

NDIRANDE NKHUNI BIOMASS BRIQUETTE PROGRAMME

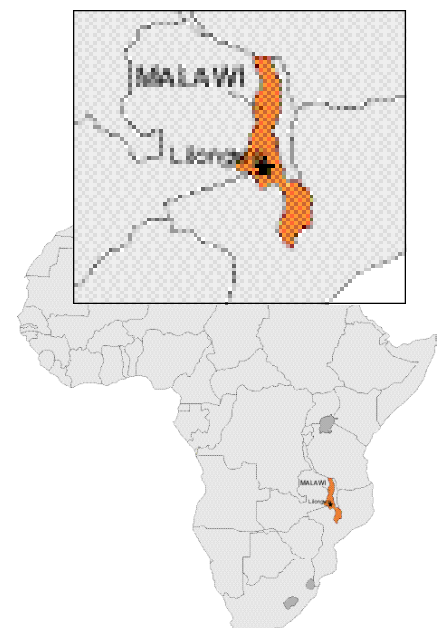
MALAWI

MALLA MABONA

The Ndirande Nkhuni Biomass Briquette Programme was initiated by the Nkhomano Development Centre, a non-governmental organization (NGO) active in natural resource management and conservation. The project was conceived following a 1996 study conducted in Blantyre City which revealed critical deforestation of the Ndirande mountain forest reserve due to fuel wood gathering and timber pole harvesting.

With the financial support of the Canadian Government, a project was initiated in April 1998 to produce briquettes from wood and paper wastes, agricultural residues and other biomass materials. The project was designed to address deforestation by providing alternative sources of energy, thereby reducing people's dependence on charcoal for fuel and allowing for regeneration of the Ndirande mountain reserve. It was also expected to allow the women involved to earn incomes, and to promote waste management through recycling of paper, sawdust and other waste materials.

The programme was intended to equip the women of Ndirande Township with the ability to produce, use and market biomass briquettes. The project engaged a wide selection of individuals and community development institutions in providing technical assistance for biomass briquette production activities. Learning from a prior UNDP-funded biomass briquette project, this programme emphasised the participation of women in project and equipment design, and in the development of a comprehensive marketing plan.



Malawi has experienced serious deforestation, primarily as a result of household use of wood and charcoal for fuel, as well as land clearing for agricultural expansion. About 90 per cent of the country's energy demand is met using wood fuels gathered from natural woodlands and forest plantations, many of which are state owned.

While demand for wood in Malawi keeps rising, wood supplies are limited. The Department of Forestry estimated that the fuel wood deficit from 1983 to 1990 rose from 1.6 to 4.6 million cubic metres and the projected deficit for the year 2000 is 7.8 million cubic metres. Since less than 5 per cent of the population has access to electricity, biomass is used to meet the greater part of domestic energy demand. Although some rural electrification has been achieved, the overall situation remains one of unfulfilled expectations due to limited resources.

Since Malawi's multi-party general elections in 1994, there has been an increasing political commitment to support women's rights and participatory democracy. This has provided a conducive environment for engagement of civil society in supplying energy technologies for the rural and urban poor.

The introduction of favourable government policies on decentralisation, forestry, energy and the environment led to the establishment of institutions at the district and community level intended to promote stakeholder participation. These policies have provided a much-needed political commitment to the involvement of communities and the private sector in forest conservation, management and use. In addition, a gender policy was adopted in 1999 as a means of ensuring that grassroots women and men benefit equally from development activities.

The general policy shift has been towards sustainable use of natural resources while ensuring sound environmental practices. The government also recognises that energy plays a major role in the social and economic development of the country. Current policies are meant to satisfy diverse and changing needs for forest goods and services, particularly among disadvantaged rural people.

Women are considered to be the most vulnerable group because they have to travel long distances to fetch fire wood. The responsibility for collecting household fuel in Malawi lies almost entirely with women and any changes in energy policies therefore directly affect women more than men.

Prior experience with biomass briquettes

An earlier UNDP-funded effort to promote biomass briquettes provided important lessons for the Ndirande Nkhuni project. The UNDP-Malawi Biomass Briquette Efficiency, Marketing and Training Pilot Project (BBEMTP) was implemented between 1992 and 1997. The objective was to provide extension services and training so that women could learn how to make briquettes for their own use and for sale to others. The project targeted women as beneficiaries, and a few officers from gov-

ernment, donor agencies and NGOs as facilitators.

The project was implemented by Stanlinks Organization, an American NGO, in three pilot districts: Mchinji, Lilongwe and Mangochi. The biomass briquette press used in the project was developed in the United States by the Forestry Products Research laboratories of the University of Washington and was adapted by the Malawi Industrial Research and Technology Development Centre in collaboration with Stanlinks.

An evaluation of the pilot project was undertaken in 2000 in order to assess the usefulness of the adapted briquette press, and to consider the appropriateness and business feasibility of briquette making as an alternative source of household energy and additional income. The project, being the first of its kind in Malawi, provided useful information on the potential of briquette production for income and energy. The evaluation identified project design weaknesses and lack of market development strategies as factors that contributed to the low field and market penetration of the briquette technology.

This earlier project was initially designed to meet needs for both household energy and income generation. During implementation, however, there was no marketing strategy to promote sales of the briquettes for use outside the producer households. Moreover, potential customers in the rural areas chosen for the pilot project could still obtain wood without cost, but would have to pay for the briquettes. Sales, therefore, were low and briquette making did not generate much additional income for the targeted women and their households.

Beyond problems relating to the selection of project locations and lack of marketing mechanisms, the project also encountered difficulties related to poor trainee selection, differing expectations between service providers and trainees about the purpose of the training, the low social status attached to biomass briquettes, and a weak entrepreneurship culture among women in Malawi. Although nearly 200 women entrepreneurs were trained, over 80 per cent of them have abandoned the technology.

The Ndirande Nkhuni programme was designed to avoid the sorts of difficulties encountered by the UNDP-funded project. Its executive director is a graduate of the BBEMTP project, and has incorporated lessons from the prior experience in refining implementation and management strategies. Table 1 shows the main lessons identified in the UNDP-funded programme and how they have been addressed in the Ndirande Nkhuni programme.

Ndirande Nkhuni Project

Ndirande is a densely populated low-income squatter area, the most heavily populated location in the commercial City of Blantyre. The project was introduced as part of the general community development activities in the area. It is being managed and supervised by local community development committees in Makata, Gamulani and Matope that oversee all develop-

Table 1: Comparison of the UNDP-funded biomass briquette project and the Ndirande Nkhuni programme

LESSONS/GAPS	UNDP-FUNDED PROJECT (1992-1997)	NDIRANDE NKHUNI
Needs assessment	No evidence that a needs assessment was done.	A participatory needs assessment was done and women identified lack of energy sources as a problem.
Project site selection	Project sites located in rural areas where fuel wood was not a crisis yet, but scarce income was major problem.	Located in urban poor locations (squatter areas) where both lack of income and energy are problems.
Trainee selection and group formation	Project selected existing women's groups formed with the sole objective of income generation.	Self-selected women groups with dual objectives of raising income and obtaining energy.
Additional burdens on women	Project targeted rural women who were already overwhelmed with individual household and community chores.	Urban women were targeted, who have fewer labour-intensive activities than rural women.
Market orientation	No cohesive and comprehensive marketing strategy.	Market development is a comprehensive component of the project.
Policy environment	No government policy on renewable energy sources.	Government sustainable renewable energy sources strategy is in place.
Technical barriers	Follow-up and monitoring was weak due to varied expectations from trainees and extension workers.	Strong monitoring component.
Unclear expectations	Project team expected women to use briquettes for household use, women expected also sales.	Realistic expectations about fuel use and income potential.
Stakeholder participation	Women only targeted as beneficiaries.	Women participate in project design and needs identification.
Donor involvement	UNDP only.	Multiple involvement.

ment activities in the townships, including complementary projects relating to water and education.

The project design integrated income generation, provision of an alternative source of energy, and waste management as key areas for intervention. It began with a comparative analysis of different types and sources of energy, including labour and time requirements, and a cost/benefit analysis with respect to each source.

