since, the canal was located in high land, and the water flow from the turbine could be used all day for irrigation, while operating the mills at the same time. In Katunjebeshi, the canal water was used for generating turbine electricity in the evening, and the same canal was used for irrigation during the day. Here, there was no power mill, and thus the power was used only for electricity at night-time.

Average amount of firewood used

There was little difference in the amount of firewood used in project and non-project areas, thus no significant reduction in firewood used in the project area, since only limited number of households had access to biogas stoves and ICS. In addition, those having access to such technologies still liked to use traditional cooking methods on certain occasions as mentioned earlier. Figure 8.5 compares the use of firewood resources in the two different areas.

Figure 8.5: Average Amount of Firewood Used per Month



Source: Field Survey, 2002

Around 26 and 38 percent of households in the project area and the non-project area respectively used 10 *bhari* of firewood per month for fulfilling household energy requirements. Around 14 and 18 percent of households in the project and non-project areas respectively used 15 *bhari* of firewood per month. Only a small percent of households (8 and 3 percent in project and non-project respectively) in both areas used 20 *bhari* of firewood. As mentioned previously households belonging to the *Tamang/Rai* ethnic group in the project area use bigger quantities of firewood for preparing alcohol. A few households (1 percent) in the project area used 40 *bhari* of firewood per month. However, in both areas, the largest percentage of households used an average 10 *bhari* of firewood per month. The higher percentage of households using 10 *bhar*i of firewood in the non-project area is because they have a good access to firewood in the nearby community forest. The focus group discussions with men's and women's groups also revealed that, there was a positive change in local resources. There was a slight reduction in use of firewood with the use of biogas stoves. The women's groups mentioned that on an average two *bhari* of firewood would be saved per month.

Changes in Culture

As stated earlier, gender based discriminations are very common in Nepal among different communities of different cultural origin, though degree of disparity varies (ADB, 1999). Women's mobility is very low especially among high caste families and they have low access to decision making processes in household and community activities (Bhattachan, 2001). In rural areas, women from all ethnic group often work about 16 hours, while men spend time lazily playing cards and drinking alcohol (2001:79). Especially among low caste families, women are victimized due to the frequent domestic violence associated with gambling and drinking habits of men.

With awareness programs supported by the REDP, communities have become aware of development activities related to environment, health and hygiene, and gender issues. There was a change in people's attitudes and behavior with regard to women's mobility and participation in development initiatives. For instance, women had more flexibility to participate in community meetings. The awareness programs also included the teaching and counseling activities to local men and women on family well being and its implication on the development of a good community. This helped to control the gambling and drinking habits of men and reduce the domestic violence to some extent. With the support from the REDP, women were able to penalize their husbands for gambling and heavy drinking of alcohols. For instance, women did not allow men to enter into the house when they were drunk.

Opportunities for Social and Economic Activities

AETs have provided some good opportunities to local men and women as mentioned in the previous chapter, though their coverage has been somewhat limited. Despite the fact that AETs have good positive implications on local people's quality of life, especially for women, they were not being used to their full potential. Women have very limited time and in addition, there were few end-use activities, which could result from improved energy supplies (such as poultry keeping, weaving, and literacy programs) for local people, especially women, to be involved for their self-enhancement and empowerment.

Table 8.17 below presents the different opportunities open to men, women and children after having access to AETs as indicated by survey respondents (women). The highest percentage of respondents (91.3% and 90% respectively) mentioned that women's households chores were easier and they had been exposed to new technology after having access to AETs. About 58 percent of respondents reported that women's workload was reduced. Around 64 percent of respondents also mentioned that women have participated in development activities with the initiation of REDP. Such activities included community meetings for awareness development, creating and mobilizing saving funds, and participating in rural energy committees. Men's participation in such

Table 8.17: Opportunities Available in Village through AETs (Percentage of cases)

Opportunities	Women	Men	Children
More income opportunities	21.3	23.7	0.0
Reduced workload	57.5	22.4	4.8
Easier household chores	91.3	12.4	17.5
Exposure to new technology	90.0	80.3	27.0
More time for school work	0.0	0.0	71.4
Participation in development activities	63.8	73.7	19.0
Exposure in different community	0.0	64.5	6.3
Better Sanitation	6.3	9.2	1.6

Source: Field Survey, 2002

activities was highest with access to AETs and they were more exposed to different communities. The men visited other communities and other villages to learn more about the technologies. A large number of respondents also noted that children have more time for schoolwork, and have enhanced lighting for study. Hence, AETs provided different kinds of opportunities to women, men and the children as well helping them enhance their knowledge and confidence. The opportunities that AETs provide to women were especially important in terms of their reduced workload, alleviation of the burden of household chores, and participation in development activities[8], which would otherwise be difficult for them.

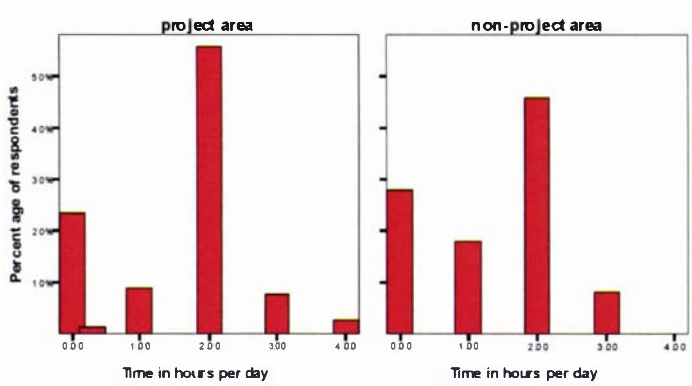
[8] Development activities refer to all social and community development activities (eg, group organization and meetings, village energy meetings, literacy programs, awareness development activities, building community halls and roads, constructing canals and so on.)

Time available for women for social and economic activities

I observed during the field visits that women and children have a less arduous time when working since having access to electricity and other cooking alternatives. There was also a considerable reduction in processing time. However, an interesting thing is that women never seemed to have free time for any other social and economic (income generating) activities. There was always something for women to do. The women hardly managed to find time once a month for group meetings organized for small saving schemes and in most cases, women did not regularly attend these meetings.

The bar chart (Figure: 8.6) below shows the time available to women for social and economic activities in project and non-project areas.

Figure 8.6 : Women's Time for Social and Economic Activities



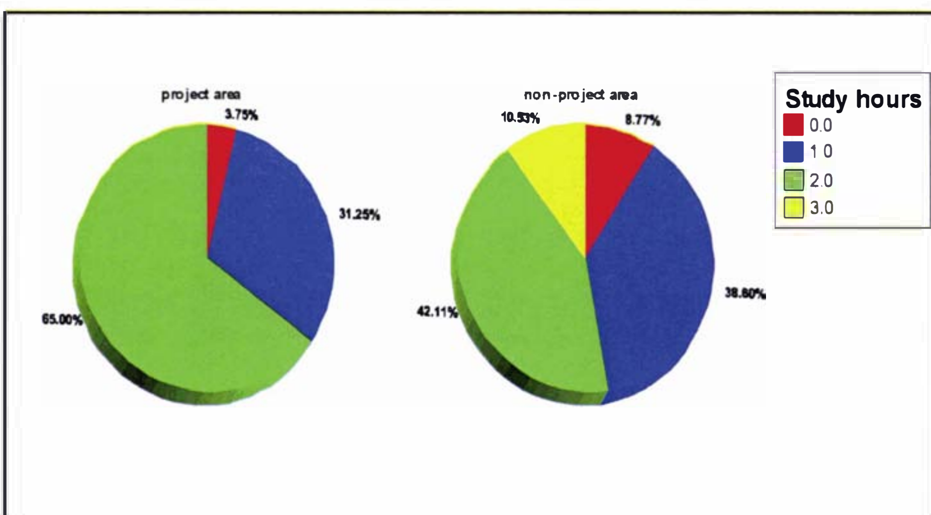
Source: Field Survey, 2002

In both project and non-project areas, the highest percentages (58% and 46% respectively) of respondents have two hours for social and economic activities. Around 24 and 30 percent of respondents in the project area and the non-project area respectively reported that they have no time for any social and economic activities. A few respondents in the project area mentioned that they had 3 or 4 hours for being involved in such activities. There was little difference between the project and non-project areas in accessing time for social and economic activities. This may be because in the project area, although women have saved time through rural energy interventions they were always busy either in the house or on the farm. During the focus group discussion, a woman mentioned that, "Our work is waiting for us; who will let us go to enjoy meetings and trainings?" Some other women said that they could find a few hours, if there were opportunities available in the village for them to pursue. In reality, however, women rarely seemed to have free time to devote to leisure activities or pursue some economic endeavor.

Children's study time

A comparison was made of children's time for study between project and non-project areas to see the changes after having access to electricity in the village (Figure 8.7).

Figure 8.7: Children's Study Time per Day



Source: Field Survey, 2002

Figure 8.7 shows that approximately 31 and 39 percent of respondents in the project and the non-project area respectively mentioned that their children study for one hour. Sixty five percent of respondents in the project area said children had two hours for study each day, compared to 42 percent in the non-project area. This difference could be accounted for by the fact that the children in the project area are motivated to study longer hours because of having electricity in the village. However, it is interesting to know that some children (around 11%) study for three hours in the non-project area, while none mentioned this in the project area. This may be because the highest percentage of sampled households (60%) in the non-project area belong to the higher castes (*Brahmin/Chhetri*), who place great emphasis on children's education and the children (especially boys) were accustomed to studying longer hours even with kerosene light. A small percent of respondents in both project and non-project areas mentioned that their children do not study at night. During a focus group discussion, the *Tamang* women, mentioned that their children hardly study at night even after having access to electricity. They were more interested in socializing with their friends including chatting in groups, walking around the village and so on as pointed out in the previous chapter. One man from this ethnic group mentioned that "our children want to enjoy the light for some other purposes and not for study".

Overall, the children's study time was increased with access to electricity, though this did not apply equally to all communities in the villages.

Promotion of end use activities

It was observed that AETs were used as an ends rather than the means for promotion of social and economic purposes, such as income generating activities and literacy programs. There were very limited extension services to create awareness among local people of how to use AETs to their full potential.

In Katunjebeshi, the power plant was only used for producing electricity, whereas it could also have been used for installing a small chilling plant, or establishing a small bakery where local people could be employed during the day. The local men in Katunjebeshi also mentioned the potential for poultry keeping with the electric light (which produces the necessary heat) in the village, and having access to the road network. However, they complained that the power broke down frequently and it was not even reliable enough for lighting purposes during the night. In addition, the biogas plants installed in a small number of households were mainly aimed at producing biogas while neglecting the use of slurry for making compost to use on farms for increased agricultural production.

The solar photovoltaic system installed in a small number of households in Mangaltar village was mainly used for lighting purposes, which was the primary need of local people; however it was not used for any other purposes except for charging the batteries. The solar panels were of low voltage so they had limited applications. It was also beyond the capacity of local people to afford high voltage panels.

In Pinthali, micro-hydropower was used for the processing mill as well as for providing electricity in the village and to those from surrounding villages. The power could have been used for more end use activities, like operating small handlooms through the power and other handicraft activities such as making wood crafts. An integrated program involving extension services, access to credit, raw materials, market network, and a good family support was however a prerequisite for promotion of such end use activities.

Health Status of People in Project and Non-Project Areas

It was too early to see the health impacts of AETs installed in the project area, since it was only around five years since the technologies were made available in the villages. However, the survey asked for comparisons of the health status of men and women after and before having AETs (Table 8.18).

Table 8.18: Health Problems in Project Area before and after AETs (Percentage of cases)

Health Problems	Before AETs		After AETs	
	Men	Women	Men	Women
Eye Problems	85.7	79.3	75.0	81.0
Lung diseases	28.6	24.1	37.5	23.8
Asthma	0.0	3.4	0.0	0.0

Source: Field Survey, 2002

Nevertheless, it was impossible to ascertain whether changes in health were due to AETs or unrelated factors. Around 86 percent of the men from sampled households had eye diseases prior to having AETs and this figure was reduced to 75 percent after having AETs. However, this change does not necessarily represent the effect of AETs, since the percentages of women having eye problems has slightly increased from 79 to 81 percent. The eye problems of men were reported to be for some other reasons like night blindness (cataracts), rather than from the smoke. The percentage of men having lung diseases increased from 28.6 to 37.5 percent after having AETs while there was little change for women. This could be attributed to the fact that men were heavy smokers. Only 3.4 percent of women had asthma prior to AETs and this was reduced to zero after AETs.

The focus group discussions provided more useful information about health. A focus group discussion with the men's group revealed that there was a reduction in the communicable diseases like cholera, diarrhea, and typhoid after using the toilet attached biogas plant. Similarly, the women's groups reported that the biogas stoves and ICS have helped to reduce their health problems like headaches and eye irritation.

Selected health problems were also compared between the project and non-project area as presented in Table 8.19 below.

Table 8.19: Selected Health problems in Project and Non-Project Areas (Percentage of cases)

	Project Area		Non project Area	
Health Problems	**Men**	**Women**	**Men**	**Women**
Eye problems	75.0	81.0	50.0	77.4
Lung disease	37.5	23.8	-	3.2
Asthma	-	-	77.8	32.3
Heart disease	-	-	5.6	22.6

Source: Field Survey, 2002

Interestingly, higher percentages of women and men have eye problems and lung disease in the project area as compared with the non-project area suggesting that these health problems are cause by a wide range of factors, not just smoke from stoves. There was however, more asthma and heart disease in the non-project area. There appears to be no significant effects from AETs on the health of men and women in the project area. The reasons could be attributed to the fact that AETs were implemented in this area quite recently, and the impact has still to be seen. In addition, only around 30 percent of households in this area have access to AETs like biogas plants and ICS, which have a high potential to reduce health problems.

Gendered Participation in Rural Energy Programs

REDP has emphasized women's participation in rural energy programs from the very beginning by establishing community organizations (COs) of men's and women's groups as mentioned in the previous chapter. The participation of men and women in the process of community mobilization was very appreciable. Especially, women's participation in group-saving scheme was especially effective and they were able to make proper use of such savings in fulfilling some emergency needs and carrying out income generating activities such as poultry, and handlooms. However, saving funds could not rotate smoothly to all group members in absence of a good cooperation among them. For instance, the funds borrowed by few group members were not paid back.

