GENERATING OPPORTUNITIES

CASE STUDIES ON ENERGY AND WOMEN

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FOREWORD

Energy plays a critical role in poverty reduction. Patterns of energy generation, distribution and utilization directly affect opportunities for income generation, the situation of women, environmental protection and national development. Energy services are an essential engine for growth to enable developing countries to overcome poverty and the conditions of poverty. Yet, worldwide, two billion people rely on traditional fuels including wood, dung and agricultural residues to meet their daily heating and cooking needs. Despite advances in the last ten years in extending electricity services in developing countries, electricity supplies to support household, agricultural and industrial activities remain beyond reach for two billion people.

The availability of energy services has a distinct impact on the lives of poor people and women, in particular. This is most critically felt in rural areas, where women shoulder the responsibility for fuel collection, household cooking and family subsistence activities. Electricity is essential for water pumping, illumination, food processing, microenterprise development and the provision of social services, including education and health. When it is not available, the lives of women and men are impacted in distinct ways. Both women and men face obstacles to overcoming conditions of poverty related to the lack of opportunities for income generation due to energy services unavailability. In the case of women, many of these linkages have remained unaddressed by national development policies, energy planning processes and development assistance efforts.

UNDP has made a commitment to address energy issues because of the multiple linkages to development bottlenecks, as well as opportunities presented by innovative approaches to energy service delivery. These linkages have been discussed and analysed extensively in previous UNDP publications including *Energy After Rio: Prospects and Challenges* (1997) and *World Energy Assessment: Energy and the Challenge of Sustainability* (2000). These argue that current approaches to energy are unsustainable in economic, social and environmental terms and that major changes are needed in energy systems worldwide. Among these changes are the need for more efficient use of energy, increased use of renewable energy sources and expanded access to and use of modern clean energy technologies in developing countries. To underpin these changes, governance mechanisms and energy policy frameworks are needed to support new approaches linking energy and poverty reduction objectives. Energy must be seen as an active ingredient for sustainable human development.

This publication, *Generating Opportunities: Case Studies on Energy and Women*, is one concrete contribution to addressing these linkages, especially the relationship between energy services availability, the conditions of poverty directly affecting women, and the opportunities for development presented when efforts are made to provide affordable access to modern energy carriers, such as electricity and clean burning fuels. Sustainable energy approaches must include a focus on the role of gender in development. Policy frameworks to support sustainable energy options must directly reflect the energy use patterns of women and support the expansion of productive activities available to women through enhanced energy services, especially in rural areas.

The Bureau for Development Policy supports advocacy and analysis activities on key development issues and provides practical support and lessons learned from global experiences in development cooperation in priority programming areas. This publication is an excellent example of sharing experience on women and energy linkages, both what works and what provides insight for improvement. It looks at real activities attempting to link gender, energy and sustainable human development objectives through concrete projects. This provides the raw material to draw policy conclusions on what conditions are needed to enable new approaches that address women's energy needs. As the international community prepares for the World Summit on Sustainable Development (WSSD) to be held in Johannesburg in 2002, we hope such material will contribute to dialogue on how multiple development objectives can be addressed through integrated approaches at the national level.

This publication is the result of collaboration among the Editor and Executive Editor, case study authors, experts of the Technical Advisory Group, and UNDP staff working in the field of sustainable energy. I congratulate them on their efforts. This case study effort was made possible through support from the Swedish International Development Cooperation Agency and the UNDP Global Programme on Sustainable Energy. On behalf of UNDP, I thank the government of Sweden for their support for this important effort. I sincerely hope that energy practitioners, gender experts, national authorities, civil society organizations and those working in the field of international development find the material presented here useful in supporting efforts to link sustainable energy, gender and income-generation activities at the national level.

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SUSTAINABLE ENERGY AND WOMEN

INTRODUCTION

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This book of case studies was prepared as part of a United Nations Development Programme (UNDP) project entitled "Energy and Women: Generating Opportunities for Development," which was initiated in February 1999 with support from the Swedish International Development Cooperation Agency (SIDA) and UNDP's Sustainable Energy Global Programme.

UNDP's Initiative for Sustainable Energy, which began in 1996, examines energy's link to socio-economic development and gives guidance on how energy activities can become important instruments for eliminating poverty, regenerating the environment, creating employment opportunities, promoting sustainable livelihoods, and advancing the status of women. This work was reinforced when, as part of the preparations for the 1997 UN General Assembly Special Session to review progress on sustainable development, UNDP published *Energy After Rio: Prospects and Challenges*. This publication examined the major changes in energy systems called for in Agenda 21, the plan of action adopted at the 1992 Earth Summit, and made recommendations on sustainable energy strategies, including specific energy service approaches to address the burdens faced by women in developing countries. These themes were further articulated in *World Energy Assessment: Energy and the Challenge of Sustainability*, a joint publication prepared by UNDP, the UN Department of Economic and Social Affairs, and the World Energy Council, as an input to the 2001 session of the UN Commission on Sustainable Development dealing with energy.

The Energy and Women project looks at new approaches to the use of energy as a means of addressing both poverty alleviation and the advancement of women, two of UNDP's major priorities. One of the project's key assumptions is that greater access to modern energy services can provide significant social and economic benefits, especially for women and girls in developing countries, who are the primary providers and users of traditional fuels such as wood, dung and charcoal. Reduced drudgery for women and increased access to nonpolluting power for lighting, cooking, and other household and productive purposes can have dramatic effects on women's levels of education, literacy, nutrition, health, economic opportunities and involvement in community activities. These improvements in women's lives can, in turn, have significant beneficial consequences for their families and communities.

This publication looks at critical policy and programme design options to improve women's access to modern energy services based on the lessons learned in the eight case studies presented. To understand which issues must be addressed in effective policymaking at the national and local level, such concrete experiences provide a wealth of insight. UNDP hopes that this effort will provide input for government policymakers, energy sector agencies, civil society groups and development assistance organisations to generate opportunities for development through energy activities.

In many parts of the world, limitations on the availability of energy services create barriers to socioeconomic development. Worldwide, approximately two billion people use traditional solid fuels for cooking and heating, and almost as many lack electricity. Without access to modern forms of energy for lighting, cooking, heating and cooling, refrigeration, pumping, transportation, communications and productive purposes, people must spend much of their time and physical energy on basic subsistence activities. Lack of energy services is correlated with many of the elements of poverty, such as low education levels, inadequate health care, and limited employment possibilities. At the local and national levels, a reliable energy supply is essential to economic stability and growth, jobs, and improved living standards.

Much of the energy use in developing countries involves consumption of traditional fuels by poor households. For the most part, household needs are not adequately addressed by existing energy policies that focus mainly on urban areas and industrial development. Because of high capital investment requirements and the need for extensive transmission and distribution lines, in many countries it is not economically feasible to meet the energy needs of rural populations by means of conventional large-scale, power plants. It seems clear that new approaches to the delivery of energy services are needed. Efforts to meet the energy needs of rural communities through increased availability of small-scale decentralised approaches show real promise for raising living standards in these areas and also introducing more environmentally friendly energy systems. The production, distribution, and consumption of energy in rural areas can serve as an engine for growth and development.

Women and sustainable development

One major factor influencing current attitudes towards energy is a growing agreement on the need for sustainable development policies. The 1992 UN Conference on Environment and Development (the Earth Summit) led to international consensus on the need for sustainable development, which balances economic growth with concerns for social equity and environmental protection.

Extension of the benefits of development to all people, men and women, is fundamental to the fulfilment of the social equity objectives of sustainable development. Unequal treatment of men and women, and their differentiated social and economic roles, has led to increased poverty for women in many countries. Of the approximately 1.3 billion people living on less than one dollar a day, 70 per cent are women. Literacy rates for women remain consistently lower than for men by about 30 per cent in developing countries, while the illiteracy rate for young women in rural areas is two to three times greater than in urban areas. Female school enrolment is 13 per cent lower than male enrolment at the primary level, and the gap increases at higher educational levels. Failure to address gender disparities, marginalization and discriminatory practices has, in many regions, contributed to entrenched conditions of poverty for women.

In 1995, the United Nations Fourth World Conference on Women in Beijing emphasised the vital role of women in sustainable development and the need to promote greater overall development opportunities for women. Although women's status varies according to their country, income level, ethnicity, age and social status, the Beijing Conference found that women throughout the world continue to have fewer options and opportunities than men.

With regard to energy, the Beijing Platform for Action called on governments to support the development of equal access for women to sustainable and affordable energy technologies. In developing countries, it is women who, because of their traditional roles, are most vulnerable to the effects of environmental damage and increasing scarcity of traditional fuels. The deterioration of natural resources reduces opportunities for income-earning activities and greatly increases women's unpaid work. The Beijing Platform of Action stresses women's potential contributions to the development of ecologically sound consumption and production patterns, as well as natural resource management.

In keeping with the Millennium Summit commitment to halving the number of people living in poverty by 2015, UNDP supports the objective of reducing by half the number of people who lack access to modern energy services in the same time frame. Indeed, the provision of energy services is an essential prerequisite to support economic growth and poverty reduction in order to achieve this global poverty reduction target. The distinct energy needs and consumption patterns of women, who as a group are over represented among the poor, must be addressed through policy and programme frameworks to meet internationally agreed poverty reduction targets.

Energy needs of women in developing countries

In most cultures, women and men have differing roles and responsibilities according to socially defined division of labour based on gender. This gender asymmetry is reflected in a variety of social and economic dimensions. In terms of reproductive activities, women generally have primary responsibility for the care and feeding of children and families, as well as health care and education. In many developing countries, it is the women who perform most of the work related to subsistence agriculture, plus gathering and managing fuel and water. Their productive activities are often unpaid and labour-intensive. When women in rural areas do generate income, it tends to be within the informal sector, and not adequately reflected in national accounting systems. This serves to under-represent the importance of energy as an input to women's economic activities. Because they operate mostly in the informal and unpaid sectors, poor women have less access to financial resources, credit and equipment than do men, and less of a voice in household, or community-level, decision making.

In past years, most energy programmes intended to improve the situation of women in developing countries have focused on household cooking and heating needs. Projects have emphasised approaches such as the introduction of improved stoves, production of briquettes from waste materials as an alternative to wood or charcoal, or tree planting to increase fuel wood supplies. Such projects, if they are properly designed, can be extremely important in terms of reducing existing domestic burdens on women and girls. They can also enhance opportunities for women to engage in income-producing activities, which are often performed on a part-time or irregular basis in conjunction with household activities.

Women are not only involved in cooking, however. They are engaged in many other tasks and responsibilities that could be accomplished more easily and efficiently if they had access to lighting and electricity, and the energy services electricity can provide.

Electrification makes basic subsistence activities such as water pumping and grain grinding much less time-consuming, and can power labour-saving as well as income-generating equipment. Availability of electricity is also essential for creating new employment opportunities and supporting value-added activities linked to agricultural production. Small-scale manufacturing, food processing industries, trading and marketing opportunities are all greatly expanded when energy services are available and have direct positive influences on women and their communities.

When women have safe and reliable lighting in the evening, they are better able to perform essential child-care responsibilities, and their children have more time to read. Lighting for homes, businesses, streets and marketplaces is also critical for facilitating women's involvement in educational, entrepreneurial and community activities.

Women are particularly impacted by lack of energy for development

Energy poverty is a problem that has a disproportionate effect on women and girls, especially in rural areas. The most obvious factors relate to time and physical effort. Many women in developing countries have to spend long hours gathering fuel and hauling water, using their own labour to carry heavy loads over long distances. They are especially vulnerable to the adverse impacts of deforestation, desertification and ecosystem disruption. As fuel wood becomes scarce due to over-harvesting, land clearing or environmental degradation, many women are forced to travel farther and spend more time and physical energy in search of fuel.

When women are overburdened, they are more likely to keep their daughters home from school to assist with household activities, including fuel and water collection, thereby limiting opportunities for girls to move forward through education, and increasing the likelihood that their families will remain in poverty. Education and literacy levels are positively correlated with decreases in fertility rates. Women with more education tend to have fewer children, and to be better able to care for them. The fuel-related burdens experienced by women in developing countries hinder social and economic progress throughout the community and have long-lasting impacts when personal and social development opportunities are lost.

Besides lost opportunities and exhaustion, women are faced with a variety of health problems related to gathering and transporting fuel. Carrying heavy loads of wood damages women's bodies, and they must worry about falls and threats of assault, as well as snake bites, while gathering wood. In many rural areas, there is no alternative to walking. There is little in the way of transportation infrastructure, and women rarely have access to vehicles to carry their loads.

Women experience other health hazards from cooking for long hours over poorly ventilated indoor fires. They, and their young children, are exposed to large amounts of smoke and incompletely burned particulates from indoor fires, together with pollutants such as carbon monoxide, benzene and formaldehyde. As a result they often suffer from respiratory infections, lung diseases, cancer and eye problems. Worldwide, close to two million premature deaths per year are attributable to indoor air pollution from cooking fires.

Growing food and processing it without any mechanised equipment is extremely tedious and time consuming. In rural areas of developing countries, women grow most of the family's food and must grind grain and other staples by hand. Their lives are spent in drudgery and repetitive activities. Mechanised grinding equipment and improved food processing alternatives allow women to provide more food for their families with less effort, and perhaps even produce additional amounts for sale and income generation. Energy services enable improved food production, processing and human well-being.

Without water pumps, women also have to haul water by

hand. Electric water pumping not only eases women's lives, but also improves community sanitation and nutrition. Water scarcity limits the family's ability to wash their hands and clothes, and decreases their consumption of cooked foods. Pumped water used for irrigation increases crop yields and food security. Water and energy are essential basic services to support human development.

Without lights and motors, productivity is limited, and families have few opportunities to improve the quality of their lives or future prospects. Women are fully occupied by their daily survival tasks and have little time or means to take on additional income-earning activities that could move them and their children out of poverty, or to work on other sorts of community development projects. Lack of opportunities in rural areas due to energy poverty is a major factor driving increased migration to cities in developing countries. Without electricity, there are few jobs in rural areas other than farming, and workers tend to move to the cities in search of employment. Often the women are left behind in the villages, struggling to provide for themselves and their children. The absence of energy services is a key barrier to development and growth opportunities in rural areas, and impacts women in distinct ways.