Under Ndirande Nkhuni, women were given a chance to choose the type and design of the technology. This has allowed the women to acquire equipment that is easy to maintain because spare parts are easy to get and inexpensive. When

these machines completely break down, local artisans who have been trained by the project can fabricate new equipment locally.

The wooden briquette-making machines were designed for women producers. Because the machines require only a small capital investment, have an acceptable production capacity using minimum physical effort, and can be locally maintained, they are financially and technically appropriate.

The strategic location of the project in a city suburb meant there was a readily available market for the briquettes beyond household usage. A variety of entrepreneurial activities take place within the city, including food vending and small-scale

RECIPE FOR PRODUCTION OF BRIQUETTES

The main ingredients of biomass briquettes are waste paper, agricultural waste (such as straw or crop residues) and sawdust, which acts mainly as a binding agent.

Women collect the paper and agricultural wastes or buy them from companies in the surrounding industrial area. Then the materials are soaked in water for about 24 hours to allow them to absorb water for easy pounding into pulp.

The pounding takes two women about one hour. Sawdust is added during the pounding phase for bonding and for improving the consistency and texture of the briquettes.

Once the paste is ready, handfuls are scooped into the presser for pressing. The amount that is hand-scooped is based on an estimated size of the briquette. The paste is pressed until all water is out and the briquette is firm and strong.

Finally, the briquette is removed from the presser and spread over a flat surface (mats, ground, roofs and racks) for sun drying. On hot and sunny days the briquettes take about four days to dry (or a week or so if it is cool and cloudy).

The resulting product is cheaper to use than firewood. A well-cooked *nsima* (thick porridge), the main staple food in Malawi, generally requires more than four pieces of firewood, at the cost of between MK2 and MK4 each, for an average family. The same meal can be prepared with just one briquette, at a cost of MK3.



businesses that depend on energy sources. The aim was to keep the total cost of the briquettes lower than that of firewood and charcoal.

The project specifically targeted women, although some men do participate in the project. The women were organized by the community development committees into operational groups of 10 women called "zones." The zones are responsible for the production, processing and marketing of the briquettes, and the management and maintenance of the briquette pressers. The men taking part in the project are not assigned to specific zones, but are floaters whose main role is to provide advisory services. Children, both boys and girls, mainly assist in the selling of the briquettes after coming back from school.

Each zone has an elected committee and a code of conduct. Within each zone a disciplinary subcommittee has been created to look into implementation of the code of conduct and disciplinary issues. This subcommittee lays down rules and regulations to govern the group and is responsible for conflict resolution. This has led to group cohesion. At regular meetings, the women monitor their activities and account for the funds realised through the sales of briquettes.

Stakeholder participation

Besides engaging women's groups in the design of the project and the equipment, the project mobilised support from the City Assembly, local development committees and the private sector.

As an entry point, the project worked with community development committees and provided training to 45 committee members on how to use the briquette-making technology, and on the advantages of briquettes over fuel wood and charcoal. With the help of project personnel, the community development committees then mobilised and trained 21 women's groups with a total membership of 270. Following the training, consultations were held with local leaders, with the assistance of the trained community development committee members, to introduce this new technology.

The project's approach involved the stakeholders in analysing the merits and demerits of each energy source in order to promote acceptance and usage of the biomass briquettes. The women also were involved in designing project activities. The committees worked with the women to plan how they were going to implement and sustain their project, while the project officer from Nkhomano facilitated the process.

The private sector has also been involved. For example, the wood products manufacturing industry is ensuring that women have access to sawdust, a major raw material in the production of briquettes. While initially these companies were giving away the sawdust, they are now charging an affordable price of MK0.50 per 50 kilogramme bag of sawdust. Other private companies provide waste paper, another ingredient in the briquette production process.

The women have complete control over the technology. Production levels depend on their time input and the availability

ty of raw materials. Decisions about when to start producing and when to stop, as well as decisions on benefit sharing and use of funds, also rest solely with the women.

Benefits to women

The benefits from the biomass briquettes include access to a source of energy, income generation, and reduced time and distances travelled to obtain fuel. Besides earning income, women reported that they have also benefited socially as they are able to mix and interact more freely. They no longer walk long distances for fuel, hence they have more time for their families and domestic work.

Above all, the involvement of family members — the boys and girls in making and selling the briquettes, the men in promoting marketing and raw material collection—has led to the success of this project. The monetary benefits of about MK400-500/week (US \$5.30 to \$6.60) generated by the groups have led to greater support from husbands who appreciate the additional income. Within the groups, the women themselves equally share the benefits of production of briquettes. Decisions on how to spend the money at the household level also lie with them, although this could change if the groups begin to generate substantially more money.

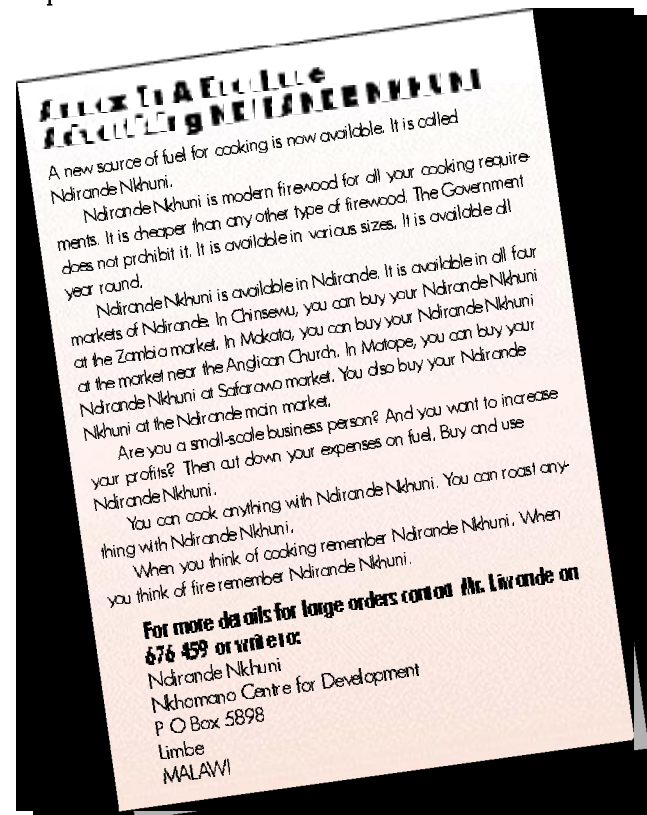
The free training and technology provided by the project represent additional benefits. The training in briquette-making focused on women for the sole reason that they are the main users of household energy. Women's groups have also been trained in maintenance skills, entrepreneurship and business management. The women have in turn offered training in these skills to other women outside the impact areas at a fee they negotiated themselves. Over and above the 270 women who were originally trained, an additional 30 women have acquired briquette-making skills from these women—a sign of local technology and knowledge transfer.

Income-generating activities

Most Malawi women lack the sort of empowerment, most notably economic empowerment, that would give them a voice in decision-making, both inside and outside the home. The limited participation of women in economic activities has been recognised as a major factor that contributes to their marginalisation. To address this problem, the entrepreneurship approach has been key to briquette-making in Ndirande. Focusing on provision of household energy alone was not attractive to participants.

The Nkhomano Centre for Development has focused on high-quality production of the briquettes to promote their acceptance and use, and has worked to create markets so that the women can generate more cash proceeds. The price of briquettes has been kept low by increasing the supply. But unlike

the UNDP pilot programme, where supply was increased by increasing the number of producers, the current programme has limited producers and increased per-woman briquette production. In a related project being implemented by the Paper Making Education Trust of Malawi (PAMET), the per-woman per-day briquette production is between 100 to 150 while under the Ndirande programme it is 300 to 400. In the PAMET programme each briquette costs MK1.50, about three times the cost of the Ndirande briquettes.



Financial and practical viability

A project assessment revealed a number of key market-based factors that have contributed to the success of the programme, including its commercial orientation and identification of existing marketing opportunities, its ability to provide additional income, its use of appropriate technology, its emphasis on cost recovery and reinvestment, its partnerships with local committees and private companies, and the ready availability of raw materials.