There were no planning exercises at the community level to identify women's needs and priorities. Both men and women were involved in village level meetings, but women were rarely involved in any decision making process. Biogas plants in particular were brought into the villages based on the decision of a few male members in most cases, except for a few households where men and women jointly made the decisions. Women were the silent users of such technology. Women were mainly involved in providing labor in construction activities. In the planning meetings, men were the ones to make any decisions and women would just agree on the same.

Table 8.20 presents the level of participation of women in planning and development of AETs.

Table 8.20: Participation of Women in Rural Energy Programs by Ethnicity

Activities	Brahmin/ Chhetri	Newar	Tamang/Rai
Attendance of planning meetings	**	**	**
Participation in decision making	*	*	*
Participation in raising local funds	***	***	**
Participation by providing labor	**	*	***
Participation by providing material	*	*	*
Other (repair/maintenance)	*	*	*

Source: Field Survey, 2002
Notes: *=low participation, **=average participation, ***=high participation

Among all ethnicities, participation of women is high in raising local funds. Among *Tamang/Rai*, women participate more actively in providing labor, than the *Brahmin/Chhetri* and *Newar*. There is average attendance of women in planning meetings, but their influence in planning activities and in decision-making remained low. The women's participation in repair and maintenance activities also remained low. As revealed during the FGDs with women, they participated actively in the construction of micro hydro canals and in savings activities. Their participation in village energy meetings and Village Energy Committees (VECs) seemed to be more as token representation than real participation in the decision-making process. Though women were represented on VECs, their participation in committee meetings seemed to be irregular. Those who participated in such meetings mentioned that men would hardly acknowledge or listen to women's ideas regarding any decisions on rural energy. A woman form VECs mentioned that "we can not push our ideas since men do not take them seriously".

Table 8.21 presents the frequency of participation of women in village level energy meetings.

Table 8.21: Frequency of Participation of Women in Village Energy Meetings (Percentages of respondents)

Frequency of Participation	Ethnicity		
	Brahmin/ Chhetri	Newar	Tamang/ Rai
No participation	67.9	50.0	48.8
Once a month	7.1	0.0	4.9
Once every two months	10.7	50.0	24.4
Once every three months	7.1	0.0	14.6
Twice a year	7.1	0.0	7.3
Total	**100**	**100**	**100**

Source: Field Survey, 2002

For all ethnic groups, the largest percentage of respondents (almost 50 percent or more) did not participate in village energy meetings. Participation was lowest among *Brahmin/Chhetri* women, because there is a large gender gap (for instance, women's mobility is much restricted within this group) among this ethnic group as compared to *Newar* and *Tamang/Rai*. Of those respondents who did participate in village energy meetings, this was more likely to occur once every two months. A relatively small percentage of respondents participated once a month. However, this kind of participation mainly represents the attendance of women in village energy meetings.

Table 8.22 below presents the reasons for women not participating in rural energy meetings. The highest percentage of respondents in all ethnic groups did not participate in village energy meetings, because they did not have time. Over 40 percent of

Brahmin /Chhetri and 30 percent of *Newar* women could not participate in the village energy meetings because they were not supported by family members. This percentage was lower (26.1%) among *Tamang/Rai,* because in this community the gender gap is lower. Almost one third of respondents in all castes mentioned that they could not participate because they did not have the knowledge to understand the talks suggesting low self-confidence among women. Some respondents also mentioned that the male members generally participate in such meetings and they do not. In addition, I observed that older women mostly participate in the group meetings rather than sending their daughter-in-laws to participate.

Table: 8.22: Reasons for Women not Participating in Village Meetings (Percentages of cases)

Reasons	Brahmin/Chhettri	Newar	Tamang/Rai
No time	77.8	66.7	73.9
Not encouraged by family members	44.4	33.3	26.1
No knowledge and understanding	33.3	33.3	34.8
Generally male members participate	27.8	0.0	21.7

Source: Field Survey, 2002

Men's perception of women's participation in rural energy programs

The men's groups reported that they encouraged women to participate in meetings and training organized for the rural energy programs. But, when talking with a few women, it was found that men do not really encourage their participation in any development activities which would mean leaving the housework undone. Men rarely share the housework and this makes it hard for women to participate in other economic and social activities. This was especially true among *Brahmin/Chhetri*. A woman in Pokharichouri said to me, "Our husbands talk nicely in front of outside people, but never do so inside the house" (FGD, 2002). Even the educated people like male school teachers imposed restrictions on women's mobility, although denying this in interviews. Among *Brahmin/Chhetri,* women's participation is encouraged by their family members only if they get allowances in the training. However, it was different for the *Tamang*. In this ethnic group, men wanted their women to go to meetings, while women themselves hesitated to attend because of their fear of not knowing anything. Among the *Kami* and *Sarki*, men encouraged their women to participate in any development activities not only for monetary expectations, but for recognition in society. A low caste man said, "We feel proud of our women if they can participate in a meeting together with the higher caste women" (FGD, 2002).

Overall, it can be said that there has been an effort by REDP to ensure women's participation in rural energy programs and technologies, although there have been limited efforts to integrate women's knowledge and capacity into the planning and development of AETs. Women's participation has been more rhetoric than active participation in plans and programs. This is because women's participation is not encouraged in the socio-cultural setting of most ethnic groups, while the officials (mostly the male members) are not themselves convinced of the need to promote active participation of women. Rather they fulfill their duties by encouraging women's attendance at meetings and training sessions but they fail to reflect women's voices in planning and management of AETs.

Conclusion

This chapter was mainly based on analysis of the survey integrated with some findings from qualitative methods. It highlights the socio-economic characteristics of sampled households, issues relating to gender and household energy systems and the relationship between AETs and empowerment of women. The analysis was centered on project and non-project areas in order to compare the two situations. The survey findings revealed that there is no significant difference in the socio-economic situation between the project and non-project areas. However, AETs have been implemented only for five years, which is probably not long enough to see changes in the community.

Women in both areas had strong involvement in management of biomass resources, with men being mainly involved in cutting trees and women having primary responsibility for collecting, storing and using firewood economically and efficiently. Collecting and cooking with biomass resources like firewood causes numerous problems for many women. Women find it very difficult to collect firewood where they have limited access to community forests. In addition, public and private forests are often far away from the villages and it takes considerable time to collect firewood. Only a few households had their own fields where they were able to obtain this source of fuel. At the same time, women experienced a number of problems with biomass cooking such as eye irritation, headaches, discomfort in facing fires during summer, and difficulties in cleaning their houses and dishes because of the smoke. Apart from managing biomass resources, women were highly involved in processing activities and other energy-related activities. There was no significant change in the health status of women in terms of reducing their lung and eye diseases after having access to biogas plants and ICS. However, the local women who used biogas stoves felt better in terms of having cleaner air, less eye irritation and headaches.

The end activities were very limited even with access to AETs. For instance, the power from the micro-hydro scheme was not fully utilized, rather it was limited to providing electricity in the village. The power could have been used for other small-scale activities, where women could have some employment opportunities at the local level. In addition, women were unable to do any economic transactions using the land as collateral, since they did not own the land nor any fixed property. Women's groups could use their savings fund created by themselves for carrying out small income activities. However, the savings were not effectively mobilized among them in the absence of cooperation and management within the group members. Similarly, the extension services were very limited. For instance, there was no proper training for the use of biogas slurry, which could have high economic value. In addition, there was no training for women to be involved in any kind of AET repair activities. Some women were trained in a limited range of gender specific income generating activities like vegetable gardening, incense making, and soap making. Even after having access to electricity and other technologies such as biogas and ICS, there were very few opportunities for women to be involved in income generating or social activities, which could enhance their self-esteem and independence.

In general, AETs have helped to reduce women's workloads and save women's time in energy related activities such as cooking, and processing grain as indicated in Table 7.18. However, time savings were not visible due to women shifting their work into other household chores. Thus, although they have saved time in processing activities they have not been able to use this time for other productive activities such as income generation. Those implementing AETs also encouraged women's participation through soliciting their involvement in community organizations, village energy boards and village level meetings. There were equal numbers of men and women in village energy committees representing different community organizations (COs), although men dominated when it came to making decisions.

Changing attitudes towards women's mobility, and development, and achieving empowerment is a long-term process. However, there are some positive changes in people's thinking and attitudes to gender, the environment and sanitation issues. The local men and women have broadened their visions regarding women's mobility, participation and development. For instance, women had greater freedom for participation in development activities than in the past. In this sense, women have gained confidence. In addition, AETs have enabled women to reduce their workloads and to be exposed to different technologies and to get access to some income generating and social activities like group formation and mobilization, adult literacy and so forth, even though, such opportunities were very limited. In this way, there is potential for AETs to contribute to women's empowerment at village level, but this has not yet been fully realized.

Chapter Nine
Conclusions and Recommendations

So far, this study has highlighted practical aspects of rural energy planning and implementation in Nepal and examined the socio-economic implications of rural energy technologies from a gender perspective. This chapter concludes the thesis by identifying policy measures that could help to integrate gender concerns into the planning and implementation of rural energy technologies. The flow on affect, can foster participation and empowerment of women and ensure the sustainability of rural energy programs.

In this chapter, the first part begins with a summary of key findings and an analysis of their significance in terms of the research objectives. The second part examines the implications of this study. In the final section, major challenges in rural energy planning and policies are outlined followed by proposed institutional frameworks and policy recommendations. Future research agendas are also discussed and some concluding remarks are made.

Summary of Key Findings

The key research findings are explained here in relation to the research objectives. The results and analysis presented in the previous chapters provides a basis for pinpointing these key findings.

Problems and Potential of Women with Regard to Rural Energy Resources

My first research objective was to analyze the problems and potentials of women with regard to rural energy resources and technologies. Women encountered a number of problems when managing biomass resources, especially in collecting and cooking with firewood. The majority of women were concerned about the problem of firewood.

Forests were often far from the village, and women had very limited time to go to the forest due to their involvement in heavy household chores. Due to lack of firewood in their own forests, many women used to steal the firewood from other people's forest. This was also a problem for women since they were afraid of being caught and paying the penalty. Because of the lack of good quality firewood, women tend to rely more on agricultural residue and fodder from around the fields for fuel. This situation created a further problem for women in terms of increasing domestic air pollution due to the use of poor quality biomass resources (Rijal, 1999a; Douglas and Willem, 1999).

Women also had problems using traditional technologies such as *dhiki* and *janto* for grain hulling and grinding, because they consumed a large amount of women's time and labor in performing such tasks. Because, women had very little time due to their busy household chores, it was also difficult for women to frequently travel to a water mill when it was located far away from the village. However, women still preferred to use such traditional technologies in certain circumstances, such as when they wanted to keep the traditional taste and when they had enough time to use them.

Women have good potential to undertake the management of AETs, having wide knowledge and skills in managing energy resources and in mobilizing the community towards the adoption of AETs (Kelkar, 1995). In addition, women's interest in participating in the management of AETs demonstrates their potential for the planning and development of AETs. Women could be involved as promoters and facilitators at the community level, if they can be trained in using and managing AETs. At present, women have very little knowledge on the use and potential implications of AETs, and no knowledge on the repair and maintenance of the same.

Changing Gender Roles Associated with Rural Energy Technologies

As my second research objective, I have analyzed gender roles in the sustainable use of energy resources and the development of alternative energy technologies. Based on my research, women are primarily responsible for managing biomass resources, which supports the findings of different scholars in the past (Cecelski, 1995; Kelkar, 1995; Batliwala and Reddy, 1996). Although men occasionally take part in collecting firewood and are responsible for cutting trees, their involvement in such activities is associated with their cultural backgrounds depending on their different ethnicities/castes. For instance, men of *Tamang* ethnicity share women's work in collecting firewood and fodder grasses, while this is not the case for *Brahmin* men. Conversely, *Tamang* women are involved in cutting trees for preparing firewood, while *Brahmin* women rarely perform this task, as they are perceived to be less strong than men.

There was no significant difference in gender roles in managing the biomass resources between project and non-project areas. Differences were more related to the ethnic background of the communities. Grain processing is mainly a responsibility of women both with traditional and alternative energy technologies (AETs). However, there was a change in division of labor with AETs. For instance, men have started to join women in carrying the grain for milling to the nearest micro-hydro mill, as indicated in past research (Rijal, 1998a:154). However, men rarely used *dhiki* and *janto* for hulling and grinding grain, which is performed by women in almost all cases. At the same time, I have also observed that when the diesel mills are located in the village itself, men will sometimes carry the grain so that women do not have to wait a long time, and they will bring back the grain and flour. Hence, location of the mill has some implications in the gender division of labor as men will help out more when a mill is located near to the village. Thus women's involvement in making such decisions become particularly significant when they have to carry the grain most of the time. Similarly, while biogas plants have a direct impact on women's work, there were some positive changes on the gender division of labor. For instance, men were also involved in light cooking with biogas stoves, unlike with traditional stoves, which were used exclusively by women in almost all cases.

Both men and women have access to traditional and alternative energy resources and technologies. However, women's involvement in management of AETs was very limited. This is both because of cultural reasons and because women were not fully aware of the use and implications of alternative technologies. There was a shift in control over technologies. For instance, when the power mill or biogas plant broke down, women had to rely on the technicians for repairing them.

Socio-Economic Implications of Alternative Energy Technologies

In line with my third research objective, I analyzed the socio-economic implications of traditional and alternative energy technologies and made a comparison between the two. As argued by Rijal (1998a) AETs have great potential to meet household energy demands as well as reduce women's workloads and improve their health conditions. In order to compare the socio-economic implications of alternative energy technologies with traditional technologies, a detailed household survey and participatory research methods were used in both areas with AETs (project areas) and areas without AETs (non-project areas).