National policies affect women's access to energy for development

Energy policies relating to fuel choices, electricity-generating capacity, and energy delivery systems have impacts on development that are not generally analysed in all of their social and economic dimensions. Although most policymakers view energy policies as gender-neutral, men and women are affected differently by energy policies wherever their work roles differ, as is the case in many developing countries. Attention to these differing interests is needed in order to achieve effective and equitable distribution of energy services.

The limited reach of rural electrification in developing countries poses special problems for women due to their traditional roles. Because of dispersed and relatively low overall energy demand levels in rural areas, plus inadequate capital financing for widespread grid extension programmes, many areas are unlikely to be connected to central power grids in the foreseeable future. Greater emphasis on rural energy needs would be particularly beneficial to women in these areas. Decentralised and off-grid electricity generation is extremely important to support rural development and meet the illumination and mechanisation needs of women.

Depletion of traditional fuel sources and limitations on grid extension have prompted calls for new energy systems that support sustainable development. Sustainable energy approaches emphasise efficiency, cleaner fuels, and adoption of alternative energy technologies that use solar, wind, micro hydro and modern biomass resources. Since women currently play a key role as collectors and managers of traditional fuels in developing countries, a transition to alternative fuels and technologies will require the active engagement of women in their roles as energy providers and consumers. Yet, in many countries, women's needs are not adequately considered in assessing energy options, and women have been effectively excluded from participation in energy policy formulation and decision-making processes due to their low political and economic status or the lack of national traditions for stakeholder-driven policy formation processes.

Rural households and communities often have very limited information on alternative energy technologies or how to use them. This presents a barrier to introduction of, and demand for, new energy options. People need more information about technology options such as improved cook-stoves and renewable energy systems, and about modern fuels like liquid petroleum gases (LPG) and biomass-derived fuels. If this information and the technologies themselves were more widely available and accessible, women and men would be better able to make their own choices out of a range of possible options.

Where energy options currently are available, poorer households often pay higher per unit costs for energy services because they buy fuel in smaller amounts or have less efficient equipment. They may use kerosene or candles for lighting and dry cell batteries to run small appliances. These energy inputs are paid for in cash and are very costly in terms of the scale and quality of energy services delivered. Energy-efficient alternatives generally have higher up-front costs, even though the energy services provided are less expensive on a life-cycle cost basis. Innovative financing mechanisms for new equipment would allow households and small businesses to pay over time, thereby increasing their access to better but more capital-intensive technologies.

Worldwide, governments are moving away from maintaining a publicly controlled energy sector towards increased liberalisation and competition. It is unlikely, however, that the private sector will be able to meet the energy needs of rural areas without government support. Although a more market-oriented approach to the energy sector can provide important benefits, liberalisation can have negative effects on the poorest people, who cannot afford prices set by competitive markets. A crucial role for governments is to establish effective policies and enabling frameworks to promote expanded availability of energy services and the protection of poor and marginalised groups.

Addressing women's concerns in energy policies and planning

What then are pro-women energy policies? For the most part they include the basic energy policies required to support rural development, but with an increased emphasis on energy services that are most used or needed by women. A starting point is to identify those energy services of primary importance to women and to remove barriers and provide incentives in support of those services. To do this, the profile of demand for energy services by

women must be understood and documented. The pattern of economic activities undertaken by women must also be assessed and policy emphasis given to support those activities for which energy is a major input. Critical pro-women energy policies include:

1. **Policies to support electricity for illumination.** Clearly both men and women use illumination services, but lighting tends to have greater significance for women. Global evidence has shown that the availability of illumination in the home increases female educational attainment and literacy and extends the working day of women to include income-generating opportunities related to cottage industry activities. Lighting in public places also increases the safety of women and communities and allows women greater access to public gatherings. Since illumination does not require a great deal of electrical power, better lighting can be provided through low-cost lighting options using battery power, small home systems or decentralised village power systems. Policies that promote the availability of lighting, therefore, represent a relatively inexpensive means of providing benefits that are particularly important for women. Kerosene pricing policies will also affect illumination opportunities for women.

2. **Policies to support availability of mechanical power and electricity for energy-using productive devices.** Higher levels of electrical power are required for running mechanical equipment than for lighting alone. When electricity is used to support activities that generate revenue streams, women and their families can earn more income, and can therefore afford to pay for both equipment and the electricity required to use it. Government policies to support decentralised rural electricity systems are essential for expanding economic activities in rural areas, where women's opportunities are most limited. Whether derived from conventional energy sources (diesel power) or decentralised village-based systems using renewable energy sources such as photovoltaics and modernised biomass, policies to support electrical power in rural areas are essential. These have a direct positive impact on women when mechanical power for grinding grain, pumping water and supporting nonfarm productive employment becomes available.

3. **Policies to support the availability of cleaner fuels and enhanced markets to address the thermal energy needs of women related to cooking, heating and food processing.** Affordable access to modern fuels, such as liquefied petroleum gas (LPG), can reduce women's dependence on fuel wood and traditional biomass. In many areas LPG is not available, however, and policies are needed to promote distribution systems and smaller canister sizes. Lack of access to cleaner fuels and the high costs of related stove technologies have proven to be barriers preventing women from moving up the energy ladder away from traditional fuels. When women are involved in fuel-intensive economic activities that use thermal energy inputs, such as beer brewing, food processing and kiln-based industries, their profits can be significantly increased by the use of cleaner fuels and more efficient stoves. Pro-women policies to reduce the energy burden related to heating and cooking needs should specifically address these issues.

4. **Policies to support technology development and dissemination in sectors and applications where women are most active.** Due to the existing social division of labour, men and women are involved in different economic and subsistence activities. Because of gender-based energy use patterns, efforts to improve technologies such as stoves, kilns, grinders, presses, and pumps will have a direct impact on the condition of women. This has implications for policies regarding the use of public research and development funds, the focus of technical training programmes, and the design of technology needs assessment activities. Policies are needed that support improved technologies and energy-efficient equipment for use by women, as well as technology dissemination and education activities that expand the economic opportunities of women.

5. **Policies to support energy service financing and credit facilities to promote energy-using business opportunities.** For women to have increased access to illumination, mechanisation and improved fuels, credit mechanisms are essential and must be accessible by women to enable them to distribute the financial costs of improved energy services over longer time frames. Credit is important for both poor women and men, but because women have less access to commercial credit than men do, in order to meet women's energy needs, financial institutions and credit mechanisms must specifically target, or be available to, women and women's organizations. Policies to support credit opportunities for women must address the collateral or revenue stream requirements of commercial credit organizations, as well as the legal status of women and other factors that may exclude women as borrowers. Credit facilities are essential to expand the business opportunities of women in energy-using industries and to enhance women's access to cleaner and more efficient technologies.

6. **Policies to provide improved information on markets and consumer demand for energy products to assist women in becoming energy entrepreneurs.** Lack of knowledge about available energy technologies, the price of traded products, urban consumption patterns,

and nonfarm economic activities pose barriers to women seeking to undertake or expand their engagement in value-adding, energy-related economic activities. Policies, programmes and institutions that address these information barriers can support increased economic participation and empowerment of women through energy activities.

Non-energy sector policies relating to women may also impact energy outcomes. Unless issues related to the legal status and political participation of women are addressed, pro-women energy policies cannot be fully effective. Important policy issues to support women and energy objectives include:

7. **Policies to support gender equity in all economic sectors and the participation of women and women's groups in national and local policy formation processes**. The need for such policies is not unique to the energy sector, but gender sensitivity is certainly important in improving energy policies. Enhanced consultation with women and women's groups, and the inclusion of gender considerations in a broad range of sectoral policies, can improve the effectiveness of energy programmes as well as the ability to reach overall development goals. Policies to support the advancement of women and girls can be particularly important in reinforcing sustainable energy policies that target women. Such efforts are needed at the local, regional and national levels in both public sector activities and the development of civil society participation in policymaking.

8. **Policies to remove barriers to the full participation of women in economic, social and political life.** When barriers exist that affect women's legal status, land-tenure opportunities, property rights, child custody or access to public services and facilities, the ability of women to take advantage of opportunities related to expanded energy services will be limited. In addition to policies to actively support gender equity, concerted efforts are needed in many countries to remove barriers, legal or otherwise, to the full participation of women in the development process.

Planning processes that involve widespread participation and consultation among energy producers, distributors and consumers can help all parties to understand and address current constraints affecting energy sector programmes, including constraints related to the status of women. Since women are often the primary users of fuels and energy-consuming appliances, it makes sense that they should be consulted concerning their assessments of energy priorities and problems, as well as approaches to their solutions. There are often cultural and practical barriers, however, that limit women's ability to participate in consultative processes when they do occur, so special efforts generally need to be made to fully include their concerns and perspectives.

Women already have valuable knowledge about local conditions and resources. In fact, for centuries women have managed forests and used forest products for fuel, food and fodder. Their knowledge of ecosystem management systems can provide significant contributions to energy planning processes. Additional education of women and women's organizations about energy policy issues can increase their ability to contribute to energy solutions, including the adoption of new, cleaner fuels and equipment. Women who are educated about energy alternatives can also play important roles as educators and activists concerning energy efficiency, renewable energy sources and better uses of traditional fuels. Throughout the world, there are untapped opportunities for women to act as agents for sustainable energy solutions.

Decentralised approaches to energy supply can open up more opportunities for rural women engaged in income-generating activities. Overall, however, there has been little planning or policy focus on energy for productive uses by women. The challenge is to encourage women and their organizations to become more effective entrepreneurs, including energy entrepreneurs. If women were encouraged to engage in entrepreneurial activities related to energy services and technology distribution, they could play an important role in disseminating alternative approaches that address rural energy needs. Since they are familiar with the specific hardships women experience due to lack of energy services, women energy entrepreneurs are in a good position to reach other women and explain the characteristics and advantages of various energy alternatives.

Because access to modern energy services is so critical to the achievement of overall sustainable development goals, focusing more attention on women and energy linkages, increasing women's contribution to new energy approaches and ensuring that women benefit from these approaches will improve the overall effectiveness of national development objectives and policies, as well as specific energy plans and programmes.

Preparation of the Energy and Women Project case studies

An important element of the UNDP Energy and Women project was to analyse energy projects in terms of their involvement with and impacts on women and sustainable development, emphasising energy for productive uses and income generation, and to present that information in the form of case studies. The projects selected have achieved varying levels of success, and some are still in the early stages of implementation, but they all contain ideas about how to strengthen linkages between energy project activities and women's development needs. To provide a basis for policy design, information is needed on what activities and what enabling conditions impact the success of women in economic activities and in overcoming poverty. Case studies help identify what critical development bottlenecks need to be addressed in policy formulation and

suggest areas needing direct policy support in order to expand opportunities open to women.

It is our hope that this information will be useful to UNDP country office staff throughout the world, as well as officials in national governments who deal with energy policies and women's issues, members of non-governmental organizations and grassroots women's groups, funding organizations and others involved with planning and implementation of energy projects and policies.

The objective of compiling this volume was not to select "best practices," but to look at projects addressing women and energy issues with a view to extracting lessons learned about success criteria for good project design, implementation and sustainability. The enabling conditions at the local and national level that facilitate or undermine the achievement of sustainable energy objectives were also considered. The selection of projects for analysis and evaluation was based in large part on national consultations and regional workshops conducted in Africa, but in order to offer a broader perspective, relevant cases from other regions were also considered.

One important function of a publication such as this is to document lessons learned from actual activities and programmes linking energy and women. Analysis of what approaches work best and which issues pose the greatest obstacles for reaching women and rural communities with modern energy services, is a critical element needed to inform policy analysis and national planning efforts. As the case studies will show, there are numerous important policy, technical, financial and organizational elements to consider when trying to design energy services and systems to meet the needs of women and communities.

UNDP Regional Workshop for Southern Africa

The Energy and Women project began by sponsoring national consultations in southern Africa in May of 1999. National experts, government officials and leaders of community organizations met in different countries to consider how national energy policies impacted on, and could be improved in relation to, women's development needs and priorities. Country reports were prepared by representatives from Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe, and presented at a regional workshop held in Pretoria, South Africa on June 21 and 22, 1999.

The regional workshop provided an opportunity for participants to share information about the constraints affecting women, and to discuss ways for women to gain better access to energy for domestic and productive purposes. They agreed that more attention needs to be paid to women's energy needs, especially in rural areas, and that women themselves should be more involved in solving those problems. They also expressed frustrations about prior projects dealing with improved cook stoves, briquette making, wood-lot management, solar electric panels, and solar cookers or food dryers. Frequent complaints were that these energy projects were donor-driven, did not involve consultations with the expected users, and ended when the donor funding was finished. In the experience of workshop participants, there was often insufficient follow-up or analysis of projects, and inadequate attention was paid to elements that would ensure project continuity. There was agreement that project level support would not reach the objectives of meeting women's energy needs unless there were widespread national programmes and supporting policies to extend the scope and impact of energy efforts. The workshop concluded that new approaches are needed for designing and implementing energy projects involving women.

Regional Workshop on Women and Sustainable Energy in Africa

Many of the themes raised at the South Africa workshop were echoed at a March 2000 regional workshop in Nairobi, Kenya, organised by members of ENERGIA—an international network working on issues relating to gender and sustainable energy—in collaboration with the Environmental Liaison Centre International, UNIFEM and Winrock International.

Participants at the workshop were drawn from Ethiopia, Ghana, Kenya, Lesotho, Mali, Mozambique, Namibia, Nigeria, Senegal, South Africa, Swaziland, Tanzania, The Netherlands, Uganda, Zambia and Zimbabwe, including some who had attended the UNDP workshop in South Africa. Those attending included representatives from NGOs, government ministries, international organizations and universities, as well as experts with direct experience with women and energy issues. Most of the countries represented had conducted prior national consultations, sponsored either by ENERGIA, UNIFEM or UNDP.

One of the common problems identified at the regional meeting was the fact that most national energy policies support urban and industrial sectors, and few address household and rural needs. Since rural areas have limited access to basic infrastructure, many rural women lack access to efficient energy services or even information about possible options. Participants emphasized that lack of education and training, as well as societal constraints, limit women's participation in energy decision-making processes, and that planners and policymakers have generally not recognised women's distinct energy needs. Many expressed the need for sharing information among countries in the region, and for documenting lessons from past projects to avoid mistakes and to build on promising approaches at the programme and policy formulation levels.

The discussions, conclusions and recommendations of both workshops, as well as the background materials presented, were very important in informing the scope and design of this publication.