The project operates like a business and responds to market forces of demand and supply. The women ensure that they cover the costs of production, which are currently at around 50 per cent of the selling price, so that they can make a profit.

Existing suburban community problems like the scarcity

and expensiveness of firewood and charcoal and hydro-electricity have been converted into market opportunities. Proximity to markets has been crucial to sustaining the programme and will remain so in the foreseeable future. For example, the women have opened briquette kiosks in open produce markets in four townships in the city where they regularly distribute briquettes. While these kiosks are not open full time, they have contributed to the success of the programme. The women regularly organize market shows where they promote use of briquettes through demonstrations. The Nkhomano Centre for Development helps to organize these events and to produce leaflets for distribution.

In addition, the project has adopted a “process hidden-product promoted” approach, which has ensured that only women who were trained and organized in the zones know the production process. Keeping the production process secret helps remove the negative attitude among Malawians about using paper and agricultural wastes to produce energy.

The project has made sure that the women are linked to raw material suppliers and that they are fully recognised by development agencies in the area. This ensures that the women's voices are frequently heard. Given the proximity of the project to main industrial areas, supplies of waste paper and sawdust

are readily available and transport is easily affordable out of the proceeds of briquette sales. The project has also created some additional revenue for wood processors, who are now selling sawdust to the women. This has created a positive relationship with the private wood industry.

Environmental protection

The primary environmental benefit from the project is that deforestation has been slowed to some extent. There has been some regeneration of the Ndirande forest reserve, which is one of only two public forest reserves in Malawi. The high awareness level created by the project and the active involvement of the community members are key to the community's commitment to environmental protection. Both men and women see a direct benefit from this project in terms of reducing deforestation.

The project is also contributing to the cleanliness of the city by utilising waste products, which may ultimately reduce the city's expenditure on waste collection and disposal. While this impact is not substantial at the moment, it could become more significant if the programme expands.

LESSONS AND CHALLENGES

Active community participation and a sense of local ownership have been crucial to acceptance of the project. The group approach has been a successful way of creating efficient production units, and the project has been very effective in providing training and guidance to producers, as well as marketing support to promote use of the briquettes.

One of the problems faced by the project, however, is that it has not been as successful in ensuring that all the women make a significant amount of income, especially where production levels and profits are small. Because the wooden press currently being used by Ndirande women is labour intensive, requiring about three or four women to operate it, production is quite low. In the long-term, the income potential of briquette-making using this equipment might not be sufficiently attractive to the women. There is a better (but four times more expensive) press used by PAMET, which requires only

two women to operate. Meanwhile, the Malawi Industrial Research and Technology Development Centre is currently developing a press that would produce six to 10 briquettes at once, to increase the productivity of the technology. This would make the production process more profitable for the women.

In order to support the project activities, there is currently a transport subsidy provided for the provision of raw materials. Ultimately, subsidies distort calculations of production costs of the briquettes and undermine the viability of the briquettes as a business.

In addition, experiences in other income generating programmes that target women show that the group approach works better if a savings and credit component system is included in the programme. This needs to be looked at in the Ndirande Nkhuni programme.



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MULTIFUNCTIONAL PLATFORM FOR VILLAGE POWER

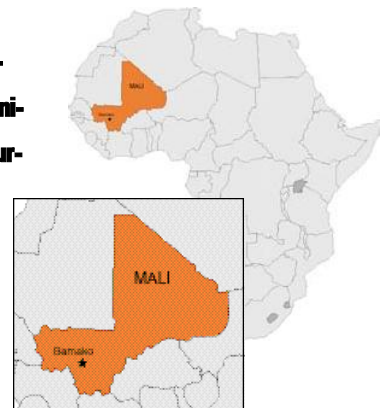
MALI

NALINI BURN AND LAURENT COCHE

The Mali multifunctional platform project provides decentralised energy to rural villages in response to requests from women's associations in these villages. The platform consists of a small diesel engine mounted on a chassis, to which a variety of end use equipment can be attached, including grinding mills, battery chargers, vegetable or nut oil presses, welding machines and carpentry tools. It can also support a mini grid for lighting (150-200 bulbs) and electric pumps for a small water distribution network or irrigation system. The configuration of equipment modules is flexible and can be adapted to the specific needs of each village.

The project was originally developed through a United Nations Industrial Development Organization/ International Fund for Agricultural Development regional project in Mali and Burkina Faso from 1994 to 1995. In 1997, UNDP and the Government of Mali began providing support to existing platforms, recognising the project's potential as an engine of development and poverty reduction for the community as a whole. After a participatory evaluation exercise was undertaken in 1998, the new project was formulated in 1999, with an expected duration of five years.

The goal of the current project is to install 450 platforms, serving 10 per cent of Mali's rural population, of which at least two-thirds will be equipped with water and electricity distribution systems. Through these platforms it is expected that approximately 8,000 women in rural areas will have access to improved community services and opportunities for micro-enterprises. At least 10 manufacturers and 45 technicians from the private sector will be trained to handle all technical aspects of the platforms. Increased income generating activities are anticipated, including oil extraction, production of food pastes and shea butter (used for skin creams and chocolate), soap manufacturing, and extraction of jatropha oil. Oil from the seeds of the jatropha shrub can be used as fuel to run the engines, and is expected to be used in at least 15 per cent of the installed platforms. At the end of the project, all activities are expected to have been taken over by a network of private technicians and financial partners.



Mali is one of the poorest countries in sub-Saharan Africa. Over 80 per cent of Mali's nine million people live in rural areas in about 11,000 villages, most of which are remote and isolated. The average size of a village is about 1,000-2,000 inhabitants. Rural transportation and communications networks are very weak. Because of the small size and dispersed locations of the villages, grid electrification is non-existent, and decentralised mechanical and electrical energy supply is the only viable option. At this stage, however, there is still not a clear energy policy for bringing decentralised power to rural areas. In urban areas, the central grid uses a mixture of hydro power and imported diesel energy. Even in urban areas many people cannot afford, or have no access to, centralised grid electrification.

At present most of the energy expended in rural areas is human energy, primarily that of women engaged in small scale agriculture or livestock production, as well as basic subsistence activities. Women expend time and energy collecting firewood and processing biomass for fuel, drawing, transporting, storing, and distributing water, collecting "wild" resources such as shea nuts, seeds, plants, and processing food and beverages. This use of female energy is still largely invisible to energy and environmental analysts and planners.

Women's work is physically arduous and time consuming and is characterised by multiple, repetitive and frequent tasks, particularly in post-harvest food processing (grinding, de-husking, and oil extraction), and in water transport and distribution. The use of private grinding mills can save some time, but even when mechanical equipment is available in the household it is generally used by men, and women have no access to it. When activities become mechanised or income-generating, the tasks which were previously seen as appropriate for women tend to be taken over by men.

The fundamental energy need for poor rural women in Mali, as in much of sub-Saharan Africa, is to find appropriate and affordable substitutes for their own energy, so that they can engage in activities that generate income, and that provide benefits for themselves and for others. The compelling nature of this need for energy is what drives interest in the platform at the village level. The platform project is not supply driven; it is user or demand driven. Requests for the installation of platforms are numerous and come from both women and men at the village level, because of the perceived savings of time and energy for women.

Project design

The platform was purposely designed to take into account the multiple end uses for energy in rural economies, and to provide a substitute for human energy. The small Indian-made Lister diesel engine is widely available throughout rural Africa and it is often used by private millers for grinding grain. When mounted on a platform, the engine's uses are flexible and mod-

AVANT LA PLATEFORME MULTIFONCTIONNELLE

BEFORE THE MULTIFUNCTIONAL PLATFORM

ular. The platform can be fabricated by artisans using locally available parts, and maintained by local mechanics. The project aims to bring together local supply and demand, as well as to build and strengthen local capacity to install, maintain, operate and manage the platform and the equipment.

