Community-based Energy Planning and Management in the Yarsha Khola Watershed, Dolakha District, Nepal

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Abstract

This paper briefly describes the process of a community-based energy planning and management activity that was tested and implemented in one of the PARDYP watersheds in Nepal. The main actors in such a process are the beneficiaries themselves, in particular women as they are the managers of the household energy systems. The extension worker has the role of facilitator. Eight main components of the activity were identified during programme implementation: (i) entry into the community; (ii) community mobilisation and confidence building; (iii) interaction with district level line agencies for micro and macro linkages; (iv) understanding the energy consumption patterns and the technologies employed; (v) assessing the availability of energy resources; (vi) balancing energy consumption and resource availability; (vii) examination of the suitability of renewable energy technologies (RETs); and (viii) implementation of selected RETs. This paper examines the issue of replicability and sustainability of the approach in the context of mountain communities and identifies the key lessons learned during programme implementation. The conclusions drawn were as follows. 1) The community-based energy planning and management approach is an effective mechanism for bringing together different stakeholders—villagers, researchers, extension workers, promoters, support institutions, manufacturers, and experts—and enabling them to arrive at consensus decisions, with each stakeholder feeling that they have gained something from the agreement (positive sum game). 2) In order to establish good rapport with communities, it is very important that the research facilitator be calm, patient, persuasive, and results-oriented. 3) Both community members and the research team benefited from enhancing their knowledge, skills, and awareness of RETs. 4) Community-based energy planning and management is an excellent tool for identifying the problems, priorities, needs, and aspirations of communities, and the presence of a research facilitator helps communities to solve problems by themselves.

Background

The increasing deficit of available energy resources (primarily biomass) and the non-availability of, or lack of access to, modern energy forms for household, commercial, and industrial use, not only hampers the fulfilment of basic minimum energy needs but also limits the economic growth potential of hill and mountain communities. Excessive and inefficient use of various forms of energy lead to environmental deterioration and a plethora of negative environmental and ecological consequences. The People and Resource Dynamics Project (PARDYP) of ICIMOD is being implemented in five watersheds, one of which is the Yarsha Khola watershed in Dolakha District, Nepal. PARDYP is developing scientific data sets related to the dynamics of change at watershed level, and has recognised that over exploitation of forest resources as fuel has contributed towards reducing soil fertility, farm productivity, and water availability, and increasing siltation and landslides, as well as exacerbating the already heavy workload of mountain women. This recognition led to the implementation of a community-based energy planning and management activity in the Yarsha Khola watershed (hereafter referred to as 'Yarsha'), which is situated some 190 km east of Kathmandu.

The main objective of the programme was to facilitate selected communities within the project area to plan and implement selected renewable energy technologies (RETs) so that they might be better able to meet their energy needs. The implementation of various energy programmes is expected to reduce the increasing pressure on natural resources (primarily biomass) and provide opportunities for communities to diversify their income generating economic activities. It is hoped that identification and implementation of RET programmes will enhance the capability of communities, extension workers, CBOs, and the PARDYP project team, to plan energy needs and implement energy programmes, and will raise awareness of RETs.

The activities were carried out over a period of nine months. The Centre for Rural Technology/Nepal (CRT/N), a private institution involved in promoting decentralised renewable energy technologies, was engaged for the project with professional support from ICIMOD's Renewable Energy Specialist. The role of CRT/N was to act as a research facilitator in the identification of energy needs and resources, and to ensure the active participation of community members. At the same time, awareness of energy alternatives was promoted, and information on various technological options, the level of incentives provided by the government, and the status of manufacturers was provided. The research facilitator was provided with an orientation to ensure that activities were carried out at the community level. In order to be able to understand and explain various energy technologies to the villagers, the research facilitator first reviewed the status of various RETs. In addition, members of the PARDYP team briefed the research facilitator on Yarsha characteristics and the project activities since 1997.