Key issues identified for consideration in the case studies

The Energy and Women project convened a special group of technical advisors to assist in the selection and preparation of the case studies. Development of this publication was guided by inputs from that expert group, the recommendations and information received from participants in the national consultations and regional workshops, and the analysis and field experiences of UNDP. A number of key factors for successful project design were identified, and authors were asked to consider these factors in analysing particular projects. While many of these factors are desirable for sustainable development projects in general, these specific topics were seen as particularly important for projects dealing with women and energy linkages. These same factors point to important areas for expanded consideration and policy analysis in the framing of energy programmes and national policies to extend energy services to rural areas to meet the economic and social development needs of women.

Benefits to women. The national consultations and regional workshops in Africa indicated that women were interested in reductions in the time and effort required for gathering fuel and performing household tasks, improvements in lighting and indoor air quality, and enhanced income opportunities. Prior energy projects specifically targeted towards women dealt mostly with household energy use. These case studies put more emphasis on income production, skills training, and capacity building, which allow women to play a greater role outside of the domestic sphere, and on enhanced individual, family and community opportunities for growth and development.

Income generation. Because women in developing countries generally cannot afford to pay for new equipment unless it somehow can be used to generate income, most of the cases were selected to include an income-generating component. In some cases, women have been able to earn money through activities that provide fuel or energy services that they can use themselves and also sell to others, becoming small-scale energy entrepreneurs. In other cases, women use more efficient equipment or energy sources to increase profits from their traditional income-producing activities, such as food production and processing.

Environmental protection. Although international organizations and donors tend to emphasise the need for environmentally friendly energy systems, participants in the national and regional consultations pointed out that energy projects designed to meet goals related to reducing deforestation or carbon dioxide emissions tend not to be successful unless the people involved feel that their lives and local conditions are directly improved by the project. The case studies chosen primarily deal with projects using decentralised energy equipment and evaluate the interconnections between environmental goals and local development needs.

Access to credit. Affordability and financial credit were identified as essential elements of projects aimed at providing poor users with greater choices among fuels and energy technologies. Access to credit can help users acquire new technologies, but women are often not eligible for credit from banks because of collateral requirements, and amounts available from microcredit institutions are not sufficient for acquiring energy equipment. The Energy and Women project looked for cases that applied innovative financing strategies to address some of these concerns.

Financial and practical viability. The case studies examine factors likely to allow projects to continue beyond the pilot phase and expand in scope. Participants in the regional workshops observed that projects are not sustainable if they rely primarily on donor financing, especially if funding is offered only on a short-term basis. Long-term financing and marketing strategies are needed to make projects self-sustaining and financially viable. Since women cannot afford to pay for energy services if they have no sustainable income base, workshop participants emphasised the need for strategic assistance with skills training and financial management to help women entrepreneurs improve or expand their businesses, and observed that the best entry point for this support is through organised women's groups that come together for collective productive purposes.

Stakeholder participation. One of the fundamental assumptions of the Energy and Women project was that greater involvement of women users in the design and implementation of energy programmes could produce more relevant and effective policies and outcomes with greater benefits to women, their families and their communities. The national consultations in Africa revealed that in most countries national planners have limited connections with women in local communities, so that even when community women have relevant experience and knowledge and could make significant contributions to development of energy projects, they have very few opportunities to provide input. The case studies were expected to provide examples of ways to actually promote greater participation by women in the design and implementation of energy projects, planning and policies.

Application of lessons learned from the case studies

The Energy and Women project aims to move beyond information gathering and analysis. The long-term objective is to integrate successful gender-sensitive approaches into mainstream national energy policies, and into country and local-level project design processes.

A number of conclusions are drawn in the "Overview" chapter that follows concerning policy considerations arising from the case studies. They include the need for credit mechanisms that reach women, energy services that meet women's unique needs, energy approaches that generate income to both empower women and sustain increased energy activities, and

the critical importance of capacity building, business training and technology information. The need to establish mechanisms to capture the experiences and perspectives of women and organised women's groups in the national policy-setting and review process is also discussed.

New approaches to the provision of energy services to meet family and community needs in developing countries can provide a powerful means of moving forwards towards overall national economic, social and environmental goals. For such approaches to be sustainable, however, experience shows that more attention is needed to women and energy linkages related to energy production and distribution, and utilisation of energy services.

UNDP hopes that publication of this book of case studies will make a significant contribution towards application of useful models and concepts for sustainable energy policies and programmes that provide benefits to women in developing countries, as well as to their families and communities.

LESSONS FROM THE FIELD

OVERVIEW

SALOME MISANA

Energy is inextricably linked to all major development issues. Indeed, the ready availability and quality of affordable energy expands people's possibilities and capabilities, which is one way of defining human development. The links between energy and development have been recognised at major international forums throughout the 1990s. They have been clearly articulated in a number of publications, particularly *Energy After Rio: Prospects and Challenges* (UNDP, 1997) and the recent *World Energy Assessment: Energy and the Challenge of Sustainability* (UNDP et al., 2000). These publications also analyse the specific ways in which the use of traditional fuels in developing countries affects the lives of women and children, showing that they are disproportionately burdened, primarily because of health impacts and lost opportunities.

This book of case studies starts from the premise that satisfying people's needs for modern forms of energy can be an effective entry point for improving standards of living and health, and creating new job and business opportunities, especially for women. It is important to recognise that women and men have different needs, interests, roles and differing degrees of access to energy resources and services. This is further differentiated among the rich and the poor, the rural and the urban populations. Energy policies, and indeed all development policies, must address these distinctions in order to be effective.

By tradition, women in Africa and most other developing areas are responsible for activities such as cooking and food processing that have high energy demands. Consequently, they shoulder much of the household energy burden, using their own labour for domestic tasks and for collecting needed fuel. Because of the central caregiving role of women, improving women's access to new sources of energy can have a ripple effect, enhancing the lives of their families and communities as well. As these case studies clearly demonstrate, however, providing energy in useful, convenient and affordable forms is not a simple matter, especially in rural areas where extension of the electricity grid is not economical.

Meeting the energy needs of women calls for a shift in focus to the demand side of the energy system, to the end users of energy and energy services. The case studies presented here describe a number of decentralised solutions for providing access to energy services. Because the initial needs of rural households are relatively modest, they can benefit greatly from small-scale off-grid solutions.

Although the projects considered here offer promising approaches, most of them nevertheless encountered significant social, economic, technical and political challenges. Our hope is that the lessons that can be drawn from them will be useful for others that are helping communities, and especially poor and rural women, to take advantage of more efficient, safe and convenient forms of energy.

This chapter provides a synthesis of the key lessons learned from the projects included in this collection of case studies. The majority deal with African countries, where issues of access to modern forms of energy are most intractable, in large part due to lack of social, financial and physical infrastructure. Case studies from Nepal and Bangladesh are also included, however, since energy scarcity affects people in all regions, and these examples present interesting approaches for providing energy services in remote locations. The case studies are briefly summarised below.

BANGLADESH: Battery-Operated Lamps Produced by Rural Women

In an area of remote islands beyond the reach of the grid, electric lighting to replace kerosene lanterns was identified as a high priority. Local women have learned to manufacture battery-operated lamps in a small factory and market them for household and business uses.

GHANA: Improving Rural Women's Enterprises

Consultations with community women revealed that they needed energy-efficient equipment to improve working conditions, increase profits and reduce time and effort required for traditional post-harvest agricultural processing work. Initial projects involve the use of an improved press for shea butter production and a more efficient, less-polluting fish smoker.

KENYA: Upesi Rural Stoves

In areas of wood scarcity, rural women participated in testing and evaluating stoves designed to use less firewood and also produce less smoke. After training, they were able to produce, install and market the stoves, and adapt them further to meet customer demands.

MALAWI: Ndirande Nkhuni Biomass Briquettes

To address problems of deforestation and fuel shortages, women in a densely populated low-income area were trained to produce and market briquettes made from sawdust and waste paper. Location of the project near a commercial city proved to be important because of high demand for fuel to meet household and small business needs, and proximity to waste material suppliers.

MALI: Multifunctional Platform for Village Power

A diesel engine mounted on a platform provides off-grid energy to rural villages for a variety of uses, including grinding, processing agricultural products, pumping water, charging batteries and running lights. Women's groups have been trained to operate and maintain the equipment and sell energy services to local customers.

NEPAL: Micro Hydro for Mountain Villages

In hilly areas of Nepal, micro hydro systems provide decentralised power for remote villages. An innovative process of community mobilisation and skills training ensures that men and women alike are able to use the energy supply for productive work and social benefits.

SOUTH AFRICA: Impact of Women's Energy Group on National Policy

As the new democratic government in South Africa moved to establish more equitable energy priorities, a group of women energy experts and activists pushed for greater attention to women's needs. Despite frustrations, they were able to call national attention to women's energy concerns, and the current energy minister has introduced policies to address past inequities based on race and gender.

UGANDA: Solar Systems for Rural Electrification

In areas without grid-based electricity, commercially marketed solar photovoltaic systems supply much-needed electricity for homes, businesses, schools and clinics. An attempt to provide loans through local banks to cover initial purchase costs showed the need for more flexible and appropriate credit arrangements.

Energy issues are complex and linked to the policies and influences of multiple economic sectors and national conditions. This complexity is even greater when gender-disaggregated considerations related to the distinct economic and social roles of men and women and their diverse energy needs are taken into account. These interlinkages and differentiations must be reflected in energy policy, programme, and project planning processes.

Even in well-thought-out efforts to provide energy services, unforeseen problems arise or subtle social dynamics (quite often having to do with gender-based issues) suddenly become obvious. That is why successful programmes generally start with small-scale pilot initiatives and projects that encourage learning through experience and have flexibility built into their design. While there are no simple and easy solutions, the following lessons drawn from the case studies presented in this volume provide a kind of checklist of design features that can often spell the difference between failure and success.

While the unit of analysis considered in the majority of the case studies is at the programme and project level, this collection of experiences provides the basis for a number of important conclusions. These can provide essential elements for sustainable energy policy formation to meet the needs of women and rural communities. The lessons learned are presented in nine broad categories.

1. A favourable enabling policy environment and the support and coordination of local and national government institutions are critical to the successful introduction of new approaches to delivery of energy services.

Although many governments have included the idea of promoting decentralised and renewable energy technologies in their national energy policies, the major emphasis is still on petroleum fuels and conventional power plants. Energy policies tend to be focused on the supply side, with little attention to the energy demand characteristics of women and rural communities. The absence of specific policies to promote alternatives for rural energy creates barriers for innovative approaches to the delivery of energy services. When appropriate enabling policies are in place, efforts to address the unique needs of women and rural communities will be more successful.

In Nepal there was a clear national policy framework to support decentralised micro hydro systems to meet rural energy needs. Government subsidies for micro hydro power were essential for the financial viability of the project. Supportive policies were also present in relation to financing and credit availability, an essential element to support decentralised systems. Government support for the provision of lines of credit through banks and lending institutions was a significant factor in the project's success. Financing was supplied not only by the Agricultural Development Bank of Nepal, but also by local and regional institutions. In fact, engagement of all different levels of government was central to the entire Nepal experience, which involved village and district-level development committees, as well as national ministries responsible for water and energy, forestry, industry and electricity and planning. In addition, national policies facilitated development of private sector hydropower companies by establishing legal and institutional provisions for equipment standardisation, subsidies, and partnerships with government agencies. This case study illustrates the importance of linkages and cohesion in the policy approaches of different levels of government, as well as the importance of addressing linkages across sectors.

The alignment of local and national policy environment was also demonstrated in the Malawi project, which enlisted local community development committees as partners and engaged them in activities to introduce briquette-making technology and provide training to women's groups. This was supported in part by the national policy that favoured decentralisation and thereby supported the establishment of institutions at the district and community level to promote stakeholder participation. The Malawi project also benefited from the introduction of favourable government policies on forestry management, energy and the environment. These policies, established after the 1994 elections, reflected an increased political commitment to support women's rights, local development and participatory democracy.

In Mali, the government does not have a clear policy for bringing decentralised power to rural areas, but has recognised the potential for using the multifunctional platform as an engine for development and poverty reduction in rural communities. The project's regional support and advisory units are supported by a national-level government coordinator who provides management oversight and monitors integration of the project with the activities of national agencies and donor groups. In this case there are local-to-national linkages reflected in project management and coordination arrangements.

The need for cross-sectoral coordination was particularly highlighted in the South Africa case study. There, an analysis of government energy policies not only revealed the need for gender sensitivity, but also showed the importance of integrating energy with other development sectors. Such an integrated approach would ensure that women could own land, obtain rights to crops, and have greater access to financial resources.

Uganda's national gender policy was a key factor in the government's efforts to make the solar photovoltaic project more gender-sensitive. Since the project worked with private sector companies and found that very few women were involved in solar businesses, the staff made a special effort to involve women as technicians and entrepreneurs. The project also worked with financial institutions in an attempt to address discrimination against women in terms of access to credit. The gender policy is coordinated with Uganda's rural electrification strategy, which is aimed at reducing inequities in access to electricity and therefore supports decentralised electricity development and accessible financing mechanisms.

Without the support and coordination of different levels of government institutions, it is very difficult to move from

the pilot project phase to more broadly based energy delivery programmes, especially in rural areas. Policies will be most effective, however, if they address the specific concerns of women regarding access to mechanised pumping and production equipment, improved cooking and heating technologies, and electricity for lights and appliances. Critical areas for national policy support in favour of sustainable energy approaches benefiting women include decentralisation, support for credit institutions, differentiated energy pricing to target poor and marginal groups, property and legal rights for women, and support for local community groups, including women's organisations.

2. Successful approaches must address actual conditions. Policies, programmes and projects should start from an assessment of people's needs rather than a plan to promote a particular technology. The needs of different rural communities vary widely, and finding appropriate technologies and effective implementation strategies can be very site-specific.

Policies and programmes need to avoid "one size fits all" approaches. Approaches that favour demand-side considerations rather than supply-side energy targets are more likely to reflect the actual needs of women and poor households. Energy needs should be considered within the overall context of community life, and energy policies and projects should be integrated in a holistic way with other improvement efforts relating to health, education, agriculture and job creation. A well-formulated needs assessment undertaken prior to programme design will ensure that the approach is grounded in the specific reality of the people involved, not driven by a donor's good but possibly misguided intentions regarding the need for a particular energy technology. Similarly, national policy design must distinguish between the energy needs of rural and urban groups, between the rich and the poor, and most importantly, between women and men.