The fixed costs of the engine can be recovered through fees on a variety of services provided by the platform. Different end use equipment can be used either simultaneously or sequentially. For example, one platform can at the same time run a mill rated at 150 kilogrammes per hour, a water pump with a capacity of one to eight cubic metres per hour, and a battery charger, as well as provide electrical power for 135-180 25-watt

APRES LA PLATEFORME MULTIFONCTIONNELLE

light bulbs. Some uses, such as rice hulling, running mechanical saws and welding, cannot be combined with other uses running at the same time. Different combinations of end use equipment are possible depending on seasonal and daily requirements, and different modules can be acquired over time to meet changing or expanding needs.

The broad intervention strategy of the project has been guided by the twin objectives of providing a decentralised and sustainable energy supply, and ensuring that the energy supply is used and controlled by women.

From the outset, the project has focused on alleviating energy poverty, and on generating the means to reduce the

income poverty of both women and men. It has targeted women as prime beneficiaries because energy poverty specifically affects women, due to the nature of gender relations. In response to requests from villages, the project's approach has been to make it a condition that the platform be managed by a women's association. Training is then provided to a women's management committee in literacy, bookkeeping, management and maintenance.

The entry point with the male village chiefs is simple and persuasive: since it is solely women who perform grinding, hulling, and water collection, this equipment has to be their property and under their control. The rigidity of the gender division of labour can be used tactically to women's advantage in this case. Women then effectively become energy entrepreneurs, selling energy services to both women and men clients. Men, for example, might purchase energy for charging batteries, welding, or pumping water for construction projects or raising livestock.

Since the pilot phase, the project has taken a decentralised approach to its intervention support. It has set up decentralised units in four zones of Mali, in Sikasso, Bougouni, San and Mopti-Sévaré, where the national coordinating unit is also located. All the support activities to villages are provided through these units.

Evaluation of the pilot project by participants

In November 1998, at the end of the pilot phase, the project engaged in an extensive participatory evaluation, primarily among users in five villages, to determine the strengths and weaknesses of platform operations and to reassess the project's objectives and strategy.

The evaluation showed that there is a need to be able to assess more accurately the financial, economic, social and technical feasibility of installing a platform in a particular village. The idea is not so much to encourage acquisition but to enable prospective users to make informed choices about the technology. Potential users need to determine whether the equipment is currently affordable and whether it can provide the outcomes and impacts desired. A minimum level of anticipated use and revenues is required to make the investment affordable.

The evaluation also revealed a need to develop village-specific methodologies and tools because village contexts vary significantly enough to affect the outcomes of feasibility studies, and thus assessments of the viability of individual platforms.

The reliability of energy production emerged as a general problem. In many cases, problems with breakdowns and the duration of downtime were major preoccupations because of difficulties with transport, communication and availability of reliable and efficient repair and maintenance technicians. Despite these problems, over 80 per cent of the 45 platforms installed before June 1999 are still operational. The evaluation

AFTER THE MULTIFUNCTIONAL PLATFORM

also uncovered an additional 19 platforms installed in the Sikasso area without project intervention by private artisans trained by the project.

The users and project staff involved in the participatory evaluation found three elements to be crucial for enhancing project results.

The first was to strengthen institutional capacity all along the line, including among the end use clients, the women's associations and management committees, as well as among the project staff and network of partners. Capacity building is particularly needed regarding the ability to make decisions

based on timely and accurate information, to implement those decisions, and to track progress on the expected results. This capacity building is required both for competence building among platform operators and users, and for consolidation and reinforcement of a network of civil and private sector partners.

The second element concerned revenue — increasing and diversifying energy sales and enhancing the energy clients' ability to pay for energy services by increasing the income-generating potential of using the platform's end use equipment. Due to the income poverty in the villages, the platform's services are needed to release the time to generate income, and at

The artisans have all tended to be men, despite efforts to recruit women. Some rural training centres now train a few women, who may be able to become artisans. Operators and managers of platforms are women.

the same time income is needed to pay for the energy services.

The third element involved reducing costs while maintaining platform effectiveness and increasing the reliability of energy supply. In particular, high transport and communication costs can reduce financial and operational viability. The project has responded to this by attempting to establish supply zones, replying to requests in geographically circumscribed areas rather than those scattered over vast distances. Since June 1999, regional support and advisory units have been reinforced to make them more responsive to local conditions and better able to act as market-making intermediaries between the women running the platform enterprise and a network of financial, technical and commercial suppliers. The costs of financial, technical and commercial services to the platforms can then be supported by a larger number of platforms in a cluster of villages. This concentration of platforms also makes it possible to set up a system of preventive maintenance to reduce downtime and ensure technical sustainability.

Stakeholder participation

The relationship of the project to the two levels of clients—those who purchase the platform, engine and equipment and those who are the end users of the equipment—is now more firmly seen from the outset as a contractual relationship. The contract establishes a collaborative relationship among the project staff, the different clients, and their partners over three broad phases of intervention lasting around two years on average: the feasibility decision making phase; the installation phase; and the operational phase. The capacity building and close support is concentrated in the earlier phase, progressively fading out until the women's energy enterprise can be autonomously managed and a network of private suppliers and partners has been established.

The project only responds to requests for acquisition of platforms from women's associations.

Before a platform is installed certain criteria must be fulfilled: the economic, social and technical feasibility study results have to be positive; the portion of the equipment costs to be paid by the village has to be mobilised; and a woman's management committee has to be appointed by the women's association. At the installation phase, training and technical support is given to the management committee, teaching members to operate the platform, keep books and accounts, and perform simple maintenance. All services required by the platform—including installation, repair, and maintenance—are handled by the private sector and paid for by the beneficiaries. Throughout the feasibility, installation and operational phases, training and follow-up activities take place in the villages, coordinated by project staff.

The support and advisory units based in Sikasso, Bougouni, San and Sévaré are responsible for leading villages through all the stages of the platform process, from the initial feasibility

study to the installation and management of the platform. There is a unit head plus a technician and at least two village level facilitators per unit. Their mission includes helping women to organize themselves into groups, training managers and operators of the platform, verifying orders and installation of the platforms, and assisting clients in fulfilling bank loan conditions.

At the national level, a coordination unit is based in Sévaré to monitor and evaluate the advisory units. It is also responsible for overall programming, management and implementation of the project's field activities, including financial and purchasing activities, for training activities, and for collecting and analysing data. This coordination unit is supervised by a national coordinator, who prepares work plans and budgets and presents progress reports every three months. The staff includes two socio-economists and an engineer.

The national coordinator represents the Government of Mali in the project and is accountable for its overall financial and strategic management. She is also responsible for coordinating the project's activities with government policies and other donor programmes. She is the facilitator of the coordination committee, which meets twice a year to discuss ongoing activities, results and problems encountered. This committee is composed of all the partners of the project, national organizations concerned with project activities and interested donors.

Financial mobilisation and access to credit

The project has an overall budget of about US\$2.5 million provided by UNDP, with co-financing by the Norwegian Government. Up to now it has mobilised local partnerships to finance platforms and training costs, involving non-governmental organisations (NGOs), other donors, the private sector, social clubs and a few individuals. Grants from development agencies, either multilateral or bilateral, are the foundation upon which further resources are mobilised. One of the innovative methods developed by the project has been to use the Internet to find partners for villages. A web site is currently under construction that will enable potential global benefactors to target particular villages, an entire platform, or any combination of end-use equipment.

The project provides grants of up to \$1,500 for platforms, and up to \$10,500 for mini electric grids or mini water networks, provided they are deemed to be financially viable. Without these grants, the women's associations would not be able to afford to purchase the platforms. The size of the grant for a particular village is determined after taking into consideration the cost of the basic modules and the village's ability to mobilise capital for purchasing a platform.

The women's associations that purchase the platforms finance on average between 40 per cent to 60 per cent of the total equipment costs of the platform, and pay for all the maintenance and operation costs.

The project has no line of credit. Up to now, project staff have concentrated on producing feasibility studies to convince financial institutions of how bankable the platforms are. The regional support units can sometimes act as intermediaries in approaching local banks and other financial institutions, providing assurances about platform enterprises on the basis of feasibility studies and collaboration contracts, and helping to reduce the transaction and information costs that often deter risk-averse banks from providing loans for these purposes.

The project management is currently exploring the possibility of negotiating a loan guarantee fund and drawing up a framework agreement with national rural credit unions and savings and loan societies such as the Nyésigiso in Mali.