Process of Community-based Energy Planning and Management

Entry into the Community

The first step was to identify and list potential key informants so that information could be collected on villagers' needs and priorities. The first contact persons were the members of savings and credit cooperative groups, since these are successful grassroots institutions (see Box 1). Good rapport with some office bearers in these cooperatives helped consolidate communication of the objectives of community-based energy planning and management. During this phase, PARDYP hydro-met readers (local residents employed to take the regular readings at hydrological survey sites) located in different areas of the watershed were instrumental in providing further information on potential key informants, village leaders,

BOX 1

Bhabisya Nirman Women Cooperative Society (BNWCS),

Maina Pokhari, Yarsha Khola Watershed, Dolakha District, Nepal

Jansachetan Cooperative Society (JCS), Kavre VDC, became so popular that a number of cooperatives were established in its wake. One such initiative was the establishment in 1995 of BNWCS, exclusively for women, by Mrs. Krishna Kumari who presently serves as the president. Mrs. Kumari realised that it was difficult for women to participate in JCS as they were unable to contribute the minimum NRs.500 as the share capital, or the monthly deposit of NRs.100. The monthly deposit required in BNWCS varies from NRs.30 to NRs.200 per month, thus allowing the participation of poorer women. At present, they have 310 women members with a total deposit exceeding NRs.600,000. Each member can borrow a maximum of NRs.5,000. Most of the women have borrowed money for livestock rearing. According to most of the borrowers, this had meant that they were able to enhance their incomes and contribute towards the welfare of their family. It had also raised their awareness, confidence, and self-esteem, and had resulted in enhanced leadership and improved management capability of the women in Yarsha. This success was a result of the dynamic leadership of one woman who was sincere in her belief that the status of women in Yarsha could be improved.

Source: Village Level Energy Planning Study of Yarsha Khola, Dolakha (Nepal) - report submitted to ICIMOD by CRT/N, July 1999.

different committee members, and other topics. Project staff also introduced local village residents to the facilitator.

Initially, it was very difficult to make village residents understand the purpose of the energy survey and programme. Even defining energy is a difficult task. PARDYP local staff informed the village residents that this energy programme was one of the project components, thus the energy survey was incorporated into on-going discussions. This meant that the facilitator was able to take advantage of the already established project-community rapport.

Community Mobilisation and Confidence Building

Interaction with Key Informants, Group Leaders, Village Leaders

After potential key informants in the villages had been identified, a series of village walks was conducted and different clusters and settlements observed. During the village walks, a number of informal and formal meetings were held with villagers and village and group leaders in which the following were explained and discussed:

- the objectives of the energy programme;
- the critical role that energy plays in terms of improving community living standards and economic potential;
- information on the various available forms of renewable energy;
- the problems faced by the villagers in terms of energy, and potential solutions to these problems; and
- energy-related experiences of the residents.

The main outcomes of these interactions were a better rapport with key informants and collection of baseline information on local level institutions.

There are several different types of local level institution operational in Yarsha in addition to the village political-administrative bodies. There are 25 forest user groups (formal and informal), 30 local governance programme groups, 12 savings and credit groups (including non-registered), 15 small farmers' development groups, and 10 other informal groups.

Following the walk-about survey, volunteers were identified in each VDC who were willing to take part in the survey and in the energy planning and management activities. These persons showed a keen interest in energy issues and possessed leadership qualities. They were not formally nominated by the community but voluntarily agreed to take on the role of contact person and villager organiser for subsequent meetings. These people basically acted as a bridge between the facilitator and the community for information sharing, awareness generation, and issue identification.

Dialogues/Interactions with Village-level Institutions and Outsiders

Intensive dialogues and interactions then took place with the officials of village-level institutions, informal/formal groups, community leaders, knowledgeable individuals, and line agencies. This further widened and consolidated understanding of the energy issues being faced by the community, both by the researcher and by the villagers themselves. Some villagers mentioned that they had never given serious thought to energy issues and always considered that energy would be available when and where desired. The facilitator was also able to help the communities realise the needs and priorities of different stakeholders and their interests in different types of energy resource and technology. The volunteers acted as enumerators and facilitators during the interactions with the village-level institutions and outsiders.

Interaction with District-level Line Agencies for Micro- and Macro-linkages

Meetings with district-level line agencies such as the District Development Committee (DDC), the District Forest Office (DFO), the District Land Conservation Office, the Agricultural Development Bank (ADB/N), the Nepal Electricity Authority (NEA) branch office, Tuki Sangh, and the REDP district office, assisted background understanding about the situation in the watershed and district and helped to identify areas of mutual interest where it would be possible to work together towards resolving the energy issues faced by the villagers. These agencies showed a keen interest in supporting programmes and initiatives identified by the community if that particular programme fell under their jurisdiction. A team of specialists including the renewable energy specialist from ICIMOD also visited these line agencies, which helped to further consolidate the relationships with these organisations.