In the Ghana project, the women knew exactly what they needed: technologies to make post-harvest processing easier and more effective. By helping them with this, the project drew support and enthusiasm. In this project, moving up the energy ladder included introducing liquefied petroleum gas (LPG) into the fish-smoking process. In Kenya, sales of improved stoves were least successful where women did not feel they were really necessary—in areas where wood scarcity was not so critical. In Uganda, households were offered solar panels, but sales were limited by the fact that the panels were difficult to afford and were not directly related to people's pressing needs for labour-saving equipment. The Bangladesh project was successful because it began from a needs assessment and then identified an appropriate technology. A local survey showed that lighting was a priority in the area, and the women involved in the project then proceeded to create a marketing plan based on people's willingness to pay for battery-operated lamps.

What is an appropriate technology in one place may not work in another place due to even slightly differing conditions, such as distances from markets, availability of resources, or varied traditions. That is why an initial assessment of needs, resources, capabilities and preferences is so important. Innovative methods of quickly obtaining indigenous knowledge and input—often called rapid rural appraisal techniques—can be valuable in gathering relevant information, including cultural sensitivities and gender-related issues. A thorough needs assessment may elicit different views from men and women that can then be addressed in the programme strategy.

Although it is reasonable to expect approaches to vary from one country to another, even within a relatively small region, different villages will respond differently to similar project inputs. In Mali, village-specific feasibility studies showed that local customs and practices affected the timing and amount of demand for post-harvest grinding and milling. In Bangladesh, the farther away a village was from a battery-charging station, the less likely people were to buy battery-operated lamps. In Malawi, the financial viability of briquette production was determined by proximity to an urban area where there was significant demand for fuel alternatives and where low-cost wood and paper waste products were readily available. In rural areas where wood could still be obtained for free, people had less income (and less motivation) for purchasing briquettes.

Starting with a needs assessment will ensure that the project design is appropriate and responsive to the distinct concerns of the people—men and women—in the communities involved. At the policy level, an accurate picture of the energy demand characteristics of targeted groups is essential for designing appropriate and effective energy policies. Just as different approaches are needed at the project level, distinct policy approaches are needed to address different demand groups. These case studies reflect some of the demand characteristics of women as energy consumers, including needs for lighting, cooking and heating, food and agricultural processing, water pumping and home businesses.

3. Environmental issues must be addressed in the context of overcoming poverty and helping people meet basic needs. The most successful programme and policy approaches to sustainable energy are those that deliver improved services and expand opportunities while also protecting the environment.

This lesson is very closely related to the point above. People struggling for survival are unlikely to adopt more environmentally friendly technologies unless it can be clearly shown how they can improve family health and well-being. Although global environmental issues are high on the agenda of many donors, due to intergovernmental processes that have made them priorities for national and international action, these objectives are not likely to be met unless they can be clearly linked to local needs. Fortunately, most sound energy strategies, which

have multiple benefits and energy technologies that are safer and more efficient at the local level, will also tend to have positive global impacts.

Sustainable energy approaches that have "win-win" economic and environmental benefits include: (1) the promotion of end-use energy efficiency to get more benefits out of existing resources and fuels; (2) the promotion of renewable energy systems, especially for use in decentralised systems to provide services in rural areas that are uneconomic for grid extension; and (3) the introduction of cleaner, modern technologies and energy carriers where energy services are scarce or absent.

The Nepal project used decentralised micro hydro energy systems to simultaneously address environmental issues, social progress and economic growth. The availability of hydro resources made it possible to develop modern energy production facilities without the environmental degradation associated with conventional fossil fuel systems. The Mali multifunctional platform project also provided decentralised power to meet economic and social needs, in this case using a diesel engine. Though not a renewable technology, the engine effectively met the energy needs of the local people, and the tradeoffs in terms of work and energy efficiency compared to using human or biomass energy made it worth while, even from an environmental standpoint. Where oil from the local jatropha plant is used as fuel for the engine, the project can be even more environmentally sustainable.

Approaches such as those in Kenya and Malawi were driven initially by concerns about deforestation that, although pressing from a national or international perspective, did not necessarily reflect the priorities of the targeted beneficiaries. In Kenya, users of improved stoves saw the benefits primarily in terms of improved health and reduced exposure of family members to smoke from cooking fires. In Malawi, buyers of biomass briquettes were less concerned with the environmental impacts of deforestation than with the availability of a reliable fuel supply.

These case studies indicate that at the local level, environmental priorities tend to be those with a direct link to health and poverty issues. Energy policies and programmes designed to promote environmental protection and energy-related natural resources conservation must also provide expanded economic opportunities or improved health and social conditions. This is essential if energy activities are to be successful in support of local sustainable development.

4. The greater the income-generating effects of sustainable energy efforts targeting women, the easier it is to mobilise support. National energy policies that support energy services that increase economic opportunities for women can promote multiple development objectives.

The most successful projects were those that stimulated income directly through engaging local people in the manufacturing and selling of energy technologies, as well as *indirectly*, through gains in productivity or expanded economic activity resulting from new energy inputs. National and local energy policies that seek to expand the availability of energy services for value-added productive activities that are typically undertaken by women not only support economic growth, the well-being of families and the advancement of women, but are more sustainable over time.

When local people can actually make money from manufacturing or selling new energy technologies and services, an entrepreneurial dynamic is unleashed. The Bangladesh and Mali case studies clearly show that new possibilities for earning income can generate real enthusiasm. Earning money, in turn, can immediately improve women's status in their communities and households. The women in the Bangladesh project earned money by manufacturing lamps, and in the process they also overcame social barriers and learned new business and management skills. While hundreds of households were able to enjoy improved and affordable lighting as a result of the project, a smaller core group benefited even more directly and substantially. A core group, with a high stake in the project results, can be a powerful impetus for sustained momentum and provide an excellent example for other groups to replicate based on the drive for expanded economic opportunities.

In Mali, women operated the diesel generators as formal businesses and became energy entrepreneurs, selling energy services to both men and women and thereby increasing economic activity in the community as a whole. Although the project is still in its early stages, the ability of women to both earn money and control equipment in a country where they have not previously had access to capital or assets, has begun to transform social and gender dynamics.

In the Kenya and Malawi projects, women also were able to realise income directly from the sale of energy-related products—the improved stoves and biomass briquettes. The success of the Uganda project, on the other hand, was limited by the fact that women were not involved in the marketing and distribution of the solar systems and so were not able gain benefits as energy suppliers. Women as energy entrepreneurs must be involved in the production, marketing and sales of energy products to gain the full economic and social benefits of this approach.

The Nepal micro hydro efforts focused on the use of energy systems as a means of promoting local entrepreneurial activity. As part of the project's capacity building, each household received training for income-generating activities, which led to the opening of new businesses such as bakeries, saw mills and agricultural processing operations that utilised the newly available electrical power. In Malawi, the availability of an affordable fuel supply in the form of biomass briquettes also supported income-generating activities, particularly food-vending businesses that required reliable energy sources. In these examples, women were not only energy entrepreneurs, but the beneficiaries of improved energy services which expanded their economic and productive options. This contributed to improving their social status due to economic empowerment.

Since lack of energy is so closely related to poverty and limited economic growth, availability of new energy services is a key factor in community development. Projects that involve manufacturing and distributing decentralised energy-related technologies can provide new income streams for both producers and users of the equipment whether they are men or women.

Encouraging women to become energy entrepreneurs, rather than merely the beneficiaries of expanded energy services, has multiple development benefits. These include the advancement of women, expansion of economic activities, diversification of productive options, and the creation of new sources of wealth and income to support family investments in education and health. Energy policies that support the development of entrepreneurial energy activities and business approaches that involve and benefit women, can achieve positive impacts beyond the energy sector.

5. Energy policies that identify and enhance market opportunities in rural areas are essential for economic and social development and can be an important engine for growth. Effective marketing strategies are crucial for realising commercial opportunities and establishing long-term financial viability of energy-related projects.

Rural villages with subsistence economies may simply not have the financial base to support investments in desirable energy technologies. Such investments become more attractive when the technologies provide revenue or expanded economic opportunities for the community. Governments play a critical role in enabling market conditions both by removing barriers to expanded energy activities (pricing, ownership, licensing or taxation bottlenecks) as well as through promoting increased access to energy technologies, consumer information and urban markets.

The revenue possibilities of energy activities targeting productive uses can be multiplied if marketing efforts allow them to reach a wider customer base. Marketing is a crucial part of most sound business strategies, and business-like models should be adapted wherever possible in project design, as a way to make them viable over the long term. In Bangladesh, for example, a detailed marketing plan analysed locations, customer characteristics, target markets, competition and electricity demand, as well as goals and budget implications for the production of battery-operated lamps.

The marketability of the products—in terms of quality, affordability and competing alternatives—should be carefully evaluated during the project design phase. If this had been done in the initial UNDP Malawi biomass briquette project, it might have been more effective. That experience did, however, contribute to better outcomes from the subsequent Ndirande Nkhuni briquette initiative in Malawi, which took advantage of a more populous location near a city where the potential demand and ability to pay were greater. The second project also did a better job of marketing the briquettes, through demonstrations and brochures, thereby increasing its potential customer base.

In Mali, village-specific feasibility studies are used to determine whether or not there is enough demand and ability to pay within a community to support a multifunctional platform installation. If there is not enough market demand to cover operating costs, the project is not initiated in that location. Demand is calculated based on actual ability to pay for the services, not merely on the fact that such energy services are needed or would be beneficial.

In Ghana, future prospects for village women will be greatly enhanced if the project is successful in circumventing "middlemen" in the marketing chain so that women can realise substantially higher prices for their shea butter products. That project is also working to acquire a fish smoker that meets international standards, which would represent an immediately leap in commercial potential, and would greatly improve the profitability of local fish processing.

These case studies suggest that when local market conditions are carefully assessed and commercial opportunities taken into account, energy programmes are more likely to continue and expand in scope. They also suggest that these factors should be important considerations in informing energy policy formation targeting the expansion of energy for productive purposes. While the economic base of poor rural communities may be insufficient to expand energy services based on local resources, the ability to generate revenue through extending the consumer base for energy services and selling energy "embodied" products to urban markets can contribute to improved economic conditions in rural communities.

6. In theory, energy initiatives should be able to pay for themselves in the long term. Short-term public policies may be needed, however, to subsidise initial costs, and to provide innovative financing and credit arrangements to offset investments in energy equipment. A critical role for government policy formation is the appropriate targeting of subsidies to benefit the poorest groups, as well as the inclusion of "sunset" strategies to phase out subsidies when they are no longer justified. Public policy is also essential to extend credit opportunities to women and rural communities.

Though subsidies may be needed to get things started, continuing subsidies tend to distort markets and undermine project viability. Project driven approaches alone, if not designed to scale up over time, tend to result in permanent subsidies to alternative energy approaches which serve to weaken markets. In many countries, donor efforts in the provision of PV systems to households have served to undermine people's willingness to pay for PV systems, ultimately limiting the size of the solar energy market. In the Uganda case, PV systems were sold using market mechanisms and credit arrangements but women's lack of capital, collateral and financial documentation proved to be barriers limiting their participation.

In Kenya, marketing efforts for the Upesi stoves were complicated by earlier subsidies that had allowed the government to distribute improved stoves without cost to users, thereby weakening later efforts to charge market rates for the stoves. In Nepal, by providing subsidies through the determination of the electricity tariff for micro hydro energy used in remote areas, the government was able to support a sustainable energy option for rural communities without undermining urban energy markets.

While some households are willing and able to pay daily running costs for new energy technologies, credit arrangements will almost always be needed to help people living in poverty to meet the high first costs for new equipment. Credit systems allow first costs to be spread out over time in small payments similar to operating costs. In the Bangladesh project, for example, when women were able to buy batteries on credit, the market for the lamps increased.

Appropriate credit arrangements are crucial, but difficult to set up. Conventional banks resist the high risks and low returns associated with new approaches, and although microcredit schemes are often offered as a solution, they can be very difficult to implement. In the Uganda case study, the microcredit loans were too small-scale and short-term to finance the photovoltaic systems. An attempt to add a credit component to the project was complicated by the fact that the bank had not been consulted in the process of initiating the project. Because the bank viewed solar systems as consumer goods without any potential for income generation, it did not see how the women could repay the loans, and imposed collateral requirements that few potential customers could meet. As a result, although the project targeted women, only one woman entrepreneur actually used the bank's credit facility.

Many poor households cannot afford to borrow for consumer goods, but they could invest in new equipment if it allowed them to earn enough money to pay off their loans and cover operating costs. That is why productive uses of energy-related equipment are so critical.

In some cases, investments proved to be more feasible at the community level than the household level. In Nepal, once a village micro hydro system is installed, community members are able to purchase electricity out of the additional income they earn due to the project's skills training component. In Mali, the women's groups earn enough money from platform operations to pay off their loans and cover their operating costs. In both Nepal and Mali, however, the projects still rely on government or donor support to cover a portion of the capital costs.

In fact, none of the projects reviewed here are financially self-sustaining as yet. To put this in perspective, however, rural energy projects in many of the now-industrialised countries initially required substantial government subsidies. Moreover, most of these projects are still pilots, and thus not able to achieve the economies of scale that may be possible later on and that will determine long-term viability.

Government subsidies may be justified to underwrite the high first costs of new energy systems or access to decentralised systems for people living in remote areas. Considering the costs of conventional grid extension, governments may decide that such subsidies are warranted to meet political, social or economic development objectives.

In any event, ongoing financing and credit arrangements are critical to the adoption of new energy-related technologies, and greater efforts are needed to allow women access to appropriate credit facilities. Government policy must address specific barriers faced by women trying to access credit. Often their legal status or lack of ownership rights or financial or personal documentation blocks their access to financing for energy services and technology.

7. Capacity building is needed to strengthen involvement of women and attention to women's concerns throughout all levels of energy policymaking, planning and project implementation. National policies should recognise gender asymmetries and target women and women's groups to have increased access to capacity-building opportunities if social and economic goals linking energy and development are to be achieved.

Capacity building at the project level can mean learning new skills, such as bookkeeping, marketing, managing a plant, or learning about various energy technologies and how to build or run them. It can also refer to the resulting sense of empowerment as people learn to take charge of their own lives and communities. Sometimes the self-confidence fostered through project activities increases people's ability to make other changes in their lives. Capacity building at the policy and national level with regard to women will often mean seeking the involvement of women's organisations and expanding the development opportunities for their members.