I found AETs did not have a significant impact on the socio-economic status of the local communities, although there were some small differences. While, the average household income was higher in the project area than in the non-project area, there was a large variation in income among the sampled households in the project area. A higher average income was associated with the availability of irrigation facilities with a micro-hydro canal in one of the villages of the project area. In addition, the people living in the project area were more commercialized as they had good access to the road network, and worked in the cities during the off-season. AETs were not used to their full potential to facilitate other economic activities especially to increase women's income. Similarly, micro-hydro electricity was not used for increasing adult literacy, although the availability of electric lights created potential to enable adult literacy programs to be conducted at night.

There was a reduction in women's workload in the project area as compared to the non-project area, especially with micro-hydro mills consuming less time and labor of women in processing grain. Women needed to collect less firewood with the availability of biogas stoves, unlike in the non-project area, where women solely depended on the burning of firewood for all cooking. However, the saved time and labor was not very visible, because women were always occupied with some other activity. Although women were less burdened in managing household energy activities, their labor and time was used for additional household chores instead of using it for other social and income generating activities. For instance, women become occupied with kitchen gardening, or additional farming activities, which on the positive side contributed to an increase in household production. There were however, few opportunities available at the village level for women to become involved in generating income for their self-enhancement, which should have been possible with the availability of micro-hydropower in a village. There was some improvement in women and children's health with access to AETs, as women felt less eye irritation and headaches with the use of biogas and improved stoves.

AETs did not have any direct impact on men's work. Men, however, had more opportunity for social gatherings and discussions in the evenings due to the availability of electric lights. In addition, men were exposed to television and radios, which helped them increase their knowledge and information about current events around the world. There was also a possibility for men to be involved in some income generating activities such as opening a saw mill with the micro hydropower available at village level. However, young boys seemed to have become idler with access to television and radios, and reluctant to go to work.

With the community mobilization process initiated by the Rural Energy Development Program (REDP), there was a change in attitude of the local men and women regarding gender issues, the environment, and sanitation. For instance, women's mobility was not restricted as in the past, and their involvement in development activities was encouraged, although this was not necessarily true in all cases. Both men and women were conscious of using the toilet for the purpose of sanitation, and preserving the environment by developing community forests. An attached toilet was a motivation for many households to install the biogas plant.

The lack of major differences in socio-economic status between the project and the non-project area is understandable given that AETs in the project area have only been implemented for a short period, and the changes are yet to be seen. In some cases, the differences between project and non-project areas were associated with ethnic issues as mentioned earlier. For instance, when observing gendered involvement in the household decision-making process, in household energy management, and participation in rural energy activities in project and non-project areas, differences were clear due to the different ethnic backgrounds of the communities. For instance, men from the *Tamang* ethnic group shared the women's work in cooking and collecting firewood, which was not the case with *Brahmin/Chhetri* men. Similarly, *Tamang* women were involved in making household decisions and this was not the case with *Brahmin/Chhetri* women. In such cases, caste and ethnicity played a greater role in differentiating between the project and non-project area than the existence of rural energy programs.

Comparison between Traditional and Alternative Energy Technologies

When comparing traditional and alternative energy technologies (AETs), I found that women preferred to have AETs in principle, as they help to improve their quality of life. Improved Cooking Stoves (ICS) and biogas stoves proved to be a very convenient means of cooking, since women experience freedom from smoke and cleaning the house and washing dishes became easier. In addition, the biogas plant attached to toilets was a good method of sanitation in the village. There was a reduction in communicable diseases like cholera, diarrhea, and typhoid. Therefore installing the biogas plant was also a motivation for having a toilet. Similarly, women were very happy to have a micro hydro mill and electricity in their village because it helped reduce their workload as the grain processing time was greatly reduced.

Despite the benefits from AETs, they were mainly used to complement traditional technologies rather than as a substitute. Local women still used traditional technologies like traditional stoves for a number of reasons. For instance, they felt comfortable with open firewood burning stoves, which kept the house warm and were also easier for cooking a big meal during rituals and festivals. Similarly, old men and women were reluctant to use biogas due to feelings of discomfort towards the human waste that was mixed with cow dung to produce the biogas. For processing activities, however, local women most frequently used the power mill because it saved their time and energy. However, they preferred to use traditional processing methods like *dhiki* and *janto* on some occasions, such as when grinding spices during festivals, or grinding small quantities of grain which would be more costly if taken to the mill.

Technologies like biogas plants and solar photovoltaic systems were rather costly, even with subsidies, so they were not accessible to all people. For biogas plants, local people did not have to pay any direct cost for the plant as they were subsidized, but the construction materials and labor were still expensive if they could not contribute their own. For the solar photovoltaic system, local people had to pay 50 percent of the total cost, which was expensive for the majority of the households. Similarly, with micro-hydro electricity, some households refused to be connected to the transmission line because of the fear of paying regular charges while others were left out due to their inability to participate in construction activities, which was a precondition for accessing electricity. In general, only those from higher economic strata within villages could afford such technologies.

A lack of awareness of the local people, especially women, who use these technologies for their daily living, was found to be one of the reasons for the low adoption of technology like biogas plants and improved stoves. Women were not the target group when planning any interventions on AETs and there was little concern for developing women's awareness for using such technologies. Hence, women were not fully aware of the proper use and potential positive implications of the AETs. At the same time, technical problems played a vital role in leading women to criticize the technologies.

For instance, women felt very annoyed when the biogas stove switched off in the middle of cooking due to inadequate gas production. Similarly, leakages in biogas stoves proved very risky due to the possibility of fire. ICS also had the potential danger of fire during winter. In addition, the majority of ICS users complained they consumed more firewood than they expected and smoke was sucked back instead of being drawn out, which should not have been the case. This revealed a problem in the design of the stoves.

Thus, the overall adoption of AETs was still low for various reasons. Such technologies proved beneficial mainly to elite groups in communities, who had the capacity to access them easily and were able to use them to their full potential. Consequently, the socio-economic gap within communities became increasingly visible with access to AETs.

Research Implications

Implications of this study are discussed in this section focusing on participation and empowerment of women, which is an ultimate aim of my research.

Alternative Energy Technologies (AETs): Towards Meeting the Goal of Sustainable Livelihoods?

As discussed in the previous chapters, AETs' intervention in Nepal was initiated with an aim to provide efficient energy and improve the quality of life of rural people through reducing the use of traditional fuel. Following the country's neo-liberal economic policy under neo-liberal agendas and global environmental imperatives in the Ninth Plan, social sustainability has not been paid adequate attention in rural energy planning and implementation. This led to an emphasis on alternative energy for fulfilling the modern energy demands of rural households, reducing environmental impacts, and enhancing the rural economy through the provision of basic infrastructure services such as electricity. However, the socio-cultural concerns of local communities, which have a central role to play in achieving sustainable development in practice, received no attention. As emphasized by Barbier (1987: 54) the process of transformation (ecological, political, social, and cultural) by which outputs (such as economic gain) are produced and distributed should receive equal importance, if not more in achieving the goal of sustainable development. Sustainable development includes economic, environmental and social dimensions, by which local people's concerns, needs, interests, and priorities are considered in achieving sustainable livelihoods (Chambers, 1986; Barbier, 1987). Development remains unsustainable, if it fails to recognize the concerns of grassroots people, needs of 'real' participation, and the local potentials such as their indigenous knowledge and skills (Vivian, 1992). For instance, alternative energy technologies in many rural parts of Nepal have been accessible to only a few wealthy households in the absence of detailed analysis of socio-economic conditions of rural households. This has created a large socio-economic gap within communities.

Recently donors such as UNDP and the World Bank have started to emphasize a 'sustainable livelihoods' approach to alleviating poverty as a global phenomenon (UNDP, 2000, World Bank 1998a). The central focus is still on protecting the environment and eco-system, which is of course a means of human survival. However, participation, justice, and equities have been rather rhetoric, although they are the most prominent issues of sustainable development (Barbier, 1987; Chambers, 1986; Friedmann, 1992) Donors have their preconceptions towards neo-liberalism, which does not address the complex social process of development but the development led by the market economy (Brohman, 1995; Mehmet, 1995).

For instance, the REDP supported by UNDP is principally based on a holistic approach as a strategy to promote sustainable livelihoods of the rural population. Its basic principles are organizational development, capital formation, skill enhancement, environment management, technology promotion, and women's empowerment. Above all, technology promotion seems to be an active agenda as a means of providing efficient energy and protecting the rural environment. The other principles like promoting skill development and women's empowerment have been rather limited in application. Although local level planning and participatory approaches are the planning framework of the REDP, much still needs to be done in practice in order to achieve equity and real participation and empowerment of people, especially women. For instance, participation of women in alternative energy initiatives (including its planning, and energy based social and economic activities) was not truly encouraged as it needed to be. In addition, community mobilization activities initiated by the REDP could not follow the path of sustainability, since both men's and women's groups became inactive once the project staff discontinued their support activities. This is partly due to the lack of an intensive focus of REDP on social factors relating to participation and empowerment. Despite the admirable principles of REDP, the philosophy behind it was still influenced by the neo-liberal model of development. The basic purpose was to provide efficient energy to the rural households in order to improve the rural economy, although the above principles were used as a means for accomplishing this purpose.

Overall, economic and environmental dimensions were the primary forces in launching the AET initiatives in Nepal as indicated in the government development plans. Although the private sector and NGOs were actively involved in promotion of AETs, their focus was on energy efficiency and protection of environment through the provision of modern energy services. Qualitative aspects such as adoptability and affordability of such technologies were overlooked. Hence, despite the availability of AETs, traditional fuel like biomass is a major source of fuel for the majority of poor households meaning there are still negative implications for the environment from firewood used in traditional stoves. Development of rural infrastructure through micro-hydro electricity received the greatest focus, while household based technology like ICS for reducing domestic air pollution, which effects women's health were not emphasized enough. Similarly, work-sharing at the household level that provides opportunities for women to participate in activities outside the home, and saves women's labor in managing the household energy system were not taken into account.

Hence, socio-cultural issues including gender inequities, participation, and justice have not received the attention they deserve in promoting AETs. No matter, how feasible they are from an economic and environmental viewpoint, it is critical that AETs consider social issues if they wish to contribute to sustainable livelihoods.

Women's Participation and Empowerment

The ultimate aim of my thesis is to anticipate women's active participation in the planning and implementation of rural energy programs and increase the self-enhancement of women by fulfilling their practical and strategic gender needs. In terms of rural energy, women's practical needs are to meet their basic energy demands thus reducing their workloads and saving time in managing household energy requirements. This enables women to obtain opportunities for social and economic activities leading to fulfilling their strategic needs and enhancing their self-confidence and empowerment. For instance, a micro-hydro mill can fulfill the grain processing needs of women,- a practical need, and micro-hydro electricity can be used at night so there are opportunities to conduct adult literacy programs, handlooms, run poultry farms, and so forth, thus fulfilling strategic needs of women.

At present, AETs have been able to meet the practical gender needs of meeting basic household energy requirements only among the elite group of the community. On the other hand, the strategic needs of achieving the self-esteem and confidence of rural women can only be ensured by providing enough social and income opportunities for women to be involved in.

As mentioned in Chapter Four, participation is closely linked with empowerment. The empowerment approach, which is essential to an alternative development, places emphasis on independent decision-making (Friedmann, 1992). As discussed in Chapter Four, Friedmann (1992: 33) suggests three different aspects of empowerment: **social power**, as having access to 'certain bases, such as information, knowledge, skills, participation in such organizations, and financial resources', **political power**, as the access to decision making, in particular 'those decisions that affect a person's own future', and **psychological power**, 'as the individual's sense of potency and self-esteem', which may positively influence his/her access to social and political power.

Women in rural Kavre have barely achieved the first level of empowerment (social power) through the involvement of REDP. The two others remain far away. Although REDP has made an effort to involve both men and women in village level energy programs through their involvement in community organizations (COs) from the very beginning, women's participation in rural energy planning seems to be more lip service than real. Women are also equally represented in village energy committees (VECs), however, their voices have rarely been sought at decision-making levels. This demonstrates the need for changing the philosophy of the REDP from efficiency to equity. As Vivian (1992) suggested, the true participation involves more than a labor contribution and representation in meetings, rather active participation is to be sought at every stage of project planning and implementation. The REDP officials first look for the head of the household: that is the man, for disseminating any kind of information at the household level, while women just listen to the conversation in the background as Dutta (1997) also observed. Men in most cases decide whether or not to have any of the proposed technologies rather than seeking the approval of the female members of the household. The acceptance of technology by women is taken for granted (Skutsch, 1995).

Women are active participants in community mobilization schemes like savings and credit, and other community activities such as contributing labor for the construction of canals, and community buildings. This indicates women's potential to play more powerful roles in the planning and management of AETs as well as energy based small enterprises. However, there are few opportunities for women to start small productive enterprises that could lead to their empowerment. For instance, even with the availability of micro-hydro power at the village level, there is no viable scheme to reach poor women. Nor are there extension services to provide women necessary skills and knowledge they need, and there is a lack of market facilities for providing reasonable prices for their produce.

However, empowerment is a long-term process, which can only be achieved with a great effort of the development machineries to change their own and other people's attitude towards empowerment of women, and a great sense of understanding and awareness by the local people. One must consider the cultural background of diverse ethnic group in Nepalese society, many of which do not accept that women can be ahead of men. This naturally restricts women's path to participate in any development program including some social and economic activities. Especially in rural areas, acceptance of women's participation in activities outside the home represents a 'big compromise' with the family members, both men and women. Women are allowed to participate, only if they manage to complete all household chores by a certain time, and if their participation will lead to them earning some money that goes to the family. This is particularly true among the low-middle class families. Especially among *Brahmin/Chhetri*, women have low levels of participation in household decision-making processes regarding the selection of alternative energy technologies as well as participation in community level activities. Compared to *Brahmin* women, *Tamang* women have a greater potential for participation in AET initiatives due to their cultural background., Among *Tamang*, there was a good work ethos between men and women with the sharing of domestic chores thus allowing women to be involved in other activities. The variation between high caste and low caste groups affects the benefits that women receive through AET initiatives, which ultimately affects the empowerment of women. In such circumstances, the positive attitude of local men and women towards women's mobility and participation through the awareness program implemented by the REDP is highly encouraging. The present efforts of the REDP to integrate women in rural energy programs can lead to empowerment, although planning practices have to be improvised to provide sufficient space for women's voices. This issue will be elaborated upon in the second part of this chapter.