Understanding the Energy Consumption Patterns, the Technologies Employed, and the Energy Resource Availability

It is essential to understand the energy consumption pattern, assess the available indigenous energy sources and the availability and access to commercial fuels, and examine the suitability of new and renewable energy technologies before designing intervention programmes. These issues are discussed briefly in the following paragraphs.

Energy Consumption Patterns and the Technologies Employed

The energy use pattern was estimated and various types of end-use devices assessed in five communities within the watershed with the help of a checklist and structured questionnaire. Village residents were also involved in the measurement of fuelwood consumption. Willingness to furnish information and to cooperate with the research was excellent. The communities were selected on the basis of the interest shown by them and the degree of energy stress, with the exception of Maina Pokhari, which was selected because it is the only market centre and demonstrates semi-urban characteristics.

The prevailing energy pattern for the whole watershed is shown in Table 52. The types of device used by different sectors and the sources of their energy are summarised in Table 53.

Table 52: **Total Energy Consumption in GJ per Annum, Yarsha Khola, Dolakha, Nepal (1998)**

Description	Fuel-wood	Agric. Resi-dues	Animal Dung	Hu-man Labour	Animal Labour	Kero-sene	Electri-city	Other	Total	% of overall total
Domestic	164970	3,014	334	NA	0	2,474	695	0	171,487	85
Commercial	1287	0	0	NA	0	0	81	0	1368	1
Cottage Industry	3883	0	0	1293	0	0	237	1418	6780	3
Agriculture	0	0	0	7208	4902	0	20	4758	16888	8
Transport	0	0	0	6123	0	0	0	77	6200	3
Total	170089	3014	334	14624	4902	2474	3507	6253	202723	100
Per cent	84	1	0	7	2	1	1	3	100	

Source: Village Level Energy Planning Study of Yarsha Khola, Dolakha (Nepal); report submitted to ICIMOD by CRT/N, July 1999.
Note: NA—not assessed

Biomass (primarily fuelwood) and animate energy (muscle power of human and animals) are the main sources of energy used in the watershed. The domestic sector is the main consumer of energy and the main energy services required are in the form of heat (low-grade energy) for cooking and heating. The demand for energy is expected to grow as a result of both population increase and an increase in the various types of economic activity within these communities. However, poverty hinders the proliferation of renewable energy technologies among low-income groups. The pattern of energy consumption reflects a situation characterised by a subsistence agricultural economy, similar to that which prevails in most of the hill and mountain communities of Nepal.

Table 53: **Energy Technologies Employed in the Yarsha Khola Watershed, Dolakha (Nepal)**

Demand Sectors	Energy Devices	Source of Energy
Household		
Cooking	Traditional/improved stoves, kerosene stoves	Biomass, kerosene
Heating	Tripod stands, electric heaters	Biomass, electricity
Lighting	Kerosene wick lamps	Kerosene
	Biogas burners	Biogas
	Bulbs, tubes	Electricity
Commercial		
Cooking	Traditional/improved stoves, kerosene stoves	Biomass, kerosene
Heating	Tripod stands, electric heaters	Biomass (agricultural residues), electricity
Lighting	Bulb, fluorescent tube	Electricity
Agriculture		
Ploughing	Human and animal mix	Human and animal labour
Weeding/planting	Human labour	Human labour
Irrigation	Human labour	Human labour
Harvesting	Human labour	Human labour
Threshing	Human and animal mix	Human & animal labour
Fertiliser		Manure, chemical ferti.
Rural Industry		
Weaving/mat making	Traditional devices	Human labour
Agro-processing	Traditional ghattas, improved water mills, electric and diesel mills	Water energy, diesel, and grid electricity
Smithy	Traditional equipment	Fuelwood
Furniture making	Traditional equipment	Human labour
Alcohol distilling	Tripod stands	Fuelwood
Others	Electrical appliances	Grid electricity
Rural Transportation		
Within Village		
Agric. Commodities	Human labour	Human labour
Agric. Residues	Human labour	Human labour
Farmyard manure	Human labour	Human labour
Fodder collection	Human labour	Human labour
Agro-processing	Human labour	Human labour
Fetching water	Human labour	Human labour
To and from Village		
Agric. Commodities	Human labour	Human labour
Others	Human labour	Human labour

Source: Village Level Energy Planning Study of Yarsha Khola, Dolakha (Nepal), Report submitted to ICIMOD by CRT/N, July 1999

Energy Resource Estimation

The estimated total primary energy available per annum from different sources is shown in Table 54.