At this point, if credit is available to the women's committee as an economic entity, it is usually through a village associa-

tion, and depends on the latter's willingness to obtain credit on behalf of the women's committee, as well as on their own creditworthiness. Generally the platform project suffers from the overall weaknesses of the financial system in rural areas. Where credit is developed at all it is in areas where there are traditional cash crops and the system is very much tied to financial cycles linked to agricultural seasons.

The issue of collateral requested by banks also poses problems relating to who actually owns the enterprise. There is a need to tighten up the legal framework in rural areas where the concept of formal individual ownership is not the norm.

Generally only the more well-endowed villages or women's associations are likely to be able to obtain project loans. The modular nature of the technology, however, means that everything does not need to be paid for at the same time, and that

EXAMPLE OF ACTUAL USAGE PATTERNS IN KONDOGOLA, SAN SUPPLY ZONE, OCTOBER 2000

Number of women customers	843.0
Number of men customers	4.0
Number of machine hours	133.25
Number of machine hours per day	4.3
Average number of customers per day	27.0
Time use of machine per customer (minutes)	9.4
Revenue per hour in CFA francs	1269.0
Expenditure per hour in CFA francs	936.0
Expenditure per customer in CFA francs	199.0

Amount in Bank in CFA francs 557,235.0

BREAKDOWN OF EXPENDITURE, KONDOGOLA, OCTOBER 2000

EXPENDITURE

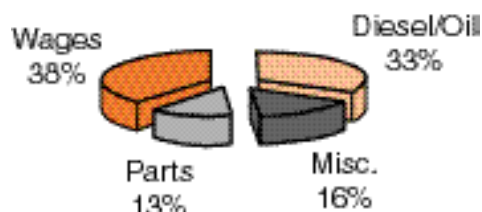
Diesel/oil	40,750
Miscellaneous	20,150
Parts	16,000
Wages	47,915
Total	124,815

RECEIPTS PER END USE (FCFA), KONDOGOLA, OCTOBER 2000

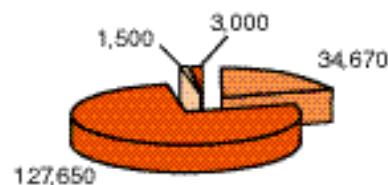
RECEIPTS

Milling	34,670
Crushing	127,650
Battery charging	1,500
Welding	3,000
Total revenue	166,820

BREAKDOWN OF EXPENDITURE, KONDOGOLA, OCTOBER 2000



RECEIPTS PER END USE (FCFA), KONDOGOLA, OCTOBER 2000



gradual acquisition can be possible, especially if there is significant scope for increased cash flows from payments for energy services provided by the platform.

Training and capacity building

The main methodological tools used in the project involve economic analysis, socio-economic gender analysis, and participatory decision making in a non-literate context. In terms of economic analysis, the emphasis is on being able to apply the concepts of willingness-to-pay and ability-to-pay to the structure and functioning of rural economies. This is closely linked to gender analysis, which is crucial for modelling household behaviour, and for understanding the implications of relations between women and men for economic behaviour and outcomes, in terms of income, spending and production.

The design of analytic tools and methodologies, as well as training activities, has taken into consideration the characteristics of those who are being trained, what the training is for and what it should be about. The training puts considerable emphasis on knowledge and analytical skills, but also on attitudes, motivation, behaviour and perception.

The primary beneficiaries of project training are at the village level—the members of the women's management committees. Other beneficiaries include private artisans, as well as local NGOs and consulting firms who receive training to undertake training activities and feasibility studies on behalf of the project.

The table on page 64 summarises the types of training for different actors involved with the platform project. The numbers relate to training conducted in 2000.

Participatory feasibility studies

In the feasibility stage—determining whether a platform is affordable for a village—the project staff must conduct an economic analysis in a rural setting where the essence of the exercise is to save human time and energy by introducing machines. One difficulty is that the principal agents and actors within the village often do not have watches and cannot tell clock time and are not numerate or literate. This calls for special methods of sharing and communicating knowledge among the project staff and the village level clients, and in particular with the women, who tend to be most excluded from participation mechanisms which require attending, and speaking up at, time-consuming meetings.

In a participatory feasibility study, the first step is to present information about the platform and all the available end use equipment, along with the terms and conditions attached to purchase of a platform. The next step is to identify the clientele for each piece of equipment, through a specially-designed “voting” system. For example, with regard to post-harvest pro-

A metal shed houses the multifunctional platform, two of the food processing attachments and a blackboard for keeping track of its use.

cessing, different combinations of price and quantities of grain and shea nuts are arrayed on the ground and potential women clients line up in turn to indicate the frequency of purchase for each season, using counters. Each client's name and household is registered at the time of “voting,” after which a number of indicators can be developed and the data cross-tabulated. The same approach is taken for battery charging, water and electric lighting but the “voters” for these services are more likely to be men.

In the same sitting, the clients are asked to identify what they expect the benefits to be from use of the platform equipment. Frequent responses include: more time for rest or for doing other activities; improved drinking water quality; better trade opportunities; and increased production volume or value added to activities already done manually. An active and direct participation by the clientele is ensured because the exercise does not take more than 10 minutes of a woman's time, she does not have to speak, and can fit the activity even into the middle of meal preparation. It is usually fun—a social event and a welcome break from the daily routine.

This exercise provides the main data for calculating expected receipts from platform operations, to determine financial feasibility, as well as for identifying the baseline situation for the expected clientele, outcomes and impacts.

The feasibility study also examines the purchase of the platform itself by the women's association, including indicators relating to financial mobilisation possibilities, the shares of different parties, the mobilisation of social and institutional capital, and the risks and conditions for long-term financial and institutional viability of the platform. The costs for expected operations in terms of machine hours are then worked out. They include operating costs for fuel, preventive and corrective maintenance, salaries of operatives, credit repayment and depre-

ciation for the end use equipment configuration. The financial viability is then assessed.

Such a study can be conducted with trained and experienced staff or partners over an average of five or six days of field work per village, including travel to the site. At the end of this period, the results and conditions for financial, technical, economic and social sustainability are known and shared, the decision is made about whether to purchase a platform, the elements of a contract are agreed upon and a work plan is established for the installation phase.

Such village-specific interventions must be included in the costs of a viable decentralised energy supply. Infrastructure projects generally fail for management and operational reasons, rather than for technical reasons. The feasibility study represents a substantial but necessary investment of time and resources to minimise the risk that equipment is misused, underused or inappropriate.

Benefits to women

While the overall goal of the installation of a platform is to secure benefits for women, considerations of technical, economic and social viability require a more differentiated gender approach. The project has developed an approach that does not treat all women as a homogeneous category, and which differentiates between women as clients of the energy source and the various end-use equipment, and women as energy entrepreneurs.

For the energy entrepreneurs, benefits to the women tend to be amplified through collective empowerment strategies as they set up the platform and operate it. The creation of a decentralised energy enterprise owned and managed by women can generate strong dynamics for structural transformation in a setting where land and agricultural based assets are primarily owned by men and tasks are performed by women as unpaid obligations to men.

The enterprise functions as a small scale but formal sector industrial operation. It is physically removed from women's residential premises. Operators are taught to run the machinery, keep accounts and stock inventories, maintain a register of clients, and perform general maintenance activities. They develop functional literacy and numeracy. They must manage bank accounts and provide reports on their operations to the Women's Association. Perhaps most importantly, they receive income for their work.

The profile of women user beneficiaries is quite varied and has significant implications for gender-sensitive poverty reduc-

tion. Older women with declining energy levels and strengths—but more time—tend to use the platform for income-generating purposes, such as processing shea nuts into butter and soap. Their willingness to pay is high and is based on their ability to generate income.

For women who are energy poor, access to end-use equipment is particularly important because they cannot mobilise other people's time and energy by means of family networks or access to land. Households with higher food security throughout the year, and women who have access to private plots, can better afford to use the equipment, but for poorer women the existence of an energy supply with a variety of end use equipment is still a benefit, even if their use of it is irregular and infrequent. It enlarges their options for trading during market days or for gaining time to collect "wild" resources. Data collected in drawing up village baseline information concerning platform feasibility can generate such disaggregated data and permit analysis of its socio-economic relevance.