Rural Energy Policy and Planning: Issues and Recommendations

In this section, key policy issues and implications are highlighted, proposed institutional frameworks are outlined pinpointing the weaknesses in the existing planning framework, and general and specific recommendations are made.

Challenges in Rural Energy: Policy Implications

There exist numerous challenges in the rural energy sector in Nepal. On the one hand, there is pressure in meeting modern energy needs of a large section of the rural population, so as to reduce the use of traditional fuel as well as save women's labor and time. On the other, energy interventions are based on the subsidies available from donors rather than considering the socio-economic and cultural needs of local communities, especially women. This indicates that there is a big gap between rural energy intervention and the energy needs of the community. This situation exists due to a number of problems associated with rural energy plans and policies both at the micro and macro levels.

Rural energy interventions in Nepal are planned in a non-integrated fashion. There is no single institution at the national level solely responsible for preparing overall rural energy plans, a policy framework, or developing short-term strategic plans and monitoring and reviewing the plans and programs of different agencies. Different institutions involved in the rural energy sector do not coordinate properly while preparing their plans and programs and in implementing such plans, which has resulted in inequities in diffusion of AETs. There is no clear institutional framework that indicates linkages between central and local level organizations and their roles in planning and implementation. In addition, there is a lack of coordination between the rural energy institutions and other line agencies both at the central and local level, thus hindering an integrated development of communities. Institutional networking is needed to share and link the information and experiences among various organizations to effectively contribute to the successful implementation of rural energy programs.

The rural energy plans and programs of various agencies follow top down rather than the bottom up practices. Consequently, community level energy planning, which considers the energy needs and priorities of local men and women, is non-existent. There is rarely a chance to incorporate gender concerns in top down planning practices, hence, the rural energy plans and policies remain almost gender blind. Various agencies engaged in rural energy programs seem to acknowledge the gender implications of AETs, however they are less concerned about planning the programs from a gender perspective. Participation of women in rural energy plans and programs is not very encouraging except in a few cases. For instance, women participated actively in the community mobilization process of the REDP, however, their involvement in decision-making processes of rural energy activities seems to be very low.

A lack of sufficient research and development in the rural energy sector, both from the technical and socio-economic viewpoints, has hindered the development of practical plans and policies. In addition, there is no proper database system for rural energy. No institution is solely responsible for keeping up to date information. The Water and Energy Commission Secretariat (WECS) is partly involved in rural energy research and development however, it does not have sufficient information on rural energy. Gender disaggregated data is non-existent. This makes it difficult to develop rural energy plans and policies from a gender perspective.

Since there were no clear policy guidelines with a standard monitoring framework, implementation of rural energy programs was directed more towards meeting the targets than achieving the real goal of sustainable energy development. The monitoring part was very weak and communities became paralyzed due to the absence of enough support from concerned agencies at later stages.

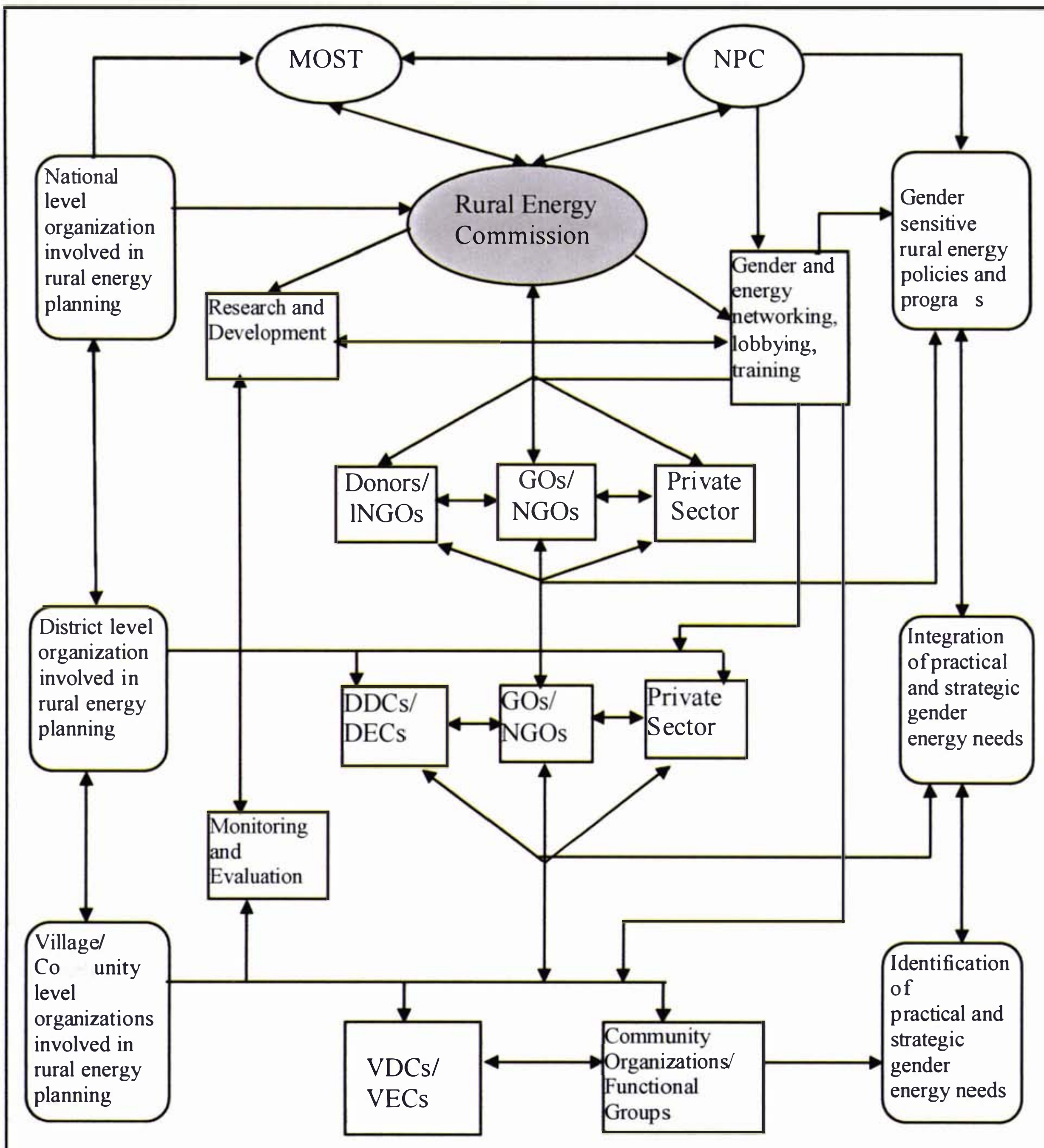
Given the planning circumstances, application of Participatory Rural Energy Planning Model (Table 4.1) developed in Chapter Four was difficult in practice. The Participatory Rural Energy Planning Model emphasized the need of participatory exercises at every stage of the project cycles in order to institutionalize gender in rural energy planning and implementation. At various stages of planning such as needs assessment, program selection, implementation design, and monitoring and evaluation, there was consultation with local leaders at district level. The planning teams at district level comprised of project staff, VDC and DDC leaders and other stakeholders, but women's groups were not represented in such teams. Although participatory approaches were used to some degree at the district level planning, village level planning did not exist for project design including programs selection, needs assessment, and monitoring and evaluation. The planning practices could actually take place at village level as well in order to identify the needs and priorities of local men and women rather than only representing the views of a few male leaders. Dedication of the district officials is essential for organizing such planning exercises.

Proposed Institutional Framework for Rural Energy Planning

As mentioned earlier, there is no proper institutional framework for rural energy planning in Nepal. Although recently the Alternative Energy Promotion Center (AEPC) has been responsible for the promotion of alternative energy technologies, it is more active in managing subsidies for AETs than reviewing and preparing plans and monitoring and evaluation of such plans. At the same time, there is no proper coordination between local and national level organizations. There is no focus on research and development or monitoring and evaluation at either the central or local level. No effort has been made at a central level to develop gender sensitive energy plans and policies and women's participation in rural energy plans and programs is rarely encouraged. Considering the drawbacks in the existing institutional framework, I have suggested an institutional framework (Figure 9.1) for rural energy planning that includes two stages: policy formulation and program implementation. The framework includes the institutions at different levels and their inter-linkages with each other in planning rural energy programs.

Proposed Institutional Framework for Rural Energy Planning

Figure 9.1 Policy Formulation



Key:
NPC = National Planning Commission, MOST = Ministry of Science and Technology,
GOs = Government Organizations, NGOs = Non Government Organizations,
INGOs = International Government Organizations, DDCs = District Development Committees,
DECs = District Energy Committees, VDCs = Village Development Committees,
VECs = Village Energy Committees

The institutions at all three levels (village, district, and national) are required to be involved in a bottom up planning exercise and two-way communication in order to integrate local energy problems and priorities in an overall rural energy planning framework. At the national level, I would replace AEPC by the Rural Energy Commission[1], which could take over AEPC's present role but with clear policy guidelines, which also combine some roles of Water and Energy Commission Secretariat (WECS) in rural energy research. The Rural Energy Commission should have sole responsibility to prepare the broader rural energy planning and policy framework and the strategic plans and policies, which could be integrated with the National Planning Commission (NPC)'s Framework. The Ministry of Science and Technology (MOST) should provide the necessary support and input for the Rural Energy Commission in preparing planning and policy documents. The Rural Energy Commission in turn, should report to MOST its overall rural energy planning and policy scenario for final approval. The NPC, as a national planning agency should be focused on overall economic planning and prepare a yearly planning document rather than concentrating on sectoral planning. At the same time, the NPC can also provide necessary inputs to the Rural Energy Commission to help in preparing effective rural energy plans and policies. Different institutions like government/non-government agencies, donors, and private sector working in the rural energy sector should prepare their programs and plans under the broader planning framework of the Rural Energy Commission as it should be taken as a central planning body for rural energy. In order to integrate gender as a key variable in rural energy planning, it is essential to develop networking lobbying, and training to develop the skills of personnel in gender-focused planning at national level as well as the local level. This could help the national level machineries to develop gender sensitive energy plans and policies and motivate local institutions to develop and implement energy plans and programs from a gender perspective.

[1] Rural Energy Commission is a new institution proposed for taking sole responsibility for rural energy planning in Nepal

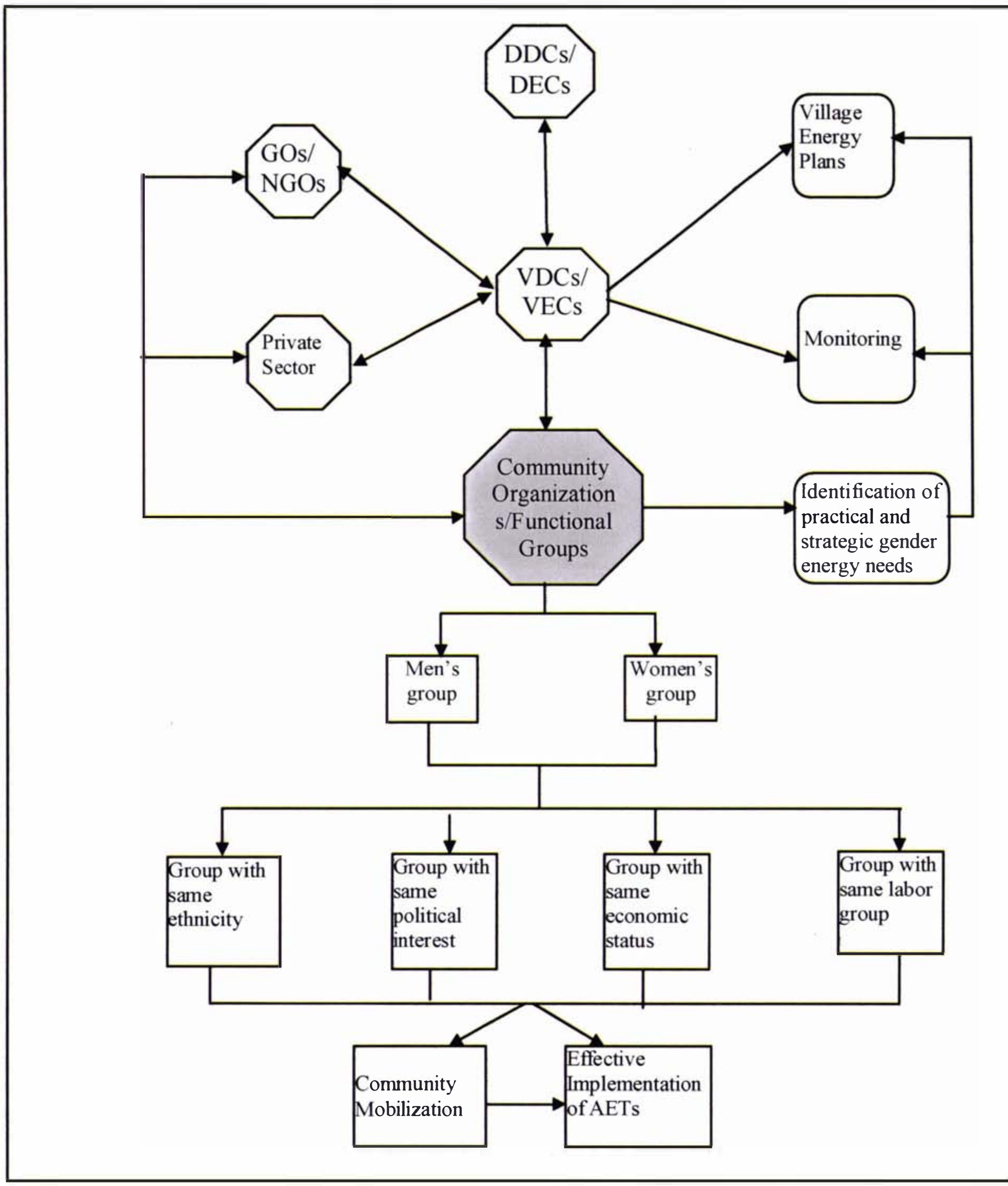
At the district level, various government and non-government agencies, and private institutions established for rural energy interventions could prepare plans together with existing District Development Committees (DDCs) and District Energy Committees (DECs)[2]. The district energy plans should integrate the practical and strategic energy needs of men and women, as identified by village level community organizations, so that the gender dimension is not forgotten in implementation of the plans.