The earliest energy technology, the three-stone stove persists as one of the most widely used cooking methods in the developing world.

In terms of energy planning and decision-making processes, capacity building can have political or sociological dimensions as people learn to work within organisations and use them to exert more power. This was clearly demonstrated in South Africa where a women's energy network played an important role in the formulation of national policy. Within the network, women shared information and skills and helped each other work towards higher levels of professional competency and recognition. Networking is a particularly useful form of capacity building because it spreads new ideas, provides a means of sharing experiences, and strengthens women's ability to acquire and deliver substantive expertise.

The Nepal project was especially interesting in terms of capacity building. Providing a mechanism for women's participation, in spite of traditional social barriers, allowed the project to mobilise both women and men. As leaders of mixed groups (with both men and women), the women now have a voice in community affairs. Their self-confidence has increased, as has their capability for independent and collective action. Both men and women gained literacy and business skills and received training in use of the technology, small business operations and environmental management.

The Nepal project also worked within a network of community development committees that offered an ongoing mechanism for local democracy. The village development committees have representation at the district development level, and linkages to decision-makers at the national level. Thus the programme helps build capacity in governance at many levels, beginning with community mobilisation. The design of the overall programme also helps link local needs to national policy.

Skills training was built into all the projects, but some, like the Mali, Bangladesh and Kenya projects, did a particularly good job of training on many levels. The table in the Mali case study clearly shows how complex this task can be, requiring different types of training for different target beneficiaries. In Kenya, also, the different actors in the Upesi Stoves project—producers, distributors, retailers, promoters and installers—were given different training packages. For producers, the training was more technical, although it also included business management skills, such as pricing and record keeping. For retailers, there was in-depth training in customer relations and sales promotion, as well as costing and pricing. In Bangladesh, women participants were taught how to construct the lamps, and group leaders were given instruction in bookkeeping, accounting and business management skills needed for operating the manufacturing facility.

For women, capacity building is an essential element of any development project. Benefits are not limited to project-level interventions and, in fact, capacity building at the local level can be an essential tool to develop increased involvement of women and their representatives at the regional and national level due to the empowerment process. This was clearly demonstrated in the Bangladesh, Mali and Malawi case studies. The case studies examined here show some of the different forms capacity building can take, and demonstrate how acquisition of technical and managerial skills can lead to substantial expansion of women's roles—at home, at work, in their communities and in national decision-making processes.

8. The full-fledged participation of intended beneficiaries, including women, is crucial in all phases of an energy programme design, implementation and evaluation. Targeted efforts are needed to include representatives of stakeholder groups, especially women, in national policy-setting processes related to energy.

Analysis of these case studies shows that informed participation is one of the principal success factors in decentralised energy projects. When stakeholders—who understand local needs, resources and dynamics better than anyone outside their community, and whose lives will be directly affected by project outcomes—debate and decide the merits of different approaches and technologies, the project is more likely to succeed. When local people drive the process and feel ownership of it, whole communities can become empowered and mobilised. Efforts worldwide to expand democratic processes and participation at the national level to improve policy-setting and implementation processes build on this same observation. Informed policymakers who have consulted with community members and fully understand local conditions, especially the situation of women, will make better policies.

For effective delivery of energy services, the beneficiaries—both women and men—must define the end uses that are most important for them, decide what they are willing to pay for different levels of service and, based on a wide range of choices, plan for future needs. Communities should also be given the choice of whether to invest in energy at all or whether they would rather put their efforts into some other income-generating infrastructure.

Getting all the stakeholders to participate, however, requires special efforts. In Nepal, for example, separate planning committees for men and women were necessary to ensure that the women would feel free to speak up. In the Mali case, accommodating women, especially young mothers, proved difficult because of the multiple demands on their time.

Although women traditionally tend to be excluded from decisions about energy, these cases studies show that when women are approached in the right way, and given enough information, their insights can be extremely useful, especially concerning technologies that they use daily. In the Kenya project, women field-tested stoves and helped adapt them to meet consumer needs, which resulted in a better and more saleable product. In the Ghana case study, a number of energy-saving technologies had been developed by research institutions, but their diffusion was slow because of the lack of involvement of the intended beneficiaries, most of whom were women.

Participation in all phases of the project cycle is important. Where women were involved only as end users, as in the

Uganda photovoltaic project, and not engaged in the design and implementation phases, their benefits were less significant than those of the men who were able to profit from marketing and distribution of solar equipment.

The one case study that deals with national energy policy formation processes, South Africa, lists a number of the challenges associated with involving stakeholder groups and women's organisations in national policy debate, especially when there is little experience or tradition in that regard. This is dealt with in more detail below.

Stakeholder participation has been found to be an important factor in successful development assistance efforts throughout the world, and these case studies show how increased attention to participation can improve the overall effectiveness of energy-related projects, programmes and government policy efforts.

9. Introducing energy policies that take into account women's concerns is a complicated process. Appropriate national policies can support sustainable energy objectives that include gender-sensitive planning and projects. To inform national policy setting, mechanisms are needed to capture the lessons learned from local experiences, especially with regard to energy needs of women and the impacts of policies in other sectors on energy outcomes.

Rural energy generally remains low on the list of priorities of government and corporate planners. Energy policies in most countries tend to focus on the industrial sector and urban centres, while decentralised options for rural areas are often neglected. Rural energy needs for domestic, agricultural and small-scale, informal production activities, where women predominate, are given low priority. Getting policymakers to focus on rural energy is difficult. Getting them to focus specifically on the needs of rural women is even harder.

Still, the South African example demonstrates that a small but committed group of individuals can make a difference. It was specifically included to show the complexity of instituting change at the national level. Though it did not fully achieve its objectives, it did manage to bring gender-based energy and equity issues to the national agenda, paving the way for future action. It also built political and leadership skills among the women involved, and perhaps influenced the later appointment of women to important energy posts.

One of the interesting things about the South African example was the fact that the members of the Women's Energy Group, who were professionals, faced many of the same barriers confronted by women in rural areas: they struggled with lack of recognition and exhaustion and multiple demands on their time. Without a strong base of support, they had difficulty wielding or influencing political power, and they found that effecting change would be an ongoing process that would take time and require organizational strength.

One factor highlighted in both the South Africa and Mali case studies was the need to collect relevant disaggregated data on the ways in which men and women are affected differently by national policies. For example, the Women's Energy Group critiqued the integrated planning methodology used in South Africa on the basis that it looked at "households" as a category, without addressing the different needs and interests of men and women within households. Accurate and gender-sensitive information from the field can have a profound impact on policy formulation, demonstrating important inequities and gender asymmetries, and also showing how to overcome them.

In the Mali experience the linkages between the local programme managers' regional support units and the government's national project coordinator provide a potential mechanism for feeding insights from local experiences with decentralised energy back into national level policymaking. In the Mali case study, one of the points raised was that the current national poverty reduction strategy does not take into account energy poverty or women's time pressures. Yet, the fact that women are already so seriously overburdened would make any labour-intensive strategy for poverty reduction unlikely to succeed.

The presence of national policies to support gender equity and the advancement of women can also be essential elements to support improved energy policy. Malawi adopted a gender policy in 1999 as a means of ensuring that men and women benefit equally from development activities. This has encouraged efforts to expand briquette activities in order to promote development opportunities for women. The existence of a gender policy will not, however, ensure that energy activities provide benefits to women. This was evident in the Uganda case where, despite a national gender policy requiring all programmes and policies to address discrimination against women, credit mechanisms to support the purchase of solar panels did not reach women due to legal and collateral barriers.

In order to design and implement energy policies that directly support poverty reduction goals, continued efforts will be required by national and local government institutions to reflect and address the distinct energy needs and conditions faced by women and men. National policy-setting mechanisms in the field of energy can benefit from supportive policies related to gender equity and the advancement of women. Policy mechanisms in other sectors must likewise reflect the considerations related to women and energy in order to avoid unintended barriers to the extension of energy services.

Where do we go from here?

Several themes clearly stand out from an analysis of these case studies. These include the importance of supportive policy frameworks for local energy activities, as well as the need to design energy, credit, and environmental policies based on the energy needs of women and communities. The importance of the expanded economic opportunities which flow from improved energy services was underlined throughout the cases, and several of them showed that women can be important agents of change in their communities when they become energy entrepreneurs.

Meeting the energy and development needs of poor and rural areas will require new attention to ways of mobilizing communities themselves. For that, key factors are training in technical and business skills, and adequate financing arrangements that allow communities to acquire new technologies and use them to achieve economic and social gains. Yet, it is difficult to mobilize communities to solve energy challenges without particularly considering the distinct roles and needs of women, especially since they are so heavily burdened under current circumstances and resource conditions.

Pro-women energy policies are those that recognize existing divisions of labour between men and women and seek to provide the energy services that women can use most. Such policies can reduce women's time and physical burdens, expand educational and productive opportunities and open new avenues for energy business development. As discussed above, one critical aspect of this is the need to move towards policy-making processes that specifically address the energy demand profiles of women and rural communities.

Unleashing the potential for community-based solutions requires care, new planning approaches, innovations in government policy development and a deeper understanding of the impact of gender differences. Efforts to expand energy services can provide a catalyst for new entrepreneurial activities, but they must be integrated into overall community development plans that also address needs for improved health, food production, clean water, sanitation, and basic education.

Some of the case studies in this book provide useful models for approaching village-level energy problems, but for the most part they are pilot projects. These case studies provide examples of approaches that address multiple development obstacles, including energy scarcity, gender inequity, income-earning limitations and environmental degradation. The real challenge is to apply these models on a broader scale, and to use the lessons learned from these examples to design better energy programmes and policies for the future.

If women's particular needs are properly addressed in national and local government policies, using some of the approaches suggested here, overall poverty reduction benefits and empowerment goals are much more likely to be met. There is great potential for improving the position of women in their households and society through energy. Increasing energy activities can be an important means for promoting development, as well as an end in the fight to overcome poverty. The experiences profiled in this collection show that innovative energy approaches can be an entry point for achieving integrated solutions to the challenges of sustainable human development and supporting poverty reduction goals in developing countries.

Efforts to expand energy services can provide a catalyst for new entrepreneurial activities, but they must be integrated into overall community development plans.

BATTERY-OPERATED LAMPS PRODUCED BY RURAL WOMEN

BANGLADESH

HASNA J. KHAN

The project "Opportunity for Women in Renewable Energy Technology Utilization in Bangladesh" began in 1999 with funding from the Energy Sector Management Assistance Programme (ESMAP), a joint programme of the World Bank and UNDP. The project grew out of ESMAP's commitment to work towards poverty alleviation and gender equity by supporting sustainable energy solutions for people in rural areas.

Through consultations with community members and non-governmental organisations (NGOs) about energy needs in an area of remote islands outside the reach of the grid, electric lighting was identified as a high priority. The project identified a low-cost solution for improving the quality of indoor lighting of rural households by replacing the traditional kerosene lamps with modern battery-operated lamps. Using a unique approach, the project trained rural women to produce the lamps in a micro-enterprise manufacturing facility and distribute them through rural markets. By helping women shift away from traditional farm labour to skilled labour and gainful employment in the energy sector, the project has elevated the knowledge base of rural women and exposed them to mainstream commercial activities, while also meeting community needs for lighting.

At this point, through the micro-enterprise project, 33 rural women of Char Montaz are engaged in the construction and sale of efficient fluorescent lamps that use direct current (DC) batteries of 12 volts or eight volts. More than 600 lamps are being used with small batteries for lighting houses, shops, fishing boats, and mosques. The long-term target area of this project covers nearly 20,000 households within 300 square kilometres located outside the reach of grid electrification.

Bangladesh has an agriculture-based rural economy. Out of over 120 million people, 80 per cent live in rural areas. Per capita yearly commercial energy consumption is less than 100 kilogrammes of oil equivalent. The 20 per cent of the population living in urban areas consumes 80 per cent of the total commercial energy. The rural majority uses traditional forms of biomass energy, which account for nearly 70 per cent of the total energy consumption of the country. People in rural areas lack access to the commercial energy needed for economic prosperity. Apart from the need for a distribution system for commercial fuel, there is also a need for policy guidelines and an institutional framework for improving access to energy to promote economic development for the rural poor.

For lighting, people in rural areas currently use kerosene. Typically, poorer households use *kupis*, which are small inexpensive cans of kerosene with wicks stuck into them. Because these have open flames, they create serious fire hazards. Households with greater resources purchase hurricane lanterns which surround the flames with glass enclosures.

So far very little attention has been focused on the relationships between energy usage patterns and women's development needs. NGOs have engaged rural women in successful micro-credit programmes, but these have not focused on energy services. Sporadic projects have been implemented in the past by different government agencies and NGOs to improve women's cooking conditions, and to reduce the time spent by women and children in collecting fuel wood for cooking. The overall impact of these activities on women has not been well documented, however.

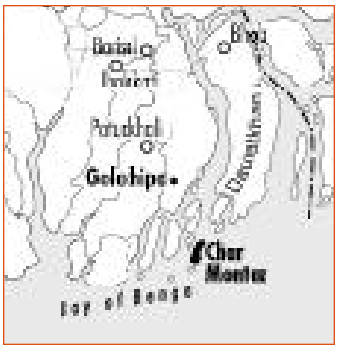
Rural electrification has had a direct impact on the growth of the rural economy, especially when electricity has been used for irrigation and other agricultural applications. Household electrification also has direct and indirect income benefits for rural households, especially for women and children. Electricity can be used not only to pump water, but also to relieve rural women of the physical burden of milling grain, allowing them more time for other activities.

Grid-based rural electrification in Bangladesh is not likely to increase from the present low level of 18 per cent to a reasonably acceptable figure within the near or medium term. Nor will it be economical to supply grid access in areas of low population density. Due to low energy consumption patterns in rural households, new rural grid-based electrification projects require significant demand for electricity for commercial, industrial or irrigation uses. Hence, it is necessary to investigate alternate supply sources and delivery mechanisms for those living in sparsely populated rural areas.

Traditionally, entrepreneurs operate diesel generators for evening lighting and productive power in non-electrified rural marketplaces. This is not yet an economic solution for rural households, which are generally left in the dark. Culturally, in Bangladesh, rural women are barred from the public markets, hence they and their children mostly spend the evening hours around kerosene lamps or in partial darkness.