The forest resources were estimated from the information collected through different forest user groups and were cross-checked against the records of the Forest Ranger Office and the PARDYP field office. The energy potential from small streams and rivers was estimated from on-site measurements, the topographical map, and measurements of discharge made by PARDYP. Meteorological stations established by the project provided information on solar radiation and wind velocity.

Table 54: **Total Primary Energy Availability, Yarsha Khola, Dolakha District, Nepal (1998)**

Energy Resources	Sustainable Yield per Annum			Usable Quantity per Annum		
	Natural Units	GJ	Per Cent	Natural Units	GJ	Per Cent
Fuelwood	2,660 tonnes	44,422	8	2,660 tons	44,422	39
Agricultural Residues	12,234 tonnes	154,148	28	537 tons [1]	6,766	6
Animal Dung	17,799 tonnes	194,009	35	2,670 tons [2]	29,103	26
Hydropower	100 kW	3,157	<1	25 kW [3]	394	<1
Solar	45,046 MWh [5]	162,166	29	9,009 MWh [4]	32,432	29
Total		557,902	100		113,117	100

Note:

1. residues suitable for energy purposes like rice husks and corncob—assessed as 5% of the total residue generated
2. 15% of total dung assumed to be available for energy purposes
3. only possible to exploit 25% of potential assuming one unit installed in one stream
4. assuming each household makes 10% of the area of landholding in which the house is set available for solar collection and 50% utilisation efficiency
5. assuming each household makes 25% of the of the area of landholding in which the house is set available for solar collection

Source: Village Level Energy Planning Study of Yarsha Khola, Dolakha (Nepal), Report submitted to ICIMOD by CRT/N, July 1999.

Information on land resources, livestock, human and draft animals, grid electricity, and commercial fuels were collected from the VDC office, key informants, local institutions, and savings and credit groups and were cross-checked with the data available from PARDYP as well as district office records.

Balancing Energy Consumption and Resource Availability

The total energy consumption pattern for primary energy is shown in Figure 47, together with the difference between consumption and usable quantity of that energy.

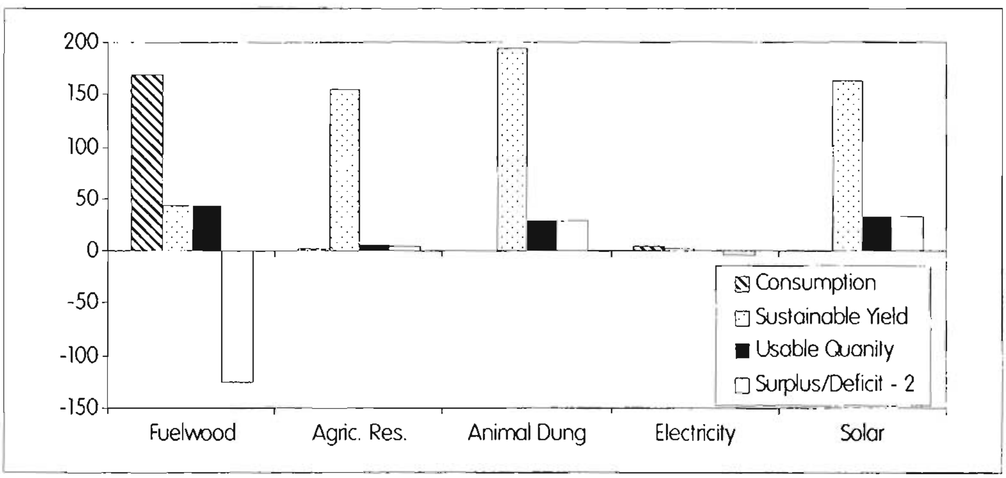

Figure 47: **Energy Consumption, Sustainable Yield, Actual Usable Quantity and Difference Between Consumption and Usable Quantity in Yarsha Khola, 1998**

The figure shows the following.