Women's economic and social options are set within parameters prescribed by men, in ways which differ across villages, and indeed across and within households. In some villages, the economic opportunities generated by the platform include the ability of women to have access to small individual plots that they now have time to tend and control for their own use. These opportunities may be limited by men, however, who state that they want to limit the size of such plots to ensure a supply of women's labour for their own fields.

Involvement with the platform enterprise increases the ability of women to bargain and negotiate within existing norms, since an available energy supply reduces the time and energy intensity of women's obligations and also increases the possibility of income generation. In one village, for example, men forego breakfast during the period of shea nut harvesting, because women are out gathering for as much as three hours each morning. With the platform, they can now crush larger amounts for income generation, while still providing butter for household consumption.

There are benefits to men as well that come as a result of the benefits to women, including (generally) more timely meal preparation, greater availability of beer brewed using milled grain, and the release of women's time and energy to work in their fields as unpaid family labour. Men also benefit from women's income by spending less of their money on certain items for which they are normally responsible. Men benefit directly from the availability of the platform's services as well, since they too obtain greater access to energy for their own occupations.

LESSONS AND CHALLENGES

The major challenge is how to build on and expand the learning-by-doing process through which the multifunctional platform project has brought decentralised energy to rural villages.

The scope for the multifunctional platform to reduce energy and income poverty on a significant scale rests primarily on a close integration of village-specific interventions with institutional and policy interventions at the national level. Currently, the national poverty reduction strategy does not explicitly analyse or take into account energy and time poverty, or their connections with gender relations.

In order to affect national policy, the project needs to increase its capacity to collect reliable data and generate monitoring mechanisms, outcome evaluations and impact indicators, which can be aggregated from the village to the national level. This will require strengthening the capacity of project staff and partners, as well as adding staff and resources.

The micro level data generated by the project shows that women identify rest and time for income generating activities as two of the main benefits expected. Changes in the proportion of women's time spent in these broad categories can be used as indicators of increases in well-being related to operation of the platforms. It is precisely this type of micro level data aggregated to the macro level that is needed to mainstream gender in policy

and planning processes.

The need for rest and the willingness to pay for rest by women is a compelling indicator of the depth and severity of their energy poverty. The implication of this need for rest is that a floor has been reached in terms of women's capability to maintain themselves, with significant trade-offs in terms of health, education and well-being. Under these circumstances, any labour-intensive strategy of growth for poverty reduction, if it means a human energy overload, would be counter-productive and bound to fail. Yet this information is not available to inform macro-economic and energy policies, or national planning.

Mainstreaming the platform project at a national level will require enhancement of the capacity of the national director, the national coordination committee, and the decentralised support units (in terms of time, resources, skills and knowledge) to support a bottom-up, village-level process for decentralised energy supply. It will also require development of decentralised credit and financial mobilisation mechanisms.

Significantly, the project has received recognition and attention in other countries as well, and recently a regional programme was set up in West Africa as a result of interest expressed by Burkina Faso, Côte d'Ivoire, Guinea and Senegal in adopting the platform approach.

The creation of a decentralised energy enterprise owned and managed by women can generate strong dynamics for structural transformation in a setting where land and agricultural based assets are primarily owned by men and tasks are performed by women as unpaid obligations to men.



RURAL MICRO HYDRO DEVELOPMENT PROGRAMME

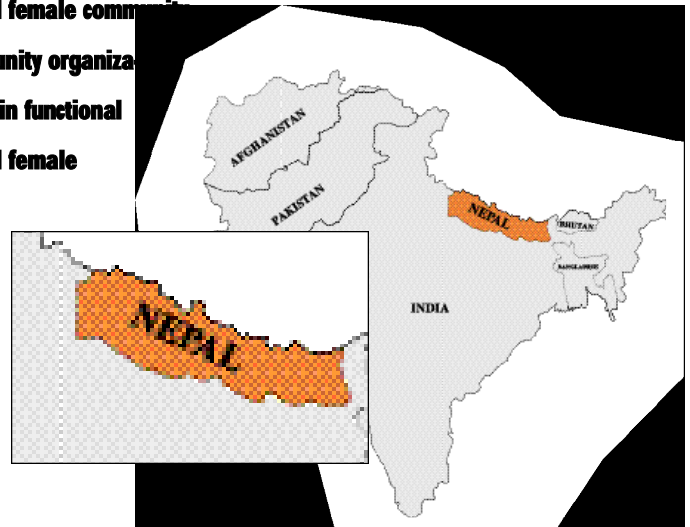
NEPAL

ARZU RANA-DEUBA

The Rural Energy Development Programme (REDP), initiated in 1996, aims to enhance rural livelihoods and preserve the environment by supporting the installation of micro hydro power systems. Expansion of sustainable rural energy systems is seen as an entry point for economic development and poverty alleviation. The programme is based on the larger development plans and perspective of the Government of Nepal and is supported by UNDP. By the end of June 2000, 31 micro hydro demonstration schemes had already been installed in remote hilly areas of Nepal. Overall, 64 micro hydro demonstration systems with the total installed capacity of about 1,157 kilowatts have been approved for installation.

It is assumed that energy can be an instrument for the eradication of poverty in rural areas only when it is specifically directed towards the actual needs of the poor. The programme stresses community mobilisation, bottom-up participatory planning and decentralised decision-making. Productive income-generating activities are targeted as the intended end uses of the energy supplied, and skills training is provided to promote agricultural and home-based businesses.

Equity and empowerment of both men and women from every target household are ensured through the establishment of separate male and female community organizations. Members of these community organizations work together on specific projects in functional groups with equal numbers of male and female representatives. This project's emphasis on the inclusion of women and due consideration to gender issues and power relations has made it a front-runner in gender sensitive planning.



Located in a land-locked and mountainous area, Nepal's social and economic indicators are among the poorest in South Asia. Per capita income was about US\$200 in 1998. Most of Nepal's 22.8 million people live in rural villages and depend on agriculture for their livelihoods. The country's poverty is due in part to problems related to difficult terrain and vast diversity within the population, combined with political instability and a late start in terms of planned development programmes.

Since the reinstatement of democracy in 1990, there has been notable progress in improving the provision of roads, water and electricity through community-driven initiatives. Nevertheless, the sustained and broad-based economic growth needed to significantly raise rural household incomes is unlikely to be achieved in the short term. Agricultural land is scarce and fragile, and due to the pressures of a growing population, the benefits of better education or irrigation generally have been outweighed by increased fragmentation of land holdings and reduced availability of fodder, biomass and firewood.

The impact of this poverty on the lives of women is magnified because social, political and economic exclusion based on gender is both pervasive and ingrained in Nepal's patriarchal society. This gender discrimination restricts women's access to resources and systematically marginalises them in decision-making processes within all social institutions. Nepal is the only country in the world where women's lives, on the average, are shorter than men's. The literacy rate for women is 38 per cent of that for men and Nepal's maternal mortality rate is among the highest in the world. In view of these facts, the Government of Nepal is working with national and international non-governmental organizations (NGOs) to mainstream women and gender issues into the development process.

Rural electrification

Nepal's electricity consumption is among the lowest in the world. Only 14 per cent of the population has electric lighting at home. In rural areas, less than five per cent of the population has access to electricity, but a number of large-scale hydro power projects are currently under construction. These will allow the expansion of rural electrification to a certain extent, especially in the plains. The steep terrain and scattered settlement patterns in the hill areas, however, deter expansion of the national grid to the upper regions of the country.

Governmental policies have stressed the potential for micro hydro schemes to provide economically productive mechanical and electrical services for the people living in the hilly regions. Although the country has the potential of generating 43,000 megawatts of hydropower, only 327 megawatts have been developed thus far. The government has put into place a number of legal and institutional provisions to encourage hydro power development. These provisions have been successful in legalising and standardising the facilities, subsidies and cooperation to be provided to the private sector. This strategy has been

adopted to ensure that smaller schemes come on line at regular intervals and provide a better match between growth of supply and demand.