Given the disparities in the situations of men and women, this project was designed as an experiment intended to support progressive improvement of women's lives, economically, socially and environmentally. Although the economic empowerment and social uplift is limited to direct participants in the project area, the overall impact of an improved environment for women has far-reaching potential that expands with every new household that adopts modern lighting.

Women's Lamp-Making Micro-Enterprise Project



The location of the project is Char Montaz in the southern region of Bangladesh, surrounded by the endless waters of the Bay of Bengal. ("Char" refers to an island isolated from the mainland.) The people in this area of Bangladesh periodically experience the trauma of natural disasters, and continually fight against poverty. It is a five-hour motor boat ride from the nearest commercial centre, Golachipa, in Patuakhali District.

Electric grid extension to this area is not economically viable, and is not included in the national plan for the next 20 years. Alternative energy sources, therefore, are crucial to economic development of the region. Surveys showed that demand was high for battery-operated lamps that provide an alternative to kerosene for lighting.

The project has shown that with proper training rural women are capable of assembling and marketing electric lamps to meet local needs. The women involved in the project are certified by the local government to do business as a cooperative, and run the manufacturing plant that produces the lamps. Besides lamp construction, women are learning quality control, business development and marketing. The project is also establishing a sales network among the rural markets situated on six different islands.

If a woman constructs and sells two lamps a day, her daily household income increases by 100 Taka (approximately US $2). This brings a woman the equivalent of the daily wages of a skilled labourer, thereby raising her income and social status.

Through the project, the rural private sector is directly involved in the implementation of the project, manufacturing of the lamps, and marketing and sales of energy services. In a country where rural electrification is viewed as a public service, the project has identified a niche for private-based operations that support broader rural development. It is the first model of its kind.

There are a number of advantages that make the DC lamps popular:

- The lamps use small batteries, familiar to rural households, that can be charged with diesel generators, which are currently available, or with solar modules when they become available.
- The lamps are made locally in the region, therefore users are confident about availability of repair services.
- The lamps use fluorescent bulbs, which produce sufficient light for children's reading and other tasks of a rural home, and exceed the normal working life of incandescent lamps.
- The lamps are designed to operate with high efficiency and low energy consumption.
- The price is affordable in relation to the benefits achieved.
- The lamps reduce the risks of fires from kerosene lamps, as well as smoke and emissions that cause health problems, air pollution and climate change.

Site identification

Selection of the project site for the women's micro-enterprise project began with area surveys to determine the potential market demand for DC lamps. Pre-determined selection criteria concerned the existence of any foreseeable government plans for electrification, the level of household density in the villages without electricity, and the general economic situation of the area.

The target area of Golachipa thana was found to have enthusiastic women participants, as well as a number of other favourable factors relating to:

- The potential market for DC lamps.
- Household income distribution in the region.
- Commercial and rural markets for sales centres.
- Entrepreneurs interested in becoming agents for selling DC lamps.
- NGOs involved in other development activities in the area.
- Support for the project from elders and the local elite.
- Support of the local administrative bodies.

Char Montaz was chosen to be the site for the lamp manufacturing plant. The factory was completed in February 2000, in space rented from a local NGO. A three kilowatt diesel generator was installed and is being used three hours a day for soldering the printed circuit boards used in the lamps.

The total number of households in the target area that lack electricity is nearly 20,000, including those on the mainland. Overall household density in the target area is approximately 65 per square kilometre.

Because the islands are isolated from the mainland by rivers flowing into the Bay of Bengal, the only means of public communication is through small motor boats for river transport. There are very few roads and motorised vehicles are nearly non-existent. Although there are a number of primary schools in the area, there are very few high schools, and only a couple of health centres.

Most people in the project impact area are involved in the local fishing industry. A large portion of their annual income is tied to this seasonal activity. Agriculture and farming also provide alternate sources of income for the population. Education and literacy levels in the area are average for Bangladesh.

Stakeholder participation

The primary basis for development of this project came from previous studies done by the designers of solar electrification projects, including a 1998 Survey of Solar PV Applications in Rural Electrification conducted by Prokaushali Sangsad Ltd. and funded by the World Bank. These surveys focused on energy utilisation patterns by rural households. The team leaders supervising the surveys, who are women engineers, took a special interest in the voices of the rural women, their current energy usage patterns, and their expectations from future programmes. In response to candid remarks made by rural women, the project designers felt the need to utilise the potential of the rural women, in terms of skills and ideas, in designing energy service delivery mechanisms.

Local NGOs were consulted at the early stages of project implementation. The survey identified five local NGOs pursuing development activities in the islands, primarily related to health and sanitation, education, and micro-credit. Nearly 90 per cent of the beneficiaries of these programmes were rural women. Since rural energy was not a mainstream activity for the NGOs, they were hesitant about offering micro-credit for energy equipment, and had to be educated about the impact of improved lighting on poverty alleviation and health of rural people, as well as potential income generation opportunities.

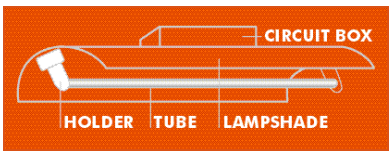
During the consultation phase, women were invited to share their thoughts on establishing project objectives and developing a detailed execution plan. Prospects for electrification were found to be of primary interest to the community as a whole. Meetings were held with the women, the local market committee, the school teachers, the local elite and NGOs during preparation of the execution plan. Since it was clear that conventional grid electrification would remain uneconomical in the area because of its remoteness and inaccessibility, off-grid technologies were perceived as the optimum choice for household lighting. In addition to modern lighting, efficient stoves and fuel-saving technologies were of great interest to the rural women.

During the initial stages of the project the NGOs showed great enthusiasm and support, especially because of the possible employment opportunities for their members. Local NGOs provided logistic support for execution of the project on a con-

tractual basis. They also assisted in preparing the first tentative list of women participants, including non-NGO members.

Recruitment of potential participants in the micro-enterprise project was undertaken from September to November of 1999 through announcements and distribution of handbills in local villages. The staff members of the local NGOs also discussed the opportunity with their contacts. Out of nearly 100 interested applicants, 52 women were selected for interviews. In total, 35 women qualified for participation based on their interest in the potential activities, levels of education, present occupations and aptitude for business. Most of the women selected for the project (93 per cent) were between 16-30 years of age. Nearly 54 per cent of the selected women had attended school up to grades six to eight, while 46 per cent had completed primary school education. None of the women had been employed before, although many were experienced in handling micro-credit through local NGO programmes.

Training of women participants



Technical training for the women participants began on 1, December 1999. Two groups of 17 were formed for the total training programme, which included:

- Identification of electronic components.
- Identification of tools.
- Printed circuit board (PCB) assembly.
- Quality control and testing.

After training in the use of the tools, and experience with the electronic components, the women were examined to ensure that their technical skills were adequate for reliable construction of the lamps. Written instructions were also provided for reference.

Training in business operations began in April 2000. Then, in June 2000, extensive training in accounting and bookkeeping was initiated for the group leaders who were to manage the manufacturing plant. Through a series of 28 lectures, these women gradually acquired a firm understanding of accounting and business operations. Today, with minimum supervision, the women keep accounts relating to daily production, sales revenues, and costs of the factory operations.

Market development

In order to develop a market for the lamps, the project advertised them by organizing public meetings, distributing handbills, and setting up billboards and posters. In addition, demonstrations of the lamps were conducted at several locations, including shops and residences. The public meetings, and placement of posters at local markets, boat landings and administrative offices, created widespread awareness of the lamps.

A detailed marketing plan was developed by the women involved in the project, based on the business training they received concerning different aspects of marketing analysis and energy demand assessment. The marketing plan covers factors such as business location, customer characteristics, target markets, competition, electricity demand, marketing goals and strategies, and budget considerations. The women hold monthly meetings to discuss project operations and local issues relevant to business development.

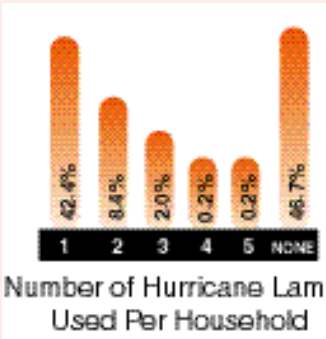


FIGURE 1

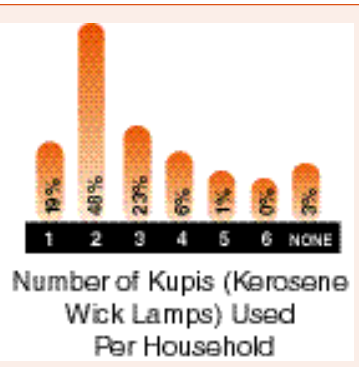


FIGURE 2

As a part of their market assessment efforts, the women recently conducted a questionnaire survey of 488 households in villages located within the Char Montaz area. The information that they compiled about current use of hurricane lamps and kupis, shown in Figures 1 and 2, is being used to help develop marketing plans. Many of the households surveyed were spending significant portions of their income on kerosene for lighting. Households earning more than 2,000 Taka per month (60 per cent of the total) were generally interested in purchasing DC lamps to replace their kerosene lanterns and kupi lamps. Their willingness to buy DC lamps was affected, however, by the unavailability of reliable battery charging facilities and the high initial cost of batteries. Overall, only 47 per cent of the surveyed households were actually willing to purchase a DC lamp.

There are a number of outlet centres and retailers engaged in sales of DC lamps in the neighbouring islands, and overall sales of lamps are expected to increase progressively as a result of the project's marketing drive. Maintaining and expanding the existing marketing network in the region will be important for increasing lamp sales. Additional sales agents are being recruited, and distributors from the towns of Patuakhali and Barisal are interested in selling the lamps.

Lamp sales are closely tied to the availability of batteries and reliable battery-charging solutions. Recharging batteries is dif-

ficult when battery-charging stations are located more than two kilometres away. The project has set up the first diesel battery-charging station in Char Montaz so that local battery users do not have to carry batteries to Golachipa, a five-hour motor boat ride away. In addition to charging batteries, this station is the major outlet centre for the sale of lamps manufactured by the cooperative, as well as reliable batteries sold at affordable rates. The battery-charging station in Char Montaz is also meeting the lighting needs of about a 100 nearby shops and households using a diesel micro-grid.

In view of the need for battery charging, the women's co-operative is co-investing in two other battery-charging stations on two other islands. It is envisioned that solar panels will soon replace diesel as the power source for all the battery-charging stations. At that stage, the women's enterprise is also expected to function as an electricity service company (ESCO), renting out solar panels in response to local market demand. A trained group of technicians will be maintained by the cooperative for installation and maintenance of the solar panels.

Financing and access to credit

Despite the popularity of the lamps, sales are hindered by the lack of consumer credit for purchasing the batteries. In order to investigate the feasibility of selling batteries through credit, 30 participants in the project were offered batteries on credit. The women made the repayments in biweekly instalments over four months, after which they had full ownership of the batteries. Following this experience, the project successfully sold 122 batteries on credit to outside clients. Almost all the purchasers were known to the women in the project, and they repaid their loans in full. Extension of this sort of financing arrangement could make lamp purchases affordable for many more people, thereby expanding the lamp market.

Future project enhancement should build on the capacity of rural women in micro-credit management and focus on "energy credits." Wider availability of credit for batteries is already under consideration for the next phase of this project. The women's micro-enterprise would then offer the following energy services: cash sales of DC lamps; credit sales of batteries; battery recharging and leasing of solar panels for household battery charging.

With a suitable financing plan, service providers could offer solar panels for household battery charging. A World Bank funded market assessment survey conducted by Prokaushali Sangsad Ltd. in 1998 revealed that "fee for service" was the mode of payment most preferred by non-electrified rural households. This sort of arrangement spreads out payments on a monthly basis, thereby eliminating the high initial costs that prevent many people from purchasing solar systems. Even under this arrangement, however, using private commercial funds for financing solar lighting projects would generally result in monthly fees beyond the means of many rural end users. Hence, it is expected that some financial subsidies will be needed to reach a broader group, at least in the short-term.

Nearly 80 per cent of the surveyed households were willing to pay a monthly service fee of 160 Taka for a solar home system capable of lighting three lamps or a television. This possible market opportunity recently caught the interest and attention of the public sector, where long term plans are being investigated. Scaling up available credit facilities to any significant degree, however, would require involvement of local banks and financial institutions in micro-credit for energy products, as well as establishment of favourable government policies.

Benefits to women

Although the project is only operating on a limited scale, its impact can be seen, above all, in terms of the empowerment of women through acquisition of technical skills. Lamp production provides a new opportunity for women to earn a living, one in which their labour is highly valued. Non-farm labour among women was not significant in the area prior to the project. Now their employment prospects have increased.

Besides increasing the non-farm skills of rural women, the project has also allowed them to generate income, play a role in decentralised energy service delivery, improve their quality of life through better lighting, and raise their status in the household and community.

Income generation has been a key motivation for people buying the lamps. Among the women who purchased batteries with credit, six out of 30 used the lights for extending their business hours in the evenings. Women with tailoring businesses at home worked an additional four hours, which increased revenue by 30 per cent (especially during festival periods). Some women let their husbands use the lantern in a retail shop in the market, giving them three extra hours of sales beyond the four hours provided by the local diesel lighting service. Household income was found to rise with electric lighting in the work place, and adequate lighting was found to be a deciding factor in whether people opened a home-based business that could be managed by family members on a part-time basis to augment household income.

Families with school age children show significant interest in purchasing lamps with batteries. These families want their children to have better light for studying. Children even encourage their parents to save money for purchasing the lights. Increased hours of studying by children and reading by elders has a direct impact on the family's long-term well-being. Adults living in households with electric light are found to encourage higher education for their children, and it is

anticipated that a majority of the children in the area will use electric appliances when they become the decision-makers in their own households.

Women who are involved with lamp construction and, by extension, with addressing the overall energy needs of the region, are being heard more. Project participants and their associates now run meetings to discuss prospects and problems in micro-enterprise operations, regional sales and electrification issues.

The husbands of the project members offer assistance to the working team of women, especially in marketing and sales. Individually and collectively, the women are encouraged to bring their husbands to monthly meetings with the marketing manager in order to discuss potential business prospects. Such interactions have been found to build women's confidence, and interest in the project among the men. As a result, the project has been successful in removing some of the social and cultural discrimination experienced by women.