- Fuelwood consumption is almost four times the sustainable supply.This has led to the encroachment of government forests within and beyond the Yarsha Khola watershed as forest areas near the settlements are under FUG management and are closed for much of the year. Many people consider that the present FUG management practices are not equitable in terms of ethnicity, class, and gender.
- With the increasing difficulty in collecting fuelwood, and if appropriate technological interventions are not introduced, there is a danger that agriculture residues and animal dung will be used for cooking and heating instead of for compost and manure production. This would result in a decline in soil fertility and agriculture productivity, and an increased health hazard from indoor air pollution.
- There is a big potential for exploiting solar energy both for low temperature applications (e.g., hot water production, drying of agricultural produce, green houses for vegetable farming and floriculture, and passive solar heating), and for electricity (for light and for low wattage electrical appliances in areas where grid extension is not feasible).
- Agricultural energy input is dominated by human labour, more than 70 per cent of which is contributed by women— partly as a result of out-migration of men. Human drudgery is high. There has also been a visible shift from cereal crop production to vegetable farming, which has further increased the amount of labour required.

The patterns of energy consumption technologies employed and energy resources available clearly indicate an urgent need for the design of an appropriate energy programme package, both to enhance environmental conditions and to improve people's livelihoods. The analysis indicates that the following interventions would be desirable and should be critically appraised by the local residents.

- Promotion of improved community forest management in such a way that it is more equitable in terms of ethnicity, class, and gender.
- Promotion of more efficient biomass cooking and heating devices to combat fuelwood scarcity.
- Promotion of biomass briquetting technology, as sufficient quantities of suitable agriculture residues are available.
- Promotion of solar home systems, solar driers (for ginger and garlic), and passive solar building technologies.
- Introduction of labour saving devices such as improved ploughs, sprinkler irrigation systems, and agro-processing devices.

Examination of the Suitability of Renewable Energy Technologies (RETs)

Visit to RET Promoters and Manufacturers

Different organisations located in Kathmandu were visited. Information on different RETs related to such points as rated capacity, input and output variables, cost, availability, incentives, and subsidies was collected and provided to the residents of Yarsha.

Motivation/Awareness Campaign on RETs

The residents of Yarsha were informed about options in the field of renewable energy technologies in different ways as mentioned briefly below.

Distribution of Posters and Information Booklets

Posters and booklets on different RETs were distributed to different groups and made available in public places such as the VDC offices and health posts.

Participation in Group Meetings and Discussions

The research facilitator attended several formal and informal group meetings and provided information on various RETs highlighting their suitability for rural hill and mountain conditions. A number of villagers showed keen interest with the most interest being shown in improved cooking stoves, biogas plants, peltric sets, and solar home systems. These meetings were also instrumental in recording energy needs, the various types of energy resources, the technologies at present in use, and the way the communities used each resource.

Orientation Session

Orientation sessions were organised at different watershed locations at the request of the communities.

Observation Tours

Observation tours were also organised for selected members of the interested communities, as it was felt that 'seeing is believing'. Two options were discussed: a) a visit to manufacturers' outlets in Kathmandu; and b) a visit to a place where some of these technologies are operational. The latter was preferred as most of the appropriate technologies existed within Yarsha or nearby, and villagers could arrange to visit these sites on their own. Observation tours were therefore organised locally.

Organisation of an Energy Fair in Yarsha

Only a limited number of people were able to undertake observation tours, and there were some useful technologies that did not exist in the area. This led to the idea of organising an Energy Fair to which relevant organisations would be invited to come and demonstrate appropriate products to the villagers. All parties liked this idea.

A one-day Energy Fair was organised at the PARDYP field office at Maina Pokhari (Kavre VDC) on September 9th 1998. Fourteen relevant manufacturing and retail institutions participated in the fair—most exhibited their products and sent a representative, while some just sent products.

There were 17 technologies on display. They included:

- solar technologies —solar parabolic/box cookers, solar home systems, a solar lantern, a solar low-head water pump, and two types of solar dryers;
- hydropower—peltric set, improved *ghatta*, rice cooker *'bijuli dekchi'*;
- biomass stoves—rice husk stove, metal stove, improved mud stove, *hutaram 'chulo'* stove; and,
- others—corn sheller, basket *'dalo'* thermos, sprinkler, self-help drinking water intake, barbed wire, wire wrench.