In this framework, a bottom up planning approach is introduced, as village level planning heads the district level planning and district level planning heads the national level planning, which is not practiced at present. This helps to formulate a practical policy and planning guidelines to the national level institutions. There is a need for networking, lobbying and training on gender and energy issues at each level that helps to identify, and integrate the practical and strategic gender energy needs and develop gender sensitive rural energy policies and programs. The national institutions should provide an adequate focus on research and development of AETs, so as to assist the planners and policy makers to develop the best possible strategies for a sustainable rural energy system. A monitoring and evaluation framework should be developed as a regular task of national and local level institutions to identify positive and negative aspects of program activities and help improve implementation. Networking on gender and energy enables the institutions to share the information on gender and energy and identify research needs, and it motivates them to carry out extensive research from a gender perspective and perform regular monitoring and evaluation.

The institutional framework for program implementation has been designed separately (Figure 9.2). At implementation level, the DDCs/DECs, and other relevant institutions such as government, non-government agencies and the private sector, support the Village Development Committees (VDCs) and Village Energy Committees (VECs) with village level planning and implementation of the program activities. The VDCs together with energy-sector institutions prepare the village energy plans and VECs[3]

[2] DEC comprises representatives from different line agencies at the district level.
[3] VEC comprises representatives from each community organizations (COs).

Figure 9.2: Program Implementation



Key: GOs = Government Organizations, NGOs = NonGovernmentOrganizations, DDCs= District Development Committees, DECs = District EnergyCommittees, VDCs = Village Development Committees, VECs = Village Energy Committees, review and make recommendations. The VDCs and VECs should be responsible for preparing village plans and monitoring the effectiveness of their implementation. The village energy plans should include gender dimensions such as participation of men and women in rural energy programs and the benefit they receive from such programs. Similarly, monitoring strategies should be based on gender indicators as indicated by village energy plans. Inclusion of gender indicators in village energy plans should be based on the practical and strategic needs of men and women identified by themselves. The different men's and women's groups at community level represent different ethnicities, different political groups, different economic groups, and different labor groups[4]. These groups basically, are local informal institutions. Such groups can be effectively utilized in community mobilization activities, planning, and implementation of rural energy programs.

The institutional frameworks for rural energy planning both at policy and program level suggested above provide a clear role for institutions and make linkages between stakeholders thus making gender sensitive rural energy plans and policies: a realistic outcome.

Recommendations

Based on the present drawbacks in rural energy planning and policies, many of which were highlighted in Chapter Six, and the implications of which were demonstrated in the findings in Chapter Seven and Eight, the following general and specific recommendations have been made. A neo-liberal environment, however, is not an environment conducive to the adoption of these policy recommendations. Nevertheless, it is hoped that these will provide the positive input for planners and policy makers of Nepal in preparing forthcoming rural energy plans and policies.

[4] Labor group involves the individual's labor from different households sharing the major farming activities.

General policy recommendations

The general policy recommendations are related to overall rural energy planning, focusing on strengthening the planning and implementation strategies in order to support a sustainable rural energy system.

Implementation of community based energy planning

Community based energy planning is a real need of the rural energy sector in Nepal in order to utilize and build upon local knowledge and skills, especially of women. Such planning exercises should take place within a participatory framework that helps to design projects according to the needs and priorities of the local community leading to demand oriented interventions of AETs. Local men and women should be involved in assessing their energy needs and resources, assessing the technologies in terms of prices and costs, and preparing the final action plan and implementation of the program (Rijal, 1998c). This ensures maximum affordability and adoptability of such technologies by the local people. Gender is an important element of community based energy planning, since such planning exercises must consider separate energy needs and the benefits of men and women from new AETs. The community mobilization strategy adopted by the REDP is a good example of a community based energy planning process.

It is also necessary to include local stakeholders in providing integrated energy services for the development of sustainable rural energy system. For this purpose, national machineries from the government such as NPC and AEPC should strengthen the capacity of local organizations (both government and civil society) at the district and village level through training, advocacy and increased networking of local level organizations. Strengthening the capacity of these organizations will help to increase the quality of extension services, increase the use of alternative energy technologies, and increase opportunities for social and economic activities.

A framework for community based energy planning is presented in Table 9.1. The Community Based Rural Energy Planning Framework has been designed highlighting the planning activities, influencing factors (the most important factors to be considered in different stages of planning) the planning teams and appropriate planning tools. Under each planning task, the planning team and planning tools have been set in such a way that the planning process takes place in a very participatory way. For instance, different stakeholders including men's and women's groups should identify local people's needs for rural energy through various PRA techniques like social mapping, focus group discussions and so on. Practical and strategic gender needs and men's and women's access and control over resources and benefits are important factors to be considered in assessing the needs. Not only men's groups but also women's groups should be included in the planning teams, in order to ensure that gender concerns will be carefully addressed. The role of project staff should be more as facilitators who will act as working partners in the planning team rather than as the instructors or leaders. The VDCs should take a major responsibility in rural energy planning by initiating and encouraging the active participation of local men's and women's group and by supporting their activities. Both men's and women's groups should actively participate in developing implementation plans as well as monitoring these plans. In this process, proper consideration of the roles and responsibilities of men and women, management of financial resources through external and internal sources, management of technical know how (knowledge and skill), should be ensured. Appropriate training will be provided to men's and women's group for developing their capacities to become involve in implementation and monitoring activities.

Such plans prepared at the village level can be approved at the district level and can be further integrated with national level plans in order to receive the necessary support and coordination from different institutions and organizations.

Table 9.1: Community Based Rural Energy Planning Framework

Planning Activities	Influencing Factors	Planning Team	Planning Tools
Needs Assessment			
Identification of needs and priorities of different stakeholders and assessment	Practical and strategic gender needs Access and control over resources	Women group, Men group Project staff, VDC members, other stakeholders	Social Mapping FGD with women's /men's group, local leaders/ stakeholders
Identification and assessment of rural energy problems/potential	Urgent problems/issues Drudgery of women	Project staff, VDC members, men and women group, other stakeholders as above	Resource mapping FGD with men's and women's group, SWOT analysis
Program Selection			
Identification/selection of feasible alternative energy program	Consistent with identified problems Possible changes in role of women Supporting participation and empowerment of women	Women's/men's groups, project staff, VDC leaders	Priority Ranking, FGD with women's group
Technology demonstration among sample households	Likes and dislikes of men and women, acceptance/rejection by men and women	Women/men group, project staff, VDC leaders	Discussions with women as basic users Physical demonstration Usage by women
Implementation Design (Action Plan)			
Assigning roles and responsibilities Management of skills and resources Fixing the scale of intervention and beneficiaries	Indigenous knowledge and skill of women Local capacity building Internal and external sources of funding Impact of intervention on women Participation of men and women	Project staff, extension workers, local government Women's/men's group	Village workshop Orientation workshop Capacity building/ training FGD with men's and women's group
Monitoring and Evaluation			
Assessing the merits and demerits Assessing the changes and utility Assessing the impacts on women	Indicators for measuring the effect of intervention on women Explicit measurement of project effect on women Positive and negative changes	Local men's and women's groups, Local government, Project staff,	Case Studies FGD with end users (women) Workshop Seminars Evaluation workshop Evaluation studies

Development of clear policy documents and training manuals

A clear policy document on rural energy should be developed at the national level, which will provide a basis for transparency in program implementation. The policy document should have clear planning and implementation guidelines, and a monitoring framework, so that it can be instrumental in designing local plans and programs and setting targets. A national level institution like the Rural Energy Commission should be more focused on developing guidelines and training manuals on AETs, (such as manuals on micro-hydro plants, and biogas plants) that would be helpful for government and non-government organizations, and private enterprises to provide training to user groups and when implementing rural energy activities.

Promotion of research and development and monitoring and evaluation

There should be adequate space for research and development in order to collect quantitative and qualitative information on different aspects of AETs. Such research should be a part of a continuous process of program development that provides feedback and necessary inputs for improvement in future-plans and programs (Amatya and Shrestha, 1998a; Rijal, 1999b). The private sector could be involved in technical research of AETs such as functioning of turbines and biogas plants, while soft research focusing on socio-economic aspects on AETs could be carried out by university staff and postgraduate students. There should be provision for publishing university research, which could be accessible to related government departments. For this purpose, adequate funding should be allocated.

The value of regular monitoring and evaluation of rural energy programs can not be leave in order to strengthen the process of management and implementation of the program activities.

Increase coordination and cooperation among energy sector institutions and between sectoral agencies

Coordination and cooperation between different energy sector institutions should be improved in order to deliver quality energy services to the local people and to avoid duplication in program implementation. For instance, different donors working on rural energy could concentrate their support activities in different regions so as to bring equity in the geographical spread of AETs. Similarly, implementing agencies such as the REDP/BSP should coordinate with private companies for technical support such as installation and repair and maintenance of alternative energy technologies. At the same time, the energy sector institutions should increase their coordination with different sectoral agencies in order to get their support for increasing end use activities and extension services for overall development of the community. At this stage, it is very essential to strengthen the capacity of local governance through coordination among different institutions established at local and national level.

Integration of rural energy with other development activities

Rural energy programs should be integrated with other development activities so as to ensure better quality of life for rural people as well as the sustainability of rural energy systems (Bhadra, 1998). For such as handicrafts, small bakeries, and adult literacy programs. These activities however need instance, rural electrification has the potential to allow establishment of small cottage industries support from different levels, such as moral support from family members, access to credit, markets, knowledge and skills. As such, a package of services is required for integration of rural energy with other development activities. Such integration could help the local people especially women to be exposed to different social and economic activities for their self-enhancement.

For instance, women's limited access to credit has hindered their access to technology and their involvement in other economic activities. Small credit schemes, which can reach women to finance household energy technologies and small scale economic activities, should be promoted at the village level. Micro credit for example, could enable women to own energy technology and be involved in some income generating activities for the upliftment of their economic status.

Promotion of community forestry program with firewood rather than timber approach

As has been pointed out in earlier chapters, biogas stoves do not replace women's desire to use firewood in traditional stoves, at least on some occasions, and thus firewood will remain a major household energy source for the foreseeable future. ICS is possibly the best option for reducing the use of firewood and from the viewpoint of cost as well as benefiting the health of women and children. When using ICS, good firewood is needed unlike with the traditional stoves where one can use any kind of biomass for cooking. Considering the potential demand for quality firewood in the long run, proper emphasis should be placed on developing community forestry with a firewood approach rather than growing timber for sawmills and building houses. This would help women to access adequate quality firewood in community forests thus relying less on other kinds of biomass like agricultural residue and low quality firewood for fulfilling their household energy needs.

Social Development Program

It was observed that socio-cultural and economic conditions of a community have a large role in the uptake of technologies in district and village levels in terms of bringing about changes in people's attitudes towards the participation and empowerment of women. It is essential to address these socio-cultural and economic issues such as those based on caste, ethnicity, and income that lead to inequalities in benefits from the development inputs from the different sectors including energy related interventions. At present REDP has initiated some awareness programs at community level as an entry point to rural electrification however, it is short-sited and it is not addressing the specific socio-cultural issues.

Thus, there must be regular mainstreaming activities at district and village level as a process to bring changes in people's attitude and culture that has resulted in the social inequalities manifest at present. Awareness campaigning should be more focused on higher caste group (both men and women) as greater inequalities exist among this group. The examples and illustrations must be demonstrated from the lower caste groups in terms of the benefits they derive from work sharing and the support from family members for participation in any development activities. For this process, the awareness program should be effectively designed as a regular mainstreaming process. Such awareness programs should be integrated with any development programs including rural energy interventions. Thus national policies should have enough focus on social development issues with clear implementation strategies and indicators (such as levels of women's participation in development activities among *Brahmin/Chhetri and Tamang, or* other low caste group, number of women's participating in productive enterprises and social activities among different ethnic groups). The policies on social development should be based on adequate groundwork and research in order to come up with appropriate strategies for addressing the challenges raised due to the existing deep-rooted social values in a Nepalese society. Social development policies should be mandatory for the government and non-government agencies to plan and implement the awareness development activities with a clear focus on caste and ethnic issues and their implications for gender roles, participation, and empowerment especially of women.

In addition to regular awareness activities, the pro-poor programs should be effectively designed for increasing access to AETs for the low-income households who have been out of reach of AETs due to their low socio-economic condition. Such programs should include three basic elements:

a) **Small credit scheme to the vulnerable group**: There should be provision of small credit facilities (without a need of any collateral) targeting the poorest women who can't access to institutional credit due to the collateral requirements. For instance, micro credit to the poorest women's groups could help to increase their access to

AETs, as many women headed households and low caste women have difficulties in accessing institutional credit.

b) **Targeted extension services**: Extension services should be targeted to the poorest womens groups, who have very little knowledge about use, maintenance and implications of AETs. For instance, extension officers at present rarely visit the low caste households and women are very unsure about use the of AETs. The extension services thus should thus be adequately provided to the low caste women in order to build up their confidence for using AETs.

c) **Training for income generating activities to poorest women group**: At present, women from low caste groups are rarely trained in income generation activities, in which they have a potential to be involved in. There is some training provided to a few women, who are from the higher caste groups, and they rarely continue the enterprising activities due to a number of problems such as lack of support from family members. However, low caste women are more likely to participate in such activities, if the opportunities exist, as they have good support from family members.

Gender specific recommendations

Specific recommendations are related to the gender specific strategies needed to plan and implement gender sensitive rural energy plans and policies.