In the mid-1990s, the government reinstated the policy of providing a direct subsidy of 50 per cent (in remote mountain regions 75 per cent) for electrical components used in micro hydro systems. This subsidy is equivalent to about 20 per cent of the total cost, which is typically \$1,600 per kilowatt. Credit is also available for micro hydro schemes from the Agricultural Development Bank of Nepal, including a line of credit available for rural development from the Asian Development Bank.

The Rural Energy Development Programme

The programme was formulated based on earlier experiences of both UNDP and the Nepalese Government in rural energy and in decentralised and participatory development. Through the promotion of renewable energy systems, the programme seeks to improve the living standards of rural people in areas where possibilities for commercial energy supply do not exist. Decentralised micro hydro systems enable people in these areas to undertake various social and economic activities that improve the quality of their lives and also promote the conservation and optimal utilisation of natural resources.

Efforts have been made to avoid the pitfalls encountered in prior attempts to establish micro hydro projects. Besides UNDP, a number of donors have supported micro hydro projects, including the Canadian International Development Agency, the Asian Development Bank, German Volunteer Services, the United Mission to Nepal and the Intermediate Technology Development Group.

At the national level, the National Planning Commission, the Ministry of Water Resources, the Water and Energy Commission, the Ministry of Industries, the Ministry of Forests, the Nepal Electricity Authority, Royal Nepal Academy of Science and Technology and the Agriculture Development Bank have all participated to some extent in micro hydro projects. At least 10 private sector companies produce and install micro hydro systems on a commercial basis, and local bodies, such as municipalities, village and district development committees, NGOs and community based organisations, are also involved in micro hydro projects for rural development.

The experience of the last 25 years has clearly shown that financial capital and technology alone are not sufficient to ensure viable projects. Therefore, this programme has included additional components, such as promotion of human capacity in local communities, coordination with local governments, NGOs and the private sector, and the introduction of modern agricultural practices and market oriented enterprises for economic empowerment.

One of the goals is to create wider acceptability for the programme's community-based, participatory approach. In recognition of the critical importance of good governance, emphasis also

has been placed on mechanisms for effective coordination, transparency and accountability at every level of the programme.

Stakeholder participation

The programme works with specially formed community organizations and functional groups that take on the implementation and management of the micro hydro projects. Existing village development committees must also approve the project, and agree to invest in it. A district development committee will then approve and invest in the project, and recommend it to the national-level Agricultural Development Bank, which provides funds for purchase of generators and turbines through a special credit line. The private sector is brought in to provide technical assistance and to develop human resources at the local level, as well as to provide the equipment required.

More than Rs. 129 million (\$1 = Rs. 74) has been mobilised so far from local, district and national sources. The funding made available from the district development committees (four per cent) and village development committees (10 per cent) is in the form of investments that have to be repaid once the plants start making a profit. The programme contributes about 40 per cent of the cost of a project, by providing 50 per cent grants for non-local costs. The government adds about 21 per cent in the form of subsidies for electrical equipment and poles. Voluntary labour from the community accounts for 14 per cent of total costs, and loans cover 11 per cent. The community's contribution in cash has been calculated to be Rs. 1,288 per household.

Once the micro hydro system is installed, community members are able to purchase electricity through the additional income they generate by using the power for productive activities. Every participating household is provided with skills training for income generation.

The programme provides technical inputs to its partners at every level. At the national level, it assists government ministries and departments in the formulation of enabling policies and procedures. At the district level, it supports capacity building for stakeholders in planning, implementation, management, and monitoring of rural energy systems. This includes the establishment and operation of a Rural Energy Development Section within the District Development Committee Office, as well as the formation of a district energy committee and district energy fund. The programme also partners with NGOs and the private sector to develop and strengthen much-needed technical and managerial support at the local level.

Mobilising communities and giving women equal importance

Community mobilisation is the core of the programme. The following six principles have been adopted for community mobilisation: women's empowerment, skill-enhancement, environ-

mental management, capital mobilisation, technology promotion and organizational development.

To initiate a project, villagers are given an orientation on participatory development and the importance of rural energy systems for both individual and community development. They are then instructed on how to form a community organization. In order to arrive at equity, which is one of the cornerstones of the programme, separate male and female community organizations are formed. Every participating household sends a male member to a male community organisation and a female member to a female community organization. These community organizations represent the basic units of this programme.

Development experience in Nepal's particular social and cultural context has clearly indicated the strategic advantages of organizing women and men into different groups. The segregation of women and men into separate community organizations encourages men and women to discuss and analyse specific problems they face. Women do not feel overpowered and they can be actively engaged. A women's community organization can serve not only as a forum where women share their concerns, but also as a place where women's leadership qualities and confidence can develop.

The community organizations meet every week and discuss different development aspects of their village's needs, focusing on the programme's six thematic areas. By the end of September 2000, there were 1,021 female and 1,000 male community organizations. The total membership was 20,258 women and 19,125 men.

Once community organizations are meeting regularly, undertaking savings and credit activities, taking collective decisions, and documenting and implementing them, they form functional groups to perform specific activities. The programme stipulates mandatory equal representation from the men's and women's community organizations in each functional group. A functional group is responsible for overall planning, implementation, operation and management of the specific activity it supports, which could be micro hydro installation, or some other development activity such as community forestry, bio-gas installation, adult literacy, or off-season vegetable farming. By the end of September 2000, 464 functional groups had been formed.

Skills training and income generation

Skills enhancement is another important component of this programme. Capacity building of community organizations begins with classes to ensure that all members can read and write. Management and leadership training is also provided.

Community members are encouraged to identify the specific skills needed to successfully manage and operate the rural energy systems and initiate income-generating activities. The programme stipulates that each household should be involved in one income-generating activity, so that the benefits of the

programme accrue to all households (including powerful as well as less powerful ones) in an equal manner.

Skills training has been provided in forestry, agriculture, cottage industries, social conservation and animal husbandry. Thus far, more than 3,963 men and women have been trained in various enterprises. An initial assessment showed that following the training more than 80 per cent of the trainees started a business in the community. The micro-enterprise training is backed by access to credit from the group's savings. More than Rs. 7 million has been saved by community organization members since 1997.

In a number of areas the programme has supported the introduction of new technologies to utilise the energy generated by the micro hydro project. Many of the enterprises chosen use appropriate technology to cut down drudgery, especially for women. New activities include setting up bakeries, preparing broiler chickens, running agricultural processing mills or saw mills, operating photo studios, and producing incense sticks. Poultry keeping, goat raising, and grocery stores are some other common areas of investment. The cumulative investment of all community organizations exceeded Rs. 13 million by September 2000.

Environmental management

The programme provides support for conserving and maintaining the environment through various interventions. Activities such as construction of pit latrines and household cleanliness campaigns have helped women maintain household cleanliness. Thus far 6,526 latrines have been constructed or renovated. In addition, nurseries and plantations have been established on public and private lands. Approximately 1,178,698 trees have been planted in the original 10 districts of the programme.

Different energy technologies, such as solar photovoltaics, bio-gas and improved cook-stoves also have been introduced. Thus far, 704 solar systems, 487 biogas plants, and 3,440 improved cook stoves have been installed by the programme. The technologies introduced either increase productivity or reduce drudgery for the men, women and children targeted by the programme, as well as help conserve the environment.

Benefits to women

Though the programme design emphasises equitable treatment of women, the programme is primarily targeted at rural development. Nevertheless, the equal opportunities offered have had a very visible and positive impact in mobilising women and integrating them into mainstream activities. The women in community organizations have a distinct voice in local affairs and their self-confidence has increased, as has their capability for independent and collective action. Almost 700 women have taken in-country study tours conducted by the programme. It was the

first time most of them had travelled outside of their villages.

For many women living in the remote rural areas served by the programme, the training component gave them access to appropriate skills training for the first time. The livelihoods of the women and their families have vastly improved as a result of the income-generating activities undertaken.

Attitudes towards women are also changing due to the programme. Even in areas and ethnic groups where the status of women has traditionally been very low, there has been a decided change in behaviour towards women. For example, two out of the five micro hydro schemes in a remote district in far-western Nepal (an area where women have the lowest social status) are chaired by women, and a woman has been accepted as the leader of a mixed group of men and women involved in a nursery project in remote Achham. Another indicator of change was the fact that during a training conducted for women managers, husbands looked after babies for the duration of the training programme.