Posters, pamphlets, booklets, and photographs of the technologies were displayed and distributed. More than 600 people visited the Energy Fair, and interest was so high that demonstration of the RETs was continued for several more days than originally planned. Residents showed considerable interest in acquiring some of these technologies during the fair. Amongst others orders were given for for 23 solar box cookers, 23 solar home systems, 11 sprinklers, and 6 corn shellers.

The Energy Fair was an excellent opportunity for the people in the watershed to observe different kinds of energy technologies and to gain first hand information from the manufacturers and promoters. Villagers were most interested in those technologies that provided immediate returns and were user friendly; they were not so good at assessing technologies whose benefit would only become apparent after a longer period of time. The demand for solar home electricity systems was also quite high as many villagers wanted to install a television set.

The Community's Perception of RETs

General feedback from the community suggested that most RETs were out of reach of poor and marginal people even with government subsidies. The following arguments underline this.

- There were no government subsidies available for solar home systems (SHS) in Dolakha district because this district is considered to be accessible by road and electricity. The research facilitator persuaded the Alternate Energy Promotion Centre (AEPC, responsible for allocating government subsidies for SHS), to allow a subsidy if there was a demand from Yarsha for more than 10 solar home units. However, the cost of one SHS unit to a farmer even after the 50 per cent government subsidy is NRs 17,000 and this is beyond the means of lower income group households.
- Another viable option for lighting in Yarsha is a peltric set. On average, a household has to bear more than NRs 5,000 of the cost of such a set. This is equivalent to using a wick lamp for 10 years for lighting at an average consumption of three litres of kerosene per month. Thus this technology is considered uneconomic, and is also out of reach of the poorest sections of the community.

- Family-sized biogas plants are a feasible option for middle income groups in villages like Namdu, Mirge, and Gairimudi. The installation cost of a small size plant is about NRs 10,000 after the flat-rate government subsidy of NRs 10,000.

The above-mentioned technologies are suitable for households that are concerned about their quality of life and are willing to save energy and reduce the drudgery of women and children. Most poor people were more interested in RETs that can provide opportunities for earning income (e.g., crop dryers). They believe a decent income must come first before they can consider a cash outlay to improve their living conditions.

Promoting Selected RETs

Improved Cooking Stoves

During the process of needs identification and the motivation and awareness campaign, community members, particularly women, expressed a strong desire to install improved cooking stoves (ICS) because of the fuelwood shortages, which have been exacerbated by the restrictions imposed by the community forestry programme. Women of poor households who do not have trees on their farmland are the main victims as they have neither the capacity to buy fuelwood nor sufficient farm residues and animal dung. Women were convinced that the installation of an ICS would save fuelwood, remove smoke-related problems, and reduce the drudgery of collecting fuelwood from far-off government forest. The installation of an ICS was seen as a priority in most communities in the middle and lower settlements of the watershed where fuelwood availability is a real problem.

In response to these needs, a four-day training programme was organised on the installation of ICSs. Four women were trained, three of them members of FUGs, and one from a savings and credit group (SCG). Soon after completion of the training programme, the trainees became trainers. Each built one stove in their own house as a demonstration unit, and then began installing stoves in different communities in the watershed. The four trained women have reported that requests for their skills have come from different FUG groups, and even from outside the watershed. This reveals the high demand and indicates that this improved technology should be disseminated. The Rural Energy Development Programme Office (REDP) of Dolakha District has committed itself to providing technical backup support and services.

Energy Saving Devices

Improved Wick Lamps

Most people in the watershed use a traditional wick lamp for lighting, which gives poor illumination and emits smoke. Some teashops in Yarsha are using an improved wick lamp that provides more light, emits less smoke, and is more fuel-efficient. The research facilitator demonstrated some improved wick lamps from Jiri and Charikot at the PARDYP field office;

after this demonstration some villagers purchased these lamps at NRs 60 each. In response to the interest shown by the villagers, arrangements were made with a local shop owner in Mirge village to keep these lamps for sale.

Rice-husk Stoves

Two types of rice-husk stove were demonstrated during the Energy Fair, one developed by the National Agriculture Research Council, the other a model available in the local markets. Some villagers wanted to purchase the latter, and five rice husk stoves were distributed.