Design of gendered plans and programs (log-frame approach)

Rural energy plans and programs should be gender sensitive, making it mandatory to include gender indicators in a systematic log-frame approach. The log-frame is essentially a planning matrix, which summarizes the linkages between the goals, purpose, outcomes, and activities of a proposed intervention (Pasteur, 2001:1). The log frame can be used to improve project implementation, planning, monitoring and evaluation (Finlayson, 1999). Many international and bilateral agencies such as Canadian International Development Agency and German Technical Cooperation use a log-frame approach for development planning and project management in the Third World. Such plans and programs should encourage participatory planning, which includes both men and women at every stage of rural energy planning, and implementation. This helps to identify the practical and strategic needs and priorities, potential of local men and women in regard to rural energy, which in turn assists the successful implementation of rural energy plans and programs and the development of a sustainable rural energy system.

Table 9.2 demonstrates how a gender-sensitive log frame could work to assist rural energy planning. At first, long-term goals, and impacts to be seen in the long term plus the relevant indicators to monitor the results have been developed. Similarly, medium term objectives have been developed focusing on the outcomes to be achieved in medium term of the project and accordingly the indicators have been set. The indicators should be developed in such a way that gender issues such as women's workload and health issues are properly addressed. For instance, one of the purposes of alternative energy projects is to reduce the women's drudgery and the outcome is to ensure that women's drudgery has been reduced which can be verified through related indicators such as time available for women to be involved in socio-economic activities, number of women suffering from heart disease, asthma and eye problems. In the short term, implementation activities such as managing human, financial, technical, and other resources have been listed and the immediate outputs in relation to resources and relevant indicators have been developed.

This framework can be used as an appropriate planning mechanism to ensure the transparency of rural energy planning at the project level.

Table 9.2: Gender Sensitive Rural Energy Planning Framework

Narrative Summary	Expected Results	Performance Measurement
Project Goal To ensure the sustainability of alternative energy technologies in the rural area	**Impact** Increased living standard of rural people particularly women Decreased degradation of the environment Ensured empowerment of women	**Indicators** Attitude of men and women regarding energy technology and women's empowerment (positive, negative) Income level, health and education status (men and women) Women's capacity to make decisions on household and community activities
Project Purposes To increase efficient energy supply in rural areas To increase self esteem and confidence of women To reduce the drudgery of women and improve health condition of women and children To reduce the use of biomass resources To increase income and social opportunities of rural people particularly women	**Outcomes** Increased efficient energy supply in rural areas, Increased production and income of women Reduced drudgery of women and improved health condition of women and children Reduced the use of firewood, dung and agricultural residue Increased small scale activities in rural area Increased social activities	**Indicators** Availability and accessibility of alternative energy in the rural area Women's time for social and economic activities Number of women and children having asthma, eye and heart diseases Use of biomass resources (in/decrease) Number of small scale activities Women's access to production income and social opportunities
Input (Resources) Human resources (project staff, participation of local men and women) Financial resources (loan and subsidy, local savings) Technical resources (Technology inputs, repair and maintenance) Local contribution (labor and materials)	**Output** Increased participation of local men and women in technology design, management and implementation of rural energy technologies Properly managed loan and subsidy for AETs Mobilized local savings in acquiring technology Increased availability of technology inputs, increased repair and maintenance services Increased use of local knowledge, labor and materials	**Indicators** Level of participation of men and women in each stage of planning Availability and accessibility of loan and subsidy Amount of local savings mobilized Availability and accessibility of technology inputs, Availability of repair and maintenance services Amount of local labor and materials used

Gender-sensitized planners, policy makers, and those implementing rural energy programs

Rural energy planners and policy makers at national and local levels should be made aware about the importance of gender in rural energy planning in order to develop their support for gender sensitive rural energy plans and policies. There are hardly any women planners at the national or district level. Male as well as female planners should be trained to develop their understanding of the importance of gender integration in rural energy plans and policies. In addition to the professionals, general staff should be trained in application of gender tools so that they can use the tools in program design, implementation, and monitoring and collect gender disaggregated information. Gender training should be provided to the representatives of local government (DDC and VDCs), and civil society (NGOs/CBOs and the private sector) in order to integrate gender mainstreaming activities as regular tasks of the institutions.

It would be helpful if there were more women planners at national and district levels so as to help promote gender equity in formulating rural energy plans and policies. For this purpose, women's capacities should be strengthened through training and mainstreaming activities. Involvement of women in developing rural energy plans and policies can have many positive implications. For instance, women are likely to be more concerned about the women's problems in managing household energy and thus more open to integrating gender issues in rural energy plans and policies.

Collection of gender disaggregated data

For developing gender sensitive rural energy planning, it is essential to collect gender-disaggregated data in the rural energy sector. Since women's work in managing household energy is not visible in energy statistics in Nepal as elsewhere in developing countries, it is essential to determine energy demands and uses of energy according to gender. This could help to give recognition to women's roles in household energy management since such gender-disaggregated data distinguishes energy users, and addresses the different energy demands and needs accordingly. This in turn enables the integration of gender in project design and implementation as well as applying the appropriate gender tools at policy level (Cecelski, 2002: 21).

Rural women's participation in rural energy plans and programs

Technically, women are segregated from rural energy plans and policies in Nepal. The REDP has integrated women's participation for implementation of the programs. However, women are rarely involved in the decision-making process of AETs. In order to address women's energy needs and priorities, their active participation in rural energy plans and programs is essential. For this purpose, awareness programs should be effectively designed to include both men and women to be aware of gender and rural energy issues so that women get support from their male counterparts to participate in rural energy programs. Awareness programs should go hand in hand with the introduction of any AETs. Both men and women should be educated in use and implications of AETs so that men also can understand the role of women in using and managing such technologies and encourage their participation in rural energy planning.

Increase networking on gender and energy

As initiated by ENERGIA (International Network on Gender and Sustainable Energy) at the international level, there is a great need for networking among the energy sector institutions in Nepal to make people aware of gender and energy issues, increase support for training, research and development and conducting of case studies in this area. Such networking is necessary both at national and local levels so as to strengthen the capacities of rural energy institutions on developing gender sensitive energy plans and policies. Networking on gender and energy should be a regular task of institutions at national and local levels in order to integrate gender into rural energy planning and policies. The national network on Gender Energy and Water (GEW) that has just been established in Nepal should be dedicated to strengthening its networking capacities at national as well as local levels (GEW, 2003).

Directions of Further Research

This study has examined the socio-economic implications of rural energy technologies, from a gender perspective and pinpoints measures required to integrate gender into rural energy planning and policies. I have focused on gender issues in rural energy as much as possible, centering women's problems, potentials, women's concerns, and finally the empowerment of women, since women are the direct users and potential beneficiaries of rural energy. While I examined the implications of AETs both from men's and women's perspectives, my main purpose was to find if there was a saving in women's labor and time, which would allow them to increase their participation in rural energy plans and programs, and other socio-economic activities for their self-enhancement and empowerment. At the macro level, I also examined policy issues required to integrate gender into rural energy planning. I found problems in understanding gender and energy issues were serious at the macro level. The planners and policymakers (almost all men) were not concerned about gender in rural energy planning. Most were not aware of the importance of gender sensitive plans and policies, and in many cases, they ignored it. They considered gender as a 'fashion' and an issue to be talked about and not to be implemented. At the grassroots level, problems with acceptance of gender sensitive energy programs are more related to cultural perceptions, which can be changed slowly with developing awareness of the local people. For this purpose, there should be clear gender mainstreaming policies with practical implementation strategies. If planners and policy makers see the problems of rural energy from a gender perspective, then it would be easier to solve the problems at the micro level.

This leads to a number of questions, which could be explored in future research. For example, how do we gain the confidence of planners to place gender as a central theme in rural energy interventions? How could planners and policy makers link gender and rural energy concerns into a broader framework that solves not only energy problems, but also poverty problems? And finally, how can gender based energy policies address the productive needs and capacity of both men and women?

Concluding Remarks

Gender issues are integral to the rural energy sector since women play significant roles in managing energy resources and technologies. In turn, their participation in rural energy programs is very important in the development of a sustainable rural energy system. Rural energy problems are a particular concern of women in terms of their workloads and health problems. At the same time, women have the potential to contribute to the development of rural energy in terms of their indigenous knowledge and skills regarding efficient use of energy and effective means of social mobilization.

Interventions in rural energy are in great demand not only for saving the use of traditional fuel, but also for saving women's energy that could be used for other productive activities. However, alternative energy initiatives undertaken by various government and non-government agencies in Nepal were in line with neo-liberal development policy demarcated in the Ninth Plan (1997-2002). This Plan emphasized the development of alternative energy in the overall context of development (NPC, 1998). The priority was then in fulfilling modern energy requirements of rural households, without paying attention to socio-cultural issues including gender roles and priorities. This provided very little opportunity to integrate gender concerns into rural energy planning and policies and to incorporate women's voices in AET initiatives. Even if there exist good policy strategies for gender sensitive planning and policies, it will be difficult to implement them in practice if the overall philosophy behind rural energy planning is influenced by neo-liberalism.

Since women are primary users and managers of energy resources, the adoption of alternative technologies largely depends on the interests, and the needs of women, even though men are the main decision makers at the household and community level. Hence, while planning any interventions on rural energy, women's needs and priorities should also be taken into account. Women's participation in rural energy programs should be emphasized both at local and national levels in terms of their active involvement in the decision-making processes of rural energy planning. Gender should be institutionalized in rural energy institutions, so that each plan and program has a "gender lens," and application of gender analysis tools should become a regular task of these institutions. This would help to ensure integration of practical and strategic gender energy needs enabling women to reduce their drudgery and to increase their self-confidence, leading towards their empowerment. Unless women's energy is counted for and accredited, alternative energy initiatives are likely to remain unsuccessful as the 'human element', a critical factor of sustainable development has been neglected. Ideally, women's active participation in alternative energy initiatives including planning and energy based socio-economic activities, should both help women to become empowered and to sustain the overall rural energy system.

Appendix I: Information Sheet and Consent Form

INFORMATION SHEET
(Representatives from Different Institutions)

1. The researcher Ishara Mahat is a Doctorate student of the Institute of Development Studies, Massey University, New Zealand.

2. This research study is conducted in order to fulfil one of the requirements for Doctor of Philosophy in Development Studies.

3. The researcher is under the supervision of Dr. Barbara Nowak and Dr. Regina Scheyvens, who are affiliated with the Institute of Development Studies and the Geography Program respectively.

4. The researcher and her supervisors can be contacted at: The Institute of Development Studies, School of People Environment and Planning, Massey University, Private Bag 11-222 Palmerston North. The Telephone and Fax No. and e-mails are listed below;

   Ishara Mahat (researcher):
   Tel: 977-1-527043(Kathmandu),
   64-06 350 5799 Ext. 2514 Fax: 64-06 350 5644 (Massey University)
   Email: ishara_m@hotmail.com

   Dr. Barbara Nowak (supervisor)
   Email: B.S.Nowak@massey.ac.nz
   Tel: 64-06-350 5799 Ext. 2509
   Fax: 64-06-350 5644

   Dr. Regina Scheyvens (supervisor)
   Email: R.A.Scheyvens@massey.ac.nz.
   Tel: 64-06-350 5799 Ext. 2502
   Fax: 64-06-350-5644

5. The main goal of this research study will be;

- to understand the socio-economic implications of rural energy technologies from a gender perspective,

- to identify the measures to integrate gender into energy planning and policies so as to ensure the successful operation of rural energy technologies in the rural hills of Nepal.

6. Participants will be encouraged to participate according to their accessibility, their preference of time and needs. The time involved in such discussion should be between 45 minutes and an hour.

7. Participants will be asked to share their experiences of rural energy projects, their perceptions on present issues of gender and energy, problems and potentials, policy perspective (to the national level authorities), focus of the institution and present strategy to address women issues in rural energy, and their suggestions for effective implementation of rural energy projects.

8. The name of such participants will be obtained through contacting to the institution itself, sometimes through the other participants and sometimes from the information of friends.

9. Participants have the right to read information sheet and have the details of the study explained to them.

10. Participants have the right to ask questions for any clarification at any time.

11. Participants have all the rights to answer or not to answer any particular question.

12. Participants have the rights to withdraw from the study at any time.

13. The researcher will respect the rules and regulations of the institution concerned, so that the representatives of such organisations feel comfortable to participate in interviews and discussions.

14. The researcher will be prepared to adopt alternative ways for best communicating with participants, even if there exists some barriers in open discussion on some important and sensitive issues.

15. The summary of research results will be made available to different agencies concerned in order to have effective implementation of such results. The agencies will be requested to keep the information confidential.

16. Finally, this research is carried out in such a way that ensures the rights of participants, the researcher and the University. All the parties will be protected under the principles of informed consent, truthfulness, and confidentiality.

The Researcher------------------------

INFORMATION SHEET
(Focus Group Participants)

1. The researcher Ishara Mahat is a Doctorate student of the Institute of Development Studies, Massey University, New Zealand.

2. This research study is conducted in order to fulfil one of the requirements for Doctor of Philosophy in Development Studies.

3. The researcher is under the supervision of Dr. Barbara Nowak and Dr. Regina Scheyvens, who are affiliated with the Institute of Development Studies and the Geography Program respectively.

4. The researcher and her supervisors can be contacted at: The Institute of Development Studies, School of People Environment and Planning Massey University, Private Bag 11-222 Palmerston North. The telephone and fax numbers and e-mails are listed below;

   Ishara Mahat (researcher)
   Tel: 977-1-527043 (Kathmandu),
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   Dr. Barbara Nowak (supervisor)
   Email: B.S.Nowak@massey.ac.nz
   Tel: 64-06-350 5799 Ext. 2509 Fax: 64-06-350 5644

   Dr. Regina Scheyvens (supervisor)
   Email: R.A.Scheyvens@massey.ac.nz.
   Tel: 64-06-350 5799 Ext. 2502, Fax: 64-06-350-5644

5. The main goal of this research study will be;

- to understand the socio-economic implications of rural energy technologies from a gender perspective,

- to identify the measures in order to integrate gender into energy planning and policies so as to ensure the successful operation of energy technologies in the rural hills of Nepal.

6. Participants will be encouraged to participate according to their accessibility, their preference of time and needs. The time involved in such discussion is two hours.