Regular participation in project activities requires women to spend time outside their homes, thereby overcoming a traditional social barrier. In addition, other family members are found to support the women by taking on household responsibilities in order to help them participate in training and production activities. With the electric lamps, housework can be done at night and women can restructure the time they spend on household activities. Women working on project activities have also shown interest in more energy efficient cooking equipment that would save time spent in cooking and allow more time for earning income. Such shifts in priorities of households in remote rural areas of the country are a sign of the social changes achieved by the project.

Environmental impact

The battery-operated lamps have replaced traditional hurricane lamps and kupis that use kerosene as fuel. Consequently, at the household level, there is significant reduction in indoor air pollution that is known to cause damage to health, as well as reduced risks of household fires. Large-scale use of batteries instead of kerosene could also reduce overall greenhouse gas emissions. In the long run, charging batteries with solar-powered equipment rather than diesel engines could eliminate emissions altogether.

LESSONS AND CHALLENGES

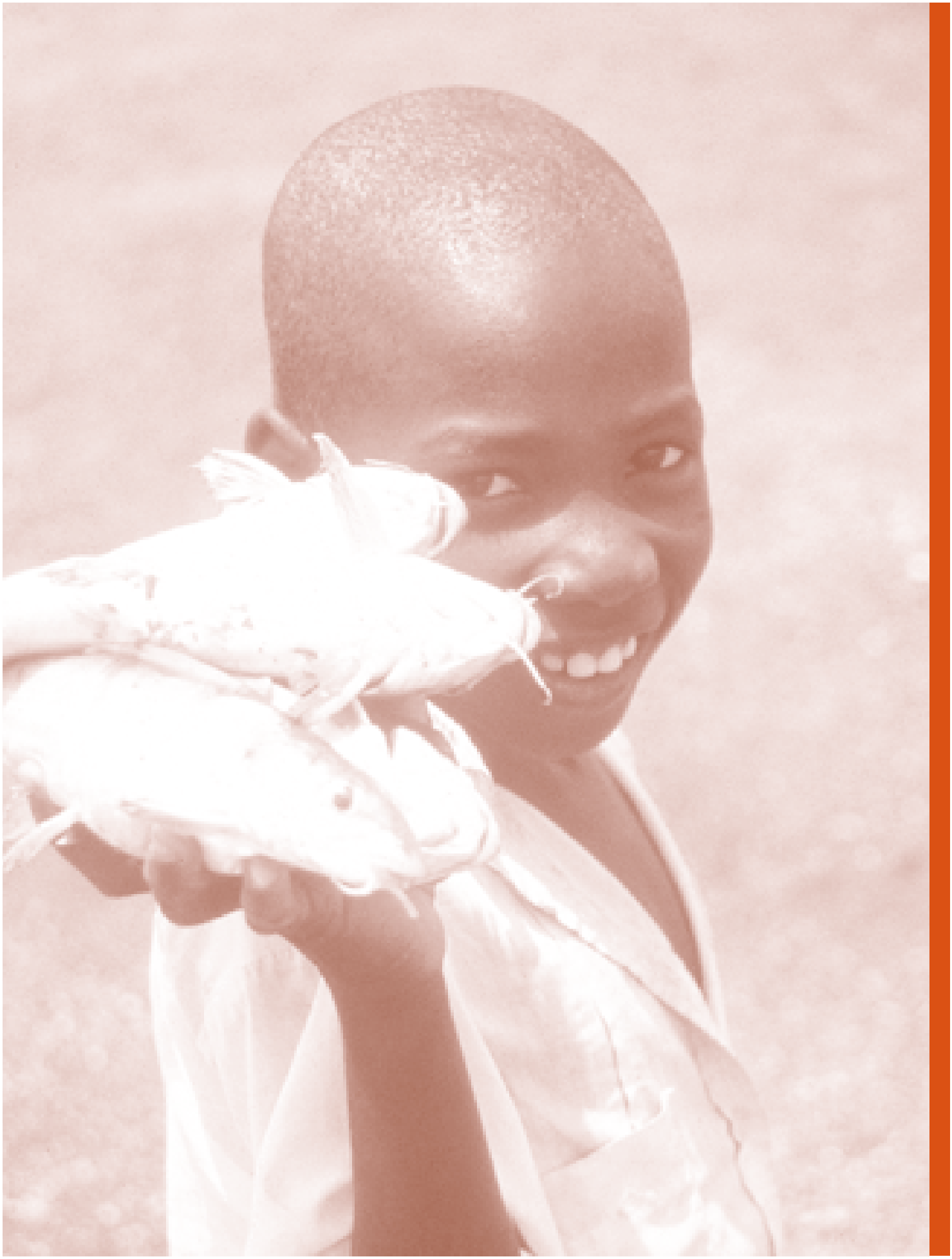
This women's micro-enterprise project is a pioneer effort testing the social and economic viability of using local producers to provide modern lighting equipment for rural households. Considering the prohibitive cost of grid-based electricity, the national rural electrification programme will not serve many remote areas of Bangladesh, even in the long term. Meanwhile, this project is establishing a sales network for an affordable off-grid lighting solution.

The women involved in the project have handled the challenge of setting up and operating the lamp factory. They have received moral support from the local people and have gained personal status because the lamps are valued consumer items within the region. Empowerment is evident among the group leaders and their associates. Typically, in Bangladesh, few women are encouraged to serve in supervisory positions, but this has begun to change through the ongoing training of women in business and leadership roles.

It is anticipated that in the near future the women's micro-enterprise will begin offering a pilot off-grid "fee for service" mode of electricity delivery using solar home systems to serve the dispersed households of the area. It is anticipated that in a favourable policy environment, a well directed "energy credit" to potential rural consumers will result in rapid adoption of this type of alternative energy option. This model for providing off-grid rural energy services through a micro-enterprise project could be replicated if the pilot is found to be economically and socially sustainable in operation.

Expansion of off-grid energy solutions will require financial resources as well as effective institutional models and financing mechanisms. Donors and funding agencies can support such innovative endeavours by contributions aimed at addressing the initial high costs of purchasing equipment which present barriers to equipment purchases by the rural poor. Finally, long-term benefits can be achieved from collaboration and partnerships among micro-enterprise projects, local governments, NGOs, formal financial institutions, and investors.

By helping women shift away from traditional farm labour to skilled labour and gainful employment in the energy sector, the project has elevated the knowledge base of rural women and exposed them to mainstream commercial activities, while also meeting community needs for lighting.



ENERGY FOR RURAL
WOMEN'S ENTERPRISES

GHANA

SABINA ANOKYE MENSAH

UNIFEM has supported the economic empowerment of women in Africa and other regions for many years. One of the major lessons drawn from its work is that lack of reliable, affordable and locally-available energy supplies limit women's productivity. For this reason, UNIFEM designed a project on "Energy for Sustainable Women's Livelihoods: Gender Responsive Renewable Energy Systems Development and Application" (GRESDA). The goal is to demonstrate selected marketable and appropriate renewable energy equipment and energy efficient appliances that can be used to create sustainable rural industries.

The project focuses on food-related activities since the majority of rural women in West Africa are involved in agriculture, small and medium scale food processing, and trade in such commodities as palm oil, shea butter, cassava, millet, smoked fish, vegetables and fruit juices. Its objective is to contribute to women's economic empowerment and food security by introducing energy technologies and equipment that improve agricultural processing enterprises and reduce post-harvest losses.

The strength of the UNIFEM approach lies in its emphasis on letting women speak for themselves. Consultations with women have provided important insights into the actual needs of rural women with regard to improving their occupational opportunities. Women have also been actively engaged in appraising equipment and adapting it to meet their needs.

Activities initiated by GRESDA in Ghana include development of an improved press for shea butter processing and of a more efficient fish smoker. Continuation of the GRESDA projects, however, will depend on attracting additional resources.

While gathering information about women and food security, UNIFEM funded a comprehensive research project to analyse existing renewable energy alternatives and assess their availability and feasibility for application in rural areas of West Africa. Experience in Ghana and Nigeria had already shown that one of the main impediments faced by rural women entrepreneurs in optimising the efficiency of their food processing activities was having to use wood for fuel. It is time consuming to gather wood and tend to wood fires, the smoke is harmful to women's health, and wood consumption contributes to deforestation.

Rural electrification is progressing but many areas remain without access to the electricity grid and are likely to remain so for a long time yet. The challenge that many African countries face is to strengthen national capacity to develop, operate and maintain alternative and renewable energy systems, and to ensure that women—who contribute to 70 per cent of the food security in Africa—control and benefit from these systems.

Most women either work individually near their homes or are organized into small business cooperatives. With the deepening of the economic crisis, more and more women are moving from subsistence-related activities to rural food processing enterprises to earn a living. Despite the growing importance of small-scale food processing for the economy, there is very little formal research or training available to support these activities. Moreover, there is little attention to women's energy needs. In most countries in the region, government energy policies do not take gender issues into account, and energy concerns have not been high priorities of women's organizations.

In the past there have been some successful attempts to support the output, efficiency and environmental sustainability of women's activities by introducing devices such as fuel-saving stoves, fish smokers and other equipment, but these have mostly focused on women's needs as household consumers rather than as producers or entrepreneurs. In addition, the technologies introduced were often designed without either a proper needs assessment or the participation and input of women end-users, and this led to problems in acceptance of the new equipment. This project emphasises participation by women, as well as the importance of increasing income so that women can afford to pay for improved processing equipment.

Stakeholder consultations

During phase one of the project, UNIFEM commissioned a baseline study on the energy use and technology needs of women in major economic sectors, with special reference to food processing. National consultations were held in Ghana in 1998 and in Nigeria in 1997. Participants in both workshops included policymakers, financial and research institutes, non-governmental organizations, international development and cooperation agencies, UN representatives, the private sector, grassroots women's agricultural processing cooperatives and women entrepreneurs.

The national consultation in Ghana involved over 120 participants and stakeholders from the ten regions of Ghana. The consultation was unique in that it raised awareness about renewable energy technologies as well as the significance of gender responsive development.

Notwithstanding their traditional roles as mothers and wives, women in Ghana engage in a variety of productive activities to sustain their subsistence-level standard of living. These activities are generally carried out using labour-intensive techniques. Because rural women have so many responsibilities, they often cannot accomplish all their daily tasks. This results in a situation where a good proportion of farm produce is not processed for long-term storage and there are substantial post-harvest losses.

To provide a permanent solution to rural women's problems, it is necessary to look at the energy requirements of the day-to-day activities of women and begin to design an improved energy supply system.

Women's energy needs include the following:

- Sufficient power for grain threshing and milling, and tuber peeling for domestic consumption and marketing.
- Devices for pumping water from wells, bore holes and rivers.
- Energy systems for lighting, refrigeration and other electrical appliances.

A number of research and technological institutions in Ghana have developed proven energy-saving technologies aimed at reducing the drudgery of rural women. However, due to lack of proper interaction with the rural community, the transfer of these technologies has been very slow.

Through the national consultation in Ghana, UNIFEM and its partners gained valuable insights about project opportunities, and limitations. The country has already developed some expertise on bio-gas and solar photovoltaic technology, as well as solar thermal systems. Wind and micro hydro technologies and knowledge are limited. The discussions also showed that liquefied petroleum gas (LPG) has great potential for meeting women's energy needs, but it is often unavailable in rural areas.

During the national consultation, women engaged in productive enterprises identified the following needs:

- Training in businesses management and operations.
- Credit facilities to buy specialized equipment for improving operations.
- Training in the use of energy-saving devices.
- Support for exchange of information among groups through newsletters and networking.

Promoting income-generating activities for women

Following the national consultations, the GRATIS Foundation was selected to be the implementing agency for the GRESDA project in Ghana. The GRATIS Foundation evolved out of the Ghana Regional Appropriate Technology Industrial Service (GRATIS) Project, which was established by the Government of Ghana in 1987 to promote small-scale industrialization in Ghana. GRATIS has established Intermediate Technology Transfer Units in nine regions of Ghana to transfer appropriate technologies to small-scale industrialists through training and the manufacture and supply of machine tools, plant and equipment.

GRATIS also has a special Gender and Development Unit that provides technical and entrepreneurial skills through the implementation of development projects and extension programmes in rural communities. The activities of this unit include batik, tie and dye production, cotton spinning and broadloom weaving, bee keeping and honey extraction, soap and bead making, food processing (including shea butter and vegetable oil extraction) and citronella oil extraction. The unit has been successful in introducing technologies related to these activities through offices in the ten regions of Ghana.

In 1999, GRATIS organized a strategic planning meeting of GRESDA partners from both Ghana and Nigeria. The major challenge was to determine how to reduce reliance on fuel wood, for health as well as environmental reasons, and to reduce the time women spend in difficult and repetitive work. Discussions centred on ways of promoting the transfer of suitable energy technologies from research institutions to end users, especially by including women in the appraisal and adaptation of these appliances.

At the strategic planning meeting participants agreed to select a few demonstration sites, using information from existing sources and from the application of a rapid appraisal method, a tool for quickly obtaining demographic, economic and social data. The projects were meant to focus on rural areas where women were already engaged in some commercial activity related to food production or agricultural processing and needed a push in terms of technology to make their work more profitable and less difficult. After consulting with women's groups and gathering proposals, GRATIS discussed the suggested options in consultation with UNIFEM, other donor agencies and support organizations.

Although there was substantial interest in renewable energy technologies, the initial project designs involved more efficient processing equipment to reduce drudgery and demand for fuel wood, rather than new energy-producing technologies.

Examples of new energy efficient equipment include a cleaner fish smoker that uses LPG, and a shea butter extractor that dramatically decreases fuel wood consumption, water use and the amount of women's effort required for processing.

Shea Butter Extraction Project in northern Ghana

Traditional shea butter extraction is a major income-generating activity for women in the northern and upper regions of Ghana. Since 1998 over 32,000 metric tonnes of shea nuts have been exported from Ghana annually, generating about US$7,000,000 revenue per year. There is high demand for shea butter in the international market both for cosmetics and chocolate production.

Shea nut harvesting and shea butter extraction are predominantly done by women. Marketing, however, is controlled primarily by businessmen who earn more than ten times the income of the primary producers. The women producers work in small groups but generally have private, individual holdings. Earnings are low, mainly due to the traditional technologies employed in shea butter processing.

The traditional shea butter production process, which gives an average extraction efficiency of 62 per cent, consists of seven steps: grinding, roasting, milling, kneading, washing, cream boiling and clarification. This process has a number of production and environmental drawbacks, including the arduousness of the seven different operations, the long processing time, low production capacity, excessive use of water and firewood, and the women's long periods of exposure to heat and smoke. Many attempts have been made to introduce improved technologies but these efforts have not created the needed impact on small-scale shea butter production. Traditional processing still accounts for about 80 per cent of total shea butter production in Ghana.