Sprinklers for Irrigation

Low-head sprinkler systems were one of the most popular of the labour saving devices displayed during the Energy Fair. Although vegetable growing has been promoted by different agencies, sprinkler systems had not been demonstrated. Farmers are increasingly interested in vegetable production in Yarsha for reasons of income. Demand for sprinklers was high, and the researcher facilitated distribution at cost price and made arrangements with some shopkeepers in Charikot to keep these units for sale. The villagers were informed that they can now buy these units in Charikot (36 km from Maina Pokhari, Yarsha - about 1½ hours by bus).

Demonstration of a Baby Hydro Unit

This is a simple device which employs a bicycle dynamo coupled to a metallic runner and can operate 2 torchlight bulbs and a small cassette player or radio. Water from a drinking water tap with a gross head of 16m can operate the system. This device from the CRT/N costs NRs 1,500 perunit. The unit was demonstrated in Mirge and Gairimudi. Many villagers were interested in installing the units, and CRT/N has agreed to make them available.

Demonstration of Solar Devices beyond Yarsha Watershed

CRT/N and Jiri Technical School organised an additional one-day solar exhibition at the Jiri Technical School with support from SDC. People from around Jiri and from Yarsha visited the exhibition.

Ensuring Sustainability of the Energy Programme

The lead role in most of the activities described above was taken by existing institutions, like the FUGs and credit-saving organisations, and by the communities themselves. The research facilitator was instrumental in establishing linkages between the communities, these local-level institutions, and district-level institutions. The Rural Energy Development Programme (REDP) of Dolakha District has the mandate to promote and disseminate RETs and has assured local groups and communities that they will provide technical backup and assistance in obtaining subsidies from the government. The CRT/N also agreed to provide any support required through the PARDYP Field Office. The energy programme in Yarsha will only be sustainable with support from REDP, Dolakha and PARDYP staff. Maintaining contact between the PARDYP Field Office, the resource organisations, and the local-level institutions and communities will be crucial.

Lessons Learned

The community-based energy planning and management activity that was pursued in Yarsha was a useful learning experience for ICIMOD's energy programme, and helped create awareness about energy related issues both within the PARDYP project team and within the watershed and beyond. It also provided an insight into appropriate methodological approaches for carrying out such programmes.

Establishing good rapport with communities is never easy, and it took some time for the research facilitator to understand the community dynamics and to build and win the confidence of the villagers. This task is made more difficult by the fact that energy issues impinge more on women than on men, and that males move seasonally to urban areas for jobs and extra income. Once good community rapport was built, however, the process of participation progressed smoothly. It is very important for a research facilitator to be calm, patient, persuasive, and results-oriented.

The community-based energy planning and management approach employed proved to be an effective mechanism for bringing together different stakeholders—villagers, researchers, extension workers, promoters, support institutions, manufacturers, and experts. Once different stakeholders enter into an open dialogue, misinformation and suspicion among stakeholders are reduced, and an approach can evolve for managing and maintaining rural energy systems on a sustainable basis.

Women's life tends to be one of drudgery, with 12-15 hours of heavy work per day, thus it was very difficult to convince women to participate in an energy programme which focused primarily on improving living standards. There is a crucial need to identify renewable energy technologies that can reduce women's actual workload, as well as help them to increase cash income. For this to happen, there is a need to examine the potential for diversifying economic activities while providing energy for value addition activities.

The work carried out in Yarsha helped both community members and the research team to enhance their knowledge, skills, and awareness of RETs. For example, the women in Yarsha measured fuelwood with a spring balance for the first time, recognised the quantity of fuelwood consumed per meal, and viewed and understood different energy-saving devices like solar cookers, solar electricity, and peltric sets.

The survey was an excellent tool for identifying the problems, priorities, needs, and aspirations of the communities, and the presence of a research facilitator assisted communities in solving problems by themselves. The Energy Fair was a most effective way of marketing and promoting technologies in a short period. The research facilitator also played an important role in narrowing the gap between communities and the support or line agencies.

The Yarsha experience shows that, if properly planned, community-based energy planning and management activities need at least one year to have a substantial impact. For example, it took three months for women to take up the improved cooking stove programme seriously. Initially the process is slow but adoption accelerates if the technology is appropriate–and that is the key to success. Especially for the poorer sections of the community and women the technology must be user friendly, of immediate benefit, sustainable, and socially and environmentally appropriate.