7. Participants will be asked about their access to various kind of rural energy technologies, and control over the technologies, access and control over energy resources, problems and potentials of alternative technologies, advantages and disadvantages of traditional technologies, gender participation in planning and designing such technologies, their present level of participation, and needs and priorities, their preferences over alternative to traditional technology and vice versa, and their suggestions and comments to successfully implement the rural energy technologies.

8. The researcher will read the information sheet for the participants and will explain the details to them.

9. Participants have the right to ask questions for any clarification at any time.

10. Participants have all the rights to answer or not to answer any particular questions

11. Participants have the rights to withdraw from the study at any time

12. The researcher will respect the rights of participants by keeping the group information confidential and anonymous. The issues raised in a group will not be made available to the other group. Any hard discussions taken place within the group will not be exposed for any reason, which might affect to the group members.

13. The researcher will be prepared to adopt alternative ways for best communicating with participants, even if there exists some barriers in open discussion on some important and sensitive issues.

14. The research result will be made available to different agencies concerned in order to have effective implication of such results. The agencies will be requested to keep the information confidential.

15. Finally, this research is carried out in such a way that ensures the rights of participants, the researcher and the University. All the parties will be protected under the principles of informed consent, truthfulness, and confidentiality.

The Researcher------------------------

INFORMATION SHEET
(Survey Participants)

1. The researcher Ishara Mahat is a Doctorate student of the Institute of Development Studies, Massey University, New Zealand.

2. This research study is conducted in order to fulfil one of the requirements for Doctor of Philosophy in Development Studies.

3. The researcher is under the supervision of Dr. Barbara Nowak and Dr. Regina Scheyvens, who are affiliated with the Institute of Development Studies, and the Geography Program respectively.

4. The researcher and her supervisors can be contacted at: The Institute of Development Studies, School of People Environment and Planning, Massey University, Private Bag 11-222 Palmerston North. Their telephone and fax numbers and e-mails are listed below;

Ishara Mahat (researcher):
Tel: 977-1-527043(Kathmandu),
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Dr. Barbara Nowak (supervisor)
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Tel: 64-06-350 5799 Ext. 2509 Fax: 64-06-350 5644

Dr. Regina Scheyvens (supervisor)
Email: R.A.Scheyvens@massey.ac.nz.
Tel: 64-06-350 5799 Ext. 2502 Fax: 64-06-350-5644

5. The main goal of this research study will be;

- to understand the socio-economic implications of rural energy technologies from a gender perspective,
- to identify the measures to integrate gender into energy planning and policies so as to ensure the successful operation of energy technologies in the rural hills of Nepal.

6. Participants will be encouraged to participate according to their accessibility, their preference of time and needs. The time involved in such discussion varies from 45 minutes to an hour.

7. Participants will be asked to share their experiences with various kind of rural energy technologies, their perception about these technology, gender and energy issues, problems and potentials, advantages/disadvantages, their present level of participation, and needs and priorities.

8. The researcher will explain the details mentioned in an information sheet to the participants.

9. Participants have the rights to ask questions for any clarification at any time.

10. Participants have all the rights to answer or not to answer any particular question

11. Participants have the rights to withdraw from the study at any time.

12. The researcher will respect the rights of participants by keeping their personal information confidential and anonymous. The information will be used only for the purpose of writing thesis and for its publication.

13. The researcher will be prepared to adopt alternative ways for best communicating with participants, on some important and sensitive issues.

14. The research result will be made available to different agencies concerned in order to have effective implication of such results.

15. Finally, this research is carried out in such a way that ensures the rights of participants, the researcher and the University. All the parties will be protected under the principles of informed consent, truthfulness, and confidentiality.

The Researcher-------------------------

Consent Form

(Representatives from Different Institutions)

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand that I have the right to withdraw from the study at any time and to decline to answer any particular questions.

I understand that I have the right to access the information I provide in this research.

I agree to provide information to the researcher on the understanding that the information is necessary for the research. The information will be used only for this research and publications arising from this research project.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signed:-------------------------

Name:-------------------------

Date:-------------------------

Consent Form

(Focus Group Participants)

The Information Sheet has been read to me and have the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand that I have the right to withdraw from the study at any time and to decline to answer any particular questions.

I agree to provide information to the researcher on the understanding that none of the issues raised in the group will be exposed outside our group. The information will be used only for this research and publications arising from this research project.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signed------------------------

Name:------------------------

Date-------------------------

Confidentiality Form

(Focus Group Participants)

This form is to be signed in conjunction with the consent form and in the presence of the researcher.

I agree that I will not disclose the names of other members of the group to any outside party without their permission.

I agree that I will not discuss or disseminate any information/issues raised by any other group members to any outside party.

Signed:

Name:

Date;

Appendix II: Standardized Questionnaire

A: Detail Household Survey Questionnaire for Project Area

ID:

VDC 1= Katunjebeshi 2 = Mangaltar

Ward No.: HHs sample no.: Date:

Ethnicity: 1= Braman/Chettri, 2= Newar, 3= Gurung/Magar, 4= Tamang/Rai, 5= Others

Respondent's Ideographic Data:

Respondents characteristics	**Male**	**Female**
Age		
Education		
Marital Status		
Occupation		

Age: 1 = 18-30, 2 = 31- 40, 3 = 41-50, 4 = >51
Education: 1 = illiterate, 2= just literate, 3= primary, 4= secondary, 5= higher education,
Marital status: 1= married, 2= unmarried, 3= widow, 4= divorced
Occupation: 1= farming, 2= wage labour, 3= paid employment other than wage labour, 4= trade, 5= household work only, 6=farming and house work, 7= others,

A. Demographic Information:

A.1 Household size, Composition and Age Structure

Age Group	Male	Female
Below 5 = 1		
5-14 = 2		
15-45 = 3		
46-59 = 4		
60 and above = 5		
Total		

A.2 Educational Status of Household Members above 5 years

Educational Status	Male	Female
Just literate =1		
Primary School = 2		
Secondary School = 3		
Higher Education = 4		
Illiterate = 5		

A.3 Occupation of Household Member above 10 years old

Occupation	Male	female
farming (1)		
wage labour, (2)		
paid employment other than wage labour (3)		
trade (4)		
Household work only (5)		
farming and household work (6)		
Others------Specify (7)		

B. Land Holding Size and Tenure Status

B.1 How much land of following type do you hold? (land owned by the household)
(Please report the area in Ropani)

Land Uses	Area (in ropani)
Owner operated 1)	
Rented in (2)	
Rented out (3)	
Total land on the name of women (4)	
Others (5)	
Total	

B.2 Do you have some land, which is used or could be used for planting fodder trees?
Yes (1) No (2) [ ]

B3. If yes, how much land is available for such fodder trees? ( )

B4. Who decides about fodder plantation? Man (1) Woman (2) both (3) [ ]

B5. Do such fodder trees replace the forest wood resources? Yes (1) No (2)

C. Farm Activities

C.1 Please list out the different crops you grow in your fields?

1. paddy
2. maize
3. millet
4. wheat
5. oat

6. potato
7. kauliflower
8. mustard
9.
10.

C.2 For how long the field crop production can meet your household food demands?

3 months (1)	6 months (2)	9 months (3)	Whole year (4)

C3. Do you have surplus production? –Yes (1) No (2),

C4. If yes, how much can you get by selling the surplus production in a current market price? ( )

C5. Who is responsible for holding and managing the cash income from surplus production? Man (1) Woman (2)

D. Livestock Activities

D.1 Please list out the livestock species and their quantities;

Livestock Species	**Numbers**		**Total**
	M	**F**	
Buffalo (1)			
Cow (2)			
Sheep (3)			
Goat (4)			
Pig (5)			
Chicken/Duck (6)			
Others (7)			

D2. Do you sell of the livestock/product? Yes (1) No (2)

D3. If yes, who decides on the sale of livestock /product?
Man (1) Woman (2) both (3)

D4. Who holds the income and decides on expenditure?
Man (1) Woman (2) both (3)

D5. Do you have other use of animal dung apart from the manure?
Yes (1) No (2)

D6. if yes, what kind of uses you have for animal dung?

1. firewood for fuel
2. biogas production for fuel
3. others

E. Sources of Annual Household Cash Income

Sources of Income	Annual Income (Rs.)
1. Crops (cash and cereal)	
2. Vegetables (if any)	
3. Livestock and livestock products	
4. Off-farm employment if any	
5. income from remittances/pensions	
6. Other sources (please specify----)	
Total	

F. Annual Household Expenditure:

Items of Expenditure	Expenditure (Rs.)
1. Total amount for education	
2. Total amount for religious activities	
3. Total amount for food items (if any)	
4. Purchasing of farm equipment (digging tools)	
5. Purchasing of farm inputs (seeds, fertilizers, pesticides)	
6. Purchase of animal feeds and animal health	
7. Total amount for medical expenses	
8. Others	
Totals	

G. Rural Energy

1. What fuel do you use for cooking?

1. firewood
2. animal dung
3. agri. residue
4. firewood and animal dung
5. firewood and agri residue
6. biogas
7. biogas and firewood
8. others

2. Is firewood easily available in your field? Yes (1) No (2) ?

2a. If not how long does it take to collect the firewood? ---------hr.

3. Can you have access to the forest resources in community forest? Yes (1) No (2)

3.a. If yes, how many Bhari of firewood can you get from the community forest in a year? ----------------

4. How many bhari of firewood do you use in a month? ----------

4a. Where do you collect them? from public forest (1) private field (2) community forest (3) ?

5. Who cuts the trees for firewood? Man (1)Woman (2) boy child (3) girl child (4)

6. Who collects the firewood? Man (1) woman (2) girl child (3) boy child (4

7. Who stores it properly? Man (1) woman (2) girl child (3) boy child (4)

8. Do you have any problems in collecting firewood? Please list out the problems.

a.-----------------
b.----------------
c.----------------
d.----------------
e.----------------

9. Do you see any problems while cooking with the firewood? If yes, please list them out.

a.-------------------
b.-------------------
c.-------------------
d.------------------
e.-------------------

10. Are you also aware of the solutions that help to reduce the above problems?

a.-----------------
b.-----------------
c.-----------------
d.-----------------
e.-----------------

11.What kind of energy technologies do you have access to? Please tick

a. ICS ☐
b. Bio gas plant ☐
c. Micro hydro plant ☐
d. Solar ☐

12. What kind of usage do you have for alternative energy technologies? Please list out the different usage of different energy technologies as indicated below:

Type/Usage	Cooking	Lighting	Agri - processing	Lift irrigation	Others
Micro-Hydro power					
Solar					
Biogas					
ICS					

13. Please list out the advantages and disadvantages (problems) of the Alternative Energy technologies.

Alternative Energy Technologies	Advantages	Disadvantages

14. Do you still prefer traditional technologies over the AETs? Yes (1) No (2).

15. Why do you prefer the traditional technologies against the alternative technologies ? please compare those listed in the following table;

Type of technologies	Reasons for Comparisons				
	Easy to use	Low cost	No people to go to mill	Long waiting time	Others
Trad. Chulo vs. ICS					
Trad.Chulo vs. Bio.gas					
Dheki /Jhanto vs. Power mill					
Water mill vs. Power.mill					
Kerosene vs. Electricity					

16. After using ICS, how much bhari of firewood can you save in a month on an average? -----------bhari.

17. How do you feel about your work burden after having alternative energy technologies? Please use the following criteria for describing your workload;

Criteria for Measuring Workload	**Measurement**		
a. Quantity of work	Light (1)	average (2)	Heavy (3)
b. Comfortability of work	easy	average	difficult
c. Consumption of labour	low	average	high
d. Consumption of time	less	average	more

18. Are you able to pay for the charges for processing mills and electricity? Yes/No.

18a. If yes, are you happy with it? Yes (1) No (2)

19. Are there technicians available in the village to repair the gas plant/ICS/power plant? Yes/No

19. a. if not, can you repair on your own? Yes (1) No (2)

20. Did you or any women from the household get any training on effective use of energy technologies and on the preservation of environment? Yes (1) No (2).

20. a. If yes, how many times did you/they get such trainings? -----------

21. Do your children study at home for longer hours after having electricity? Yes (1) No (2).

21. a. If yes, how long do they study as compared to before? -----------

22. Are you able to use electricity for undertaking some economic activities? Yes (1) No (2),

22 a. if yes, please explain the activities you are involved in;

1. ------------------------
2. ------------------------
3. ------------------------
4. -----------------------
5. ------------------------

22b. If not please explain the reason;

1. ----------------------
2 ----------------------
3. ----------------------
4. ----------------------
5. ----------------------

23. Have you or other women in the house received training to carry out any income generating activities? Yes (1) No (2)

23. a. If yes, please indicate below;

Training Activities	in the village	outside village
1. Vegetable farming/kitchen gardening		
2. Livestock raising		
3. Sewing/Knitting		
4. Cottage and handicrafts		
5. Others		

24. What are the factors that encourages/discourages you to participate in development of alternative energy technologies?

25.

Factors for Encouragement	Factors for Discouragement
1. 2. 3. 4. 5. 6.	

H. Gender Aspect

1. Please mention the energy related activities and the respective time you take for the activities:

	Adult		**Female**		**Time (hrs)/head**	
Activities	Male	Female	Male	Female	Before AETs	After AETS
Who does ?						
1. Cooking meal (2 times)						
2. Preparing nasta						
3. Hulling grains						
4. Grinding grains						
5. Collecting firewood						
6. Going to the mills						
7. Mixing dung and water for bio gas						
8. Collecting water for biogas						
9. Collecting dung for biogas						
10. Collecting grass for stall feeding						
11. Others						

2. Are you or any adult females in the household involved in development of alternative energy technologies? Yes (1) No (2) ,

2a. if yes, in which way?

1. participation in planning meetings
1. participation in decision making
2. participation in raising local fund
3. participation by providing labor
4. participation by providing material
5. Others

2b. If you are not participating in such activities, please explain the reason;

1. 2. 3. 4. 5.

3. Have you been involved in operational and maintenance activities as well? Yes (1) No (2)

a. In what way please indicate below;

1.Daily operation of the plant
2.Check the functioning of plant
3.Repairing the plant
4.Participation in training for usage
5.Others

3b. If you are not participating in such activities, please explain the reason;

1. 2. 3. 4.
5.