The changes brought about in the daily lives of participants, especially the women, have resulted in reduced drudgery in household tasks and an increase in productive and community roles. The women in the community organizations are emerging as leaders and decision-makers inside the programme, in the community and finally within their households. Empowered by being involved in community groups, literacy classes, leadership training, skills training, and by gaining access to credit and markets, time-saving technologies, and even to television in some areas, women are experiencing definitive changes in their lives. A change in the life of the mother of a family means a change in the lives of her children and other members of the family. The positive effects brought about by the programme will also have enduring inter-generational impacts on the lives of the women of these remote villages.

From a gender and energy perspective, REDP stands out as an exceptionally gender sensitive programme. Micro hydro and alternative energy forms are being promoted by a number of agencies in Nepal, but few go beyond technical, environmental and economic goals. This programme's additional effort in promoting women and analysing gender issues has paid rich dividends in its impact at all levels.

Because of the many benefits to communities, local leaders are strong supporters of the REDP programme. Power from the micro hydro systems to run useful new technologies, plus environmental conservation activities, have helped fulfil overall developmental goals set out by local leaders for their constituents.

Project viability and replication

This programme has enjoyed success in very different geographical and demographic areas within Nepal. The main reasons for this success in replication is the fact that both technical and social aspects are carefully examined before selecting a target area. In many rural communities energy is highly valued and is

CHANGED LIVELIHOODS: STORIES OF REAL CHANGE

Krishna Kumari Shahi who lives in a remote hill village in Western Nepal is very happy with the establishment of a micro hydro system in her village. She says "Electricity has brought lots of changes in our village. Now we can do evening chores under a bright light. It has helped our children in their studies and in improving our health. With the generation of electricity, we now have an agricultural processing mill nearby. This has saved us the time and labour previously spent on food processing. The improved cook-stove installed in my home and the pressure cooker I have now bought makes one bundle of wood last for a week, prior to which it used to last me only for three days." In the time freed-up by the use of energy, Krishna Kumari and her husband have started a poultry business. They are excited about the \$100 that the business has generated in just three months.

Bhoemu Lama lives in the village of Katunje in Kavre, a district neighbouring Kathmandu. Prior to her involvement in the REDP programme, she ran a small tea shop. After undergoing an entrepreneurship organized by the programme, she took a loan totalling Rs.12 7,000 (approximately \$120) from her community organization's savings plan and started an incense-making business. She purchased an incense-rolling machine and produces 500 sticks a day with help from family members and hired labour. Her product is purchased by a Mahaguthi, an entrepreneurs' cooperative and high-end craft shop in Kathmandu. Bhoemu estimates she makes about a 50 per cent profit before deducting her own labour inputs. She has already paid back the loan, with interest.

Stories such as Krishna Kumari's and Bhoemu's abound in all the programme's target districts. The changes brought about in the daily lives of participants, especially the women, have resulted in reduced drudgery in household tasks and an increase in productive and community roles. The women in the community organizations are emerging as leaders and decision-makers inside the programme, in the community and finally within their households. Empowered by being involved in community groups, literacy classes,

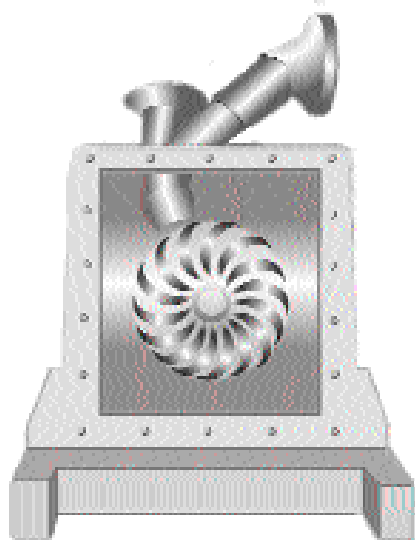
leadership training, skills training, and by gaining access to credit and markets, time-saving technologies, and even to television in some areas, women are experiencing definitive changes in their lives. A change in the life of the mother of a family means a change in the lives of her children and other members of the family. The positive changes brought about by the programme will also have enduring inter-generational impacts on the lives of the women of these remote villages.



HARVESTING POWER FROM WATER

For centuries, small water wheels, called ghattas, have been used in Nepal for milling and other kinds of agricultural tasks. And with an enormous annual runoff of water down its steep mountains and slopes, Nepal has one of the highest per capita hydro-energy potentials in the world. Yet per capita electricity consumption is among the lowest in the world—the equivalent of one 60-watt bulb burning for one hour per day. Development of micro hydro power systems (defined as systems with an output of less than 100 kilowatts) offers the potential of cheap electricity for remote rural areas with negligible environmental impact.

Essentially a micro hydro system consists of a turbine, generator and civil structures. The turbine converts the potential energy of flowing water into mechanical energy. The generator coupled to the turbine converts the mechanical energy into electric energy. The major civil structures include the diversion intake at river, canal, forebay and powerhouse. In order to transmit and distribute electricity to consumers (mainly households, shops and rural industries), a transmission and distribution network is erected.



prioritised as a need second only to agricultural development. Thus at the village level there is enthusiasm and willingness to participate in the programme.

Besides identifying the technical viability of a micro hydro site, the programme takes into account other selection criteria, such as a community's financial resources, its willingness and ability to take out loans, the political commitment of the village development committee, the potential for end-use activities, distances from roads, and possible linkages with irrigation and drinking water projects.

In the broader context, success for this programme is supported by Nepal's policies which promote micro hydro development. De-licensing of micro hydro projects, and establishment of a credit line for alternative energy promotion, as well as the growth of private sector manufacturers and technicians, have resulted in a conducive environment for the growth of this sector. The recently enacted Self-Governance Act of 1999 has given this programme an added impetus by bringing decision-making for the micro hydro sector to the district level.

The success of the programme has resulted in its expansion to an additional five districts within a short time frame of four years. It has also led to national and international recognition. In March 2000 REDP was awarded the Energy Global Award 2000. The Energy Globe Award recognises sustainable energy solutions and honours successful projects and initiatives around the world in the field of energy efficiency and renewable energy sources. REDP was also featured at EXPO 2000 in Hanover, Germany in June 2000.

LESSONS LEARNED

The following have been some of the lessons learned in the process of implementing this programme:

- ▲ The best method for providing electricity to remote areas of Nepal outside of the grid is by mobilising and training both the men and women of a community and developing their technical and managerial capabilities to install and operate decentralised micro hydro systems.
- ▲ Because adaptation of any rural energy technology directly affects women's lives, relieving them from drudgery and tedious working hours, it is important to involve women fully in rural energy development plans.
- ▲ Energy projects should not be promoted in isolation. In rural and generally poor communities, energy projects should be introduced as a component of integrated development activities.
- ▲ Community mobilisation is key to harnessing people's potential to help themselves. Both men and women must be equally involved if gender and equity issues are to be addressed. Provision of an institutional mechanism for equal participation of women based on transparency and accountability encourages women to come out of their traditional roles and become active partners in development programmes.
- ▲ Energy is a priority for rural people. As an entry point, it can propel development by harnessing resources available in rural communities.
- ▲ Careful planning and patient facilitation is required to help people acquire skills for planning, implementing and maintaining systems through consensual decision-making.
- ▲ It is essential to provide knowledge and information on different technologies, costs and manufacturers. If this is done, rural communities become capable of pooling together their own latent resources (human resources, money and material) for activities commonly identified and agreed upon.
- ▲ It is essential to develop the capacity of local groups (locally elected bodies and NGOs) to manage and operate rural energy projects. Holistic development is a gradual process and depends on the participation and leadership of the community members. Therefore, once leadership is developed in the community through mobilisation and capacity building, the community leadership must be enabled to take initiatives and make decisions for sustaining the project and for growth.
- ▲ Appropriate government policies and regulatory frameworks at all levels are essential for wide scale promotion of micro hydro and rural energy technologies and their sustainability.

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