Women without working capital cannot run their own operations, and generally work for one of the six local companies that export shea butter. Poor women in need of income are hired by exporters to produce butter for them at very low cost and under very deplorable conditions. In Tamale, the northern regional capital of Ghana, hundreds of women queue daily for a chance to earn a daily wage producing butter for a company. Sometimes 200 women out of 600 women in the queue are

The improved bridge press reduces fuel and water use, as well as exposure to smoke and heat.

THE LEGENDARY SHEA BUTTER

Shea butter is treasured in West Africa for its many healing properties, and legend has it that it is used as an oil and food by the gods. It has been used there for thousands of years as an all-around remedy for skin problems, to ward off wrinkles and stretch marks, rejuvenate skin cells, protect against ultraviolet rays and strengthen weak hair. It also has anti-inflammatory properties that make it useful in the treatment of rheumatism, muscular pain and sunburn. These days, it is found in a variety of pharmaceutical products and high-end cosmetics and chocolates. A 200-millilitre container of rich shea body butter sells for more than $25 in some New York Stores.

The butter is derived from the seed of the shea tree (*Butyrospermum parkii*) that grows wild in the savannas to a height of 55 to 60 feet. Once every year, the tree produces delicious fruits that are harvested during the rainy season. The seeds within are collected and usually sun dried.

At the end of the season when the nuts are well cured and dried, they are threshed. Because the shea nut seed is as hard as a pebble, the grinding process is arduous, especially without grinding machines. The powdered shea nuts are boiled in extra large clay pots for four to five days. The shea butter is skimmed off the top and stored in calabash containers.

selected and given the job of producing butter using the traditional processing method. Each woman is paid a daily wage of 3,000 Cedis, equivalent to $0.50.

The GRESDA shea butter processing project was formulated after women's groups in northern Ghana that had participated in the national consultation organized themselves and appealed to UNIFEM for assistance. They were shea butter producers who wanted to find appropriate technologies that would allow them to increase output, reduce fuel use, and eliminate the middlemen.

The focus of the project is on introducing and testing an improved bridge press that reduces fuel and water use, as well as exposure to smoke and heat. To eliminate middlemen, the project promotes more effective marketing of the women's products and is making efforts to link the women processors directly with international markets through collaboration with shea butter processors and exporters in Burkina Faso.

In an attempt to improve on the traditional processing method, Ghana's Technology Consultancy Centre developed a simple process known as the Intermediate Moisture Content (IMC) method for shea butter extraction. In collaboration with community-based women's groups, the centre successfully field-tested the new processing method at Vitim and Savelegu in northern Ghana.

The IMC method involves grinding dry kernels into paste using a motorised plate mill. This eliminates the roasting, creaming and boiling steps in the traditional process, which consume large quantities of firewood and water and expose the women to a great deal of heat and smoke. Immediately after milling the paste has a moisture content of 12 per cent and is at a temperature of 70° Celsius—warm enough to allow pressing to be done effectively. After loading into empty cotton sacks the paste is placed directly into the bridge press.

Some advantages of the new improved method over traditional processing include:

- A five per cent increase in extraction efficiency and 200 per cent increase in daily production capacity.
- Decreased firewood consumption (e.g. eight kilogrammes of firewood for the IMC method versus 72 kilogrammes in the traditional process for the processing of 85 kilogrammes of kernels).
- Decreased water use (e.g. eight litres of water for the IMC method as against 160 litres in the traditional method for 85 kilogrammes of kernels processed).
- Higher consumer preference for butter produced using the new improved method owing to its milder shea smell.

There are over 1,000 women's groups involved in shea butter processing, with an average of 30 members per group. The pilot project is targeting four women's groups with a total of more than 200 members.

Fish Smoker Project in Accra communities

The fish smoker project grew out of persistent requests by women entrepreneurs and women's groups in four rural fish smoking communities in the Greater Accra Region who asked for assistance from GRATIS in improving the traditional smoking processes. The communities include Kpone, Prampram, Tema and neighbouring fishing communities in Accra. The project was designed to involve 70 women and to be completed within 14 months.

The project is introducing a new hygienic smoker that meets the requirements of both the Ghana Environmental Protection Agency (EPA) and the Ghana Standards Board (GSB), as well as international standards. Fish processed using traditional methods do not meet international standards and

Fish processed using the new hygienic smoker (left) can be marketed internationally at higher prices.

can only be marketed locally at low prices.

The target beneficiary group is women who currently use fuel wood for fish smoking and in so doing are subjected to long hours of smoke inhalation. The women are faced with dwindling wood supplies, low returns from the sale of low-quality smoked fish, and environmental as well as health hazards. They are therefore impatient to be assisted with an improved technology.

Fish provide an important source of animal protein for most people in Ghana. There is a fair-sized fishing industry comprised of both marine fishing and inland fishing. Marine fishing has been the most important sector, contributing about 80 per cent of the total domestic fish supply. Ghana's fishing industry has made tremendous strides during the past decades, developing from a predominantly traditional canoe fleet to a mixed traditional/modern fleet that includes factory trawlers. In the villages, however, canoe fishing is still of great importance and accounts for over half of the marine catch nationally.

In Ghana, canoe fishing is done only by men, and fish processing (smoking) is exclusively the domain of women. The main methods employed to reduce post-harvest losses in the fishing industry include solar drying, refrigeration, salting and smoking. Post-harvest losses are estimated at 45 per cent for fish products. In rural areas and less privileged communities, refrigeration facilities are either not available or too costly for most women to use. Solar drying, unfortunately, is only effective for a couple of fish species—the less bulky types. Preservation of fish through smoking represents the only option for most poor rural communities.

Fish smoking is traditionally done on an individual basis, or by a family group composed of three or four members, which may include a mother and daughters or a group of sisters. Sometimes individuals will break off from these groups once they have acquired the capital to set up business on their own. The fish are purchased from fishermen who demand immediate cash payment for the day's catch. The smoked fish are later used for domestic consumption and sold in the local market for income generation.

For many decades, women fish smokers have depended on traditional wood-fired techniques that are very laborious. Trees are cut daily for fish smoking, which contributes to the depletion of the wood stock. The women, often with their babies on their backs, inhale volumes of smoke into their lungs. The vicinity where they operate is engulfed with thick smoke, affecting other people in the area as well as the environment.

The traditional fish smoker is made out of an empty metal barrel cut in half. The chorkor smoker, an improvement over the traditional smoker, reduces fuel wood consumption to some extent, but does not solve problems of smoke inhalation or fire wood scarcity.

At the GRATIS Foundation, engineers, technicians and a food scientist, in consultation with the women's fish smoking groups, developed an improved fish smoker which depends solely on gas (LPG) for fuel. The improved fish smoker offers an acceptable, clean, energy-efficient and environmentally friendly fish smoking technology. The LPG-fired fish smoking oven is constructed from aluminum sheets and equipped with smoke generators neatly embedded at the rear. Smoke is generated by burning crushed sugar cane, coconut husks or any approved agricultural wastes.

The fish-smoking village of Prampram, in the Ga Dangbe district of Greater Accra, was chosen for the initial pilot project. The men in this village go to sea and do the fishing while the women buy the catch from them and do the smoking and marketing. The main income source for these women is the sale of smoked fish, mainly herrings, tuna fish and the local favourite, "Keta school boys" (anchovies). The smoked fish is only sold locally and the women's earnings are extremely low.

In the pilot project, three LPG-fired fish-smoking ovens will be constructed and installed. The women have no direct access to commercial banks because they cannot provide collateral or other security. The project will provide the smoker and the women will pay for the equipment in instalments out of their

Trees are cut daily for traditional fish smoking, depleting the wood stock.

profits. Operating costs for the LPG smoker are slightly less than for the traditional smoker. According to the women, they use about 30,000 Cedis worth of fire wood to smoke 50 crates (one ton) of fish. The new smoker uses 28,000 Cedis worth of LPG gas to smoke the same quantity of fish.

The project will also provide the women with credit for fish so they can get started and be able to operate the new facility close to full capacity. Two cartons of fish (about 260,000 Cedis or $40 per carton on the average) will be provided to each of the first 25 active women in the group out of a fund of about 10 million Cedis ($1,500). As the women repay their loans, the money will be used as a revolving fund.

During the pilot phase, the women will also benefit from a comprehensive training scheme provided by GRATIS and Divine Sea Foods Ltd., which will cover:

- Proper operation of the technology, i.e. the smoke generator, the heat generation apparatus and the temperature sensors.
- Minor repairs and maintenance of the equipment.
- LPG handling, purchase, valves and hoses.
- Simple bookkeeping and basic business management.
- Smoked fish packaging for national/international markets.
- Oven cleaning and wastewater disposal treatment.
- Credit utilisation and management.

At the end of a 12-month pilot phase, the project will be evaluated. If the women's collective group is found to have a strong management team, it will be given an opportunity to take over project operations entirely. Otherwise, an individual entrepreneur among the group, who is willing to operate and manage it to serve the others on a commercial basis, will be invited to make an offer for possible transfer.

LESSONS AND CHALLENGES

The GRESDA projects so far have tried to build on women's own knowledge and to engage them in the development and use of various technologies. It is not a simple matter, however, to get women involved in the design and use of equipment.

One of the difficulties in introducing new technologies is that they generally have to be accepted and approved by men in the community before the women can openly embrace them. Sometimes meetings with husbands, chiefs and elders at selected project sites are required to convince them that women are capable of using the technology.

In any event, getting illiterate rural women to operate and maintain equipment is a very great challenge in itself. Some of the women lack self confidence and are afraid to even touch the equipment, fearing that they might damage it. Therefore, comprehensive training and confidence building is required at the beginning of the project process.

In many cases, however, rural women do know what they need to make their work easier and more profitable, even though they lack equipment, capital and skills training. Stakeholder consultations are an important method for providing local women with an opportunity to present their needs, discuss them with technology experts, and consider viable options. Cooperation and coordination between women's groups and equipment designers can result in more widespread adoption of new technologies, and more effective results in meeting the real needs of rural women for income-enhancing improvements.

Approaching project design through focusing on activities women are already engaged in, like food processing, and working with them to improve food security and current livelihoods, can promote acceptance of new techniques and technologies and lead to tangible results in rural communities. It also seems that energy efficiency in equipment and processing techniques may be more important in some cases, because of enhanced income-generating opportunities, than provision of energy technologies (e.g., for lighting and electricity) not directly related to production needs.

…one of the main impediments faced by rural women entrepreneurs in optimising the efficiency of their food processing activities [is] having to use wood for fuel. It is time consuming to gather wood and tend to wood fires, the smoke is harmful to women's health, and wood consumption contributes to deforestation.

UPESI RURAL STOVES PROJECT

KENYA

BEATRICE KHAMATI NJENGA

The Upesi Project, supported by the Intermediate Technology Development Group (ITDG), was initiated in 1995 to promote the adoption of more efficient stoves in rural areas of western Kenya. Its goal was to improve the living and working conditions of women in rural households by enabling a significant and increasing number of women and their families to benefit from fuel-saving wood-burning stoves. The project set out to test and demonstrate the effectiveness of new approaches and technologies for commercialisation of Upesi stoves in five districts in western Kenya.

By working with interested women's groups and involving them in the design and field-testing of the stoves, the project was able to take advantage of women's knowledge and experience. Besides training the women in stove production, distribution and installation, the project focused on improving their marketing skills as well. This has been a critical element in enhancing the ability of women to earn income from stove-related activities.

Over 16,000 stoves have been installed, providing significant poverty alleviation for members of the women's groups, and their families. The benefits to men and women in the project areas include improved health and time savings for users of the energy efficient stoves, as well as relief from pressures caused by wood fuel shortages.

Reliance on wood for rural energy

Kenya has about 30 million people, 85 per cent of whom live in approximately four million households in rural areas. The average per capita annual income is about US$290, derived mainly from agriculture and tourism. The major sources of energy are biomass, hydro, imported petroleum, and geothermal resources, with growing utilisation of modern solar and wind technologies. Overall, traditional biomass is the largest single source of energy, providing about 75 per cent of final energy demand, and over 93 per cent of rural household energy needs.

Energy use patterns vary significantly between rural and urban areas and also among different economic levels. The preferred forms of energy continue to be electricity and liquefied petroleum gas (LPG), but these are inaccessible to the majority of Kenyans. A 1994 welfare survey showed that only 3 per cent of Kenyans use LPG for cooking. The national electricity grid is mainly hydro powered and supplies under 40 per cent of urban households, and less than 2 per cent of rural households. The electricity is primarily used for lighting. Poor urban households use biomass in the form of charcoal for cooking, while in the rural areas fuel wood and agricultural wastes are the predominant fuels for cooking and heating. Approximately 85 per cent of rural and 50 per cent of urban households use kerosene for lighting. While only a few households currently have access to solar energy, the numbers are increasing steadily, with about 10,000 new households added per year.

Women and children suffer the most from over-reliance on limited biomass energy resources in rural areas. They are the main procurers and consumers of wood fuel for domestic use and generally have very limited access to modern, clean and efficient energy technologies. Consequently they spend considerable amounts of time and energy involved in the drudgery of gathering fuel and performing basic daily tasks, and are exposed to high levels of air pollution and associated illnesses related to smoke from wood fuel fires.

Improved cookstove development

Following the 1980 United Nations Conference on New and Renewable Sources of Energy, many organizations began to work individually and collaboratively on improved stove development and dissemination. The organizations involved in the early 1980's included the newly created Kenya Ministry of Energy, the Appropriate Technology Centre, the Kenya Energy and Environment Organization (KENGO), United Nations Childrens Fund, Maendeleo ya Wanawake, CARE-Kenya, the Intermediate Technology Development Group and GTZ, the German technical cooperation organization. Among the more popular stoves introduced were the charcoal-burning Kenya Ceramic Jiko, and the wood-burning "Kuni Mbili" and "Maendeleo Jiko"—known also as the "Upesi stove".

The Kenya Ceramic Jiko stove, inspired by the "Thai bucket", was developed through a design process spearheaded by the Ministry of Energy. KENGO was responsible for making the Jiko stove available and popular in several countries in Eastern Africa, and in the 1980's the Appropriate Technology Centre was recognised as the regional focal point for training on stove design and testing. The Jiko stove easily