4. Do you have time for some social or economic activities? Yes(1) No (2)

4a. If yes, how much time is available for such activities? -------hrs.

5. Have you received training in designing improved stoves? Yes (1) No (2)

5a. If yes, can you make them independently without any help from menfolk? Yes(1) No (2)

6. Are you participating in the village level orientation and workshop for CS/Biogas/MicroHydro Power? Yes(1) No(2)

c. Are you involved in designing/constructing ICS/gas plant?
Yes (1) No (2)

7a. If yes, who encourage you to be involved in such activities?

1. Community promoter
2. Family member
3. Program facilitator
4. Personal interest
5. Others

7b. If not why did not you involve in such activities? please explain;

8. Were you consulted about the site selection of gas plant/power mills? Yes(1) No (2)

8a. Are you satisfied with their site? Yes (1) No (2)

8b. if not please explain the reason for your dissatisfaction;

1. 2. 3. 4. 5.

9. Have you got training on production of biogas and uses of slurry for composting? Yes (1) No (2)

9a. If not would you like to have such training? Yes(1) No (2)

10. Do you like to participate in village review meetings called for different usage and implications of the rural energy technologies in the village? Yes(1) No (2)

10a. If yes, how many times have you attended such meeting? --------hr.

11. If not why did not you participate in such meetings? Please indicate reasons;

1.-----------------
2. ----------------
3. ----------------
4.-----------------

12. Do the officials come and ask your views about the usage of the electricity, ICS, Gas plant and agri-processing mill? Yes (1) No (2)

12a. If yes, how often do they come for such purposes?

13. Are there any women members in the Village Committee and/ Village Energy Board from your family? Yes (1) No (2)

13a. Do you think you need to be involved in energy planning program for providing energy at household and at community level? Yes (1) No (2)

14a. If yes, why? put the tick mark.

a. for personal interest	
b. for knowing the proper and efficient usage	
c. To be able to maintain properly	
d. As being the main user	
e. Others	

15. Have alternative energy technologies helped to increase the life quality of your family? Yes(1) No (2)

15 a. If yes how?

Opportunities	Men	Women	Children
a. More income opportunities			
b. Reduced workload			
c. Easy HHs.Chroes			
d. Exposure to new technologies			
e. More time for school work			
g. Participation in devt. activities			
h. Exposure in different community			
j. Others			

16. Do any of your family members have eye problems, asthma and heart diseases? Please indicate the problems in two different time period;

Diseases	**Before using AETs**				**After using AETs**			
	Women	Men	Boy	Girl	Women	Men	Boy	Girl
Eye problems								
Asthma								
Lung cancer								
Heart diseases								
Others								

B: Detail Household Survey Questionnaire: for Non Project Area

ID:

VDC Methinkot

Ward No.: HHs sample no.: Date:

Ethnicity: 1= Braman/Chettri, 2= Newar, 3= Gurung/Magar, 4= Tamang/Rai, 5= Others

Respondent's Ideographic Data:

Respondents characteristics	Male	Female
Age		
Education		
Marital Status		
Occupation		

Age: 1 = 18-30, 2 = 31- 40, 3 = 41-50, 4 = >51
Education: 1= just literate, 2= primary, 3= secondary, 4= higher education, 5 = illiterate
Marital status: 1= married, 2= unmarried, 3= widow, 4= divorced
Occupation: 1= farming, 2= wage labour, 3= paid employment other than wage labour, 4= trade, 5= household work only, 6=farming and house work, 7= others,

A. Demographic Information:

A.1 Household size, Composition and Age Structure

Age Group	Male	Female
Below 5 = 1		
5-14 = 2		
15-45 = 3		
46-59 = 4		
60 and above = 5		
Total		

A.2 Educational Status of Household Members above 5 years

Educational Status	Male	Female
Just literate =1		
Primary School = 2		
Secondary School = 3		
Higher Education = 4		
Illiterate = 5		

A.3 Occupation of Household Member above 10 years old

Occupation	Male	female
farming (1)		
wage labor, (2)		
paid employment other than wage labour (3)		
trade (4)		
Household work only (5)		
farming and household work (6)		
Others------Specify (7)		

B. Land Holding Size and Tenure Status

B.1 How much land of following type do you hold? (land owned by the household)
(Please report the area in Ropani)

Land Uses	Area (in ropani)
Owner operated 1)	
Rented in (2)	
Rented out (3)	
Total land on the name of women (4)	
Others (5)	
Total	

B.2 Do you have some land, which is used or could be used for planting fodder trees?
Yes (1) No (2) ☐

B3. If yes, how much land is available for such fodder trees? (   )

B4. Who decides about fodder plantation? Man (1) Woman (2) both (3)

B5. Do such fodder trees replace the forest wood resources? Yes (1) No (2)

C. Farm Activities

C.1 Please list out the different crops you grow in your fields?

1. paddy
2. maize
3. millet
4. wheat
5. oat
6. potato
7. kauliflower
8. mustard
9.
10.

C.2 For how long the field crop production can meet your household food demands?

3 months (1)	6 months (2)	9 months (3)	Whole year (4)

C3. Do you have surplus production? –Yes / No,

C4. If yes, how much can you get by selling the surplus production in a current market price?

(   )

C5. Who is responsible for holding and managing the cash income from surplus production? Man/Woman

D. Livestock Activities

D.1 Please list out the livestock species and their quantities;

Livestock Species	Numbers		Total
	M	F	
Buffalo (1)			
Cow (2)			
Sheep (3)			
Goat (4)			
Pig (5)			
Chicken/Duck (6)			
Others (7)			

D2. Do you sell of the livestock/product? Yes (1) No (2) ☐

D3. If yes, who decides on the sale of livestock /product?
Man (1) Woman (2) both (3) ☐

D4. Who holds the income and decides on expenditure? ☐
Man (1) Woman (2) both (3)

D5. Do you have other use of animal dung apart from the manure?
Yes (1) No (2)

☐

D6. if yes, what kind of uses you have for animal dung?

1. firewood for fuel ☐
2. biogas production for fuel ☐
3. others ☐

E. Sources of Annual Household Cash Income

Sources of Income	Annual Income (Rs.)
1. Crops (cash and cereal)	
2. Vegetables (if any)	
3. Livestock and livestock products	
4. Off-farm employment if any	
5. income from remittances/pensions	
6. Other sources (please specify----)	
Total	

F. Annual Household Expenditure:

Items of Expenditure	Expenditure (Rs.)
1. Total amount for education	
2. Total amount for religious activities	
3. Total amount for food items (if any)	
4. Purchasing of farm equipment (digging tools)	
5. Purchasing of farm inputs (seeds, fertilizers, pesticides)	
6. Purchase of animal feeds and animal health	
7. Total amount for medical expenses	
8. Others	

G. Rural Energy

1. What fuel do you use for cooking?

1. firewood
2. animal dung
3. firewood and animal dung
4. agri. residue
5. firewood and agri residue
6. biogas
7. biogas and firewood
8. others

2. Is firewood easily available in your field? Yes/No?

2a. If not how long does it take to collect the firewood? ---------hr.

3. Can you have access to the forest resources in community forest? Yes/No

3.a. If yes, how many Bhari of firewood can you get from the community forest in a year?

4. How many Bhari of firewood do you use in a month?

4a. Where do you collect them? from public forest/private field/community forest?

5. Who cuts the trees for firewood? Man/Woman/boy child/girl child

6. Who collects the firewood? Man/woman/girl child/boy child

7. Who stores it properly? Man/woman/girl child/boy child.

8. Do you have any problems in collecting firewood? Please list out the problems.

a.-----------------
b.----------------
c.----------------
d.----------------
e.----------------

9. Do you see any problems while cooking with the firewood? If yes, please list them out.

a.-------------------
b.-------------------
c.-------------------
d.------------------
e.-------------------

10. Are you also aware of the solutions that help to reduce the above problems?

a.-----------------
b.-----------------
c.-----------------
d.-----------------
e.-----------------

11. Have you heard about or seen the energy program in other villages? Yes,(1) No (2)

11 a. If yes, please indicate which kind of energy technologies have you seen or heard about ?

1. Micro hydro
2. Bio Gas
3. Solar
4. ICS
5. Others

12. Do you think any of these technologies would be useful for you? Yes/No.

12a if yes, please explain the positive reasons;

Type of Technologies	Positive reasons	Negative reasons
Micro hydro power		
Biogas		
Solar		
ICS		

13. What sort of traditional technologies are you using these days for cooking, lighting and processing purpose? Please indicate below;

Usage of Technology	Cooking	Lighting	Grinding grains	Oil expelling
Traditiona Stove				
Kerosene				
Dheki/Jhanto				
Pani Ghatta				
Kol				
Others				

14. Please indicate any problems you face in using the traditional technologies;

	Problems
Traditional stoves	
Dheki/jhanto	
Pani ghatta	
Oil expeller	
Kerosene lighting	

H. Gender Aspect :

1. Please list your energy related activities and the respective time you take;

Major Activities	Adult		Children		Time (hrs.)
	Male	Female	Male	Female	
1. Cooking Meal (two times					
2. Preparing Nasta (two times)					
3. Hulling grains					
4. Grinding grains					
5. Collecting Firewood					
Others.					

2. How do you feel about your workload? Please use the following criteria to describe your workload;

Criteria for Measuring Workload	Measurement		
a. Quantity of work	Light (1)	Average (2)	Heavy (3)
b. Comfortability of work	easy	average	difficult
c. Consumption of labour	low	average	high
d. Consumption of time	less	average	more

3. Do you have some free time to be involved in some social or economic activities? Yes/No. ☐

3a. If yes, how much time is available for such activities? (   )

4. What kind of social and economic activities are you involved in?

a.----------------------
b.------------------------
c.------------------------
d.-------------------------
e.-------------------------

5. Have you or any other women in the house received training to involve in any income generating activities? Yes (1) No (2)

5a. If yes, what kind of training have you got? Please indicate below;

Training Activities	in the village	outside village
1. Vegetable farming/kitchen gardening		
2. Livestock raising		
3. Sewing/Knitting		
4. Cottage and handicrafts		
5. Others		

6. How much time do your children study in night with kerosene light? (hrs.)

7. Does any of your family members have eye problem, lung diseases, heart diseases or asthma? please indicate below;

Type of Diseases	Adult		Children		Time (years)
	Male	Female	Male	Female	
Eye problem					
Asthma					
Lung cancer					
Heart Disease					
Others					

8. Please explain if you think any of these problems are associated with the energy sources you use;

8a.

8b

8c.

Appendix III: Checklist for Interviews and Discussions

Checklist (Discussion with Community Leaders)

1. Perception of community development activities
2. Opportunities for women to increase their efficiency and productivity
3. Community Acceptance of the rural energy technologies/Adoptation
4. Cost and economy of the technologies/versus traditional technologies
5. Support to preserve the environment
6. Project objectives to address the women drudgery
7. Program Support in terms of management and technical factors
8. Repair services at village Level
9. Participation of women folk in planning , implementing and maintaining the energy technologies
10. Changing Situation and Work Structure of Women
11. Program Continuity and Ownership
12. Availability of Community forest for collecting Firewood
13. Comparison between traditional and AETs
14. Problems/Impact of AETs
15. Views about women rights/access/control over the resources
16. accessibility to resources and technology

Checklist for FGD with Men Group

1. Type of energy technology they are using in their household
2. Energy resources and their management (collection, uses, management)
3. Use of energy for different purposes
4. Most essential needs for rural energy
5. Planning and designing of the technology
6. Participation of Men/Women in Planning activities-
7. Level of participation
8. Advantages and disadvantages of traditional energy technologies
9. Pros and Cons of Alternative energy technologies
10. Potentials for rural energy technologies
11. Liking and disliking/Preferences
12. Access to technology-Men/Women
13. Control over technology-Men/Women
14. Suggestions

Checklist for FGD with Women Group

1. Type of technologies at household level
2. Energy resources and their accessibility
3. Collection and management of the household energy resources
4. Advantages and disadvantages of traditional technologies
5. Accessibility to alternative energy technologies
6. Control over the technologies- Management of technical device, energy use
7. Planning and designing of the technologies-Women's participation
8. Participation of women in training activities,
9. Opportunities /Constraints for women
10. Needs and Priorities of women regarding the household energy
11. Women's awareness about use and operation of energy resources
12. Impact of technologies perceived by women-positive/negative
13. Liking, disliking/Preferences of women
14. Suggestions/Comments

Checklist for In-Depth Interview with Key Informant

1. Development resources at village level,
2. Existing development activities, and situation of rural energy
3. Perception about gender role in management of energy resources
4. Potential of technology development at village level,
5. Perception about alternative energy technologies,
6. Comparison between traditional and alternative energy technologies,
7. Community participation in planning such technologies
8. Problems and potentials of such technologies,
9. Access and control over the technology and benefit (energy)
10. Income opportunities for women,
11. Opportunities at community level-Provisions of good services (health and education,) for women
12. Possibilities for women empowerment
13. Gender integration at village level planning of rural energy program
14. Existing level of participation in planning and management and monitoring activities
15. Training and awareness development activities at village level
16. Adoption trend of technologies at village level

Policy Level Discussion with the Representatives of Different Energy Sector Institutions

1. What are the current strategies to promote the rural energy technologies with sustainable approach?
2. How does this institution coordinate with local government (district and Village authorities) in planning rural energy projects?
3. Is there any specific policy to address women and energy issues?
4. Has there been any action-oriented policy to increase effective participation of women in rural energy sector?
5. Is there any account how women contribute their own energy in household energy management?
6. Are there any strategies developed to address the gender concerns in rural energy planning?
7. Is there a clear policy to address the practical and strategic gender needs?
8. What are the practical problems in rural energy planning and implementation?
9. Is there any consideration for community based energy planning? Please give an example.
10. How do you coordinate with other energy institutions and other sectoral agencies so as to have integrated services for overall development of the community?
11. What are the most serious challenges so far in rural energy sector?
12. What strategies do you suggest to improve the present energy policy framework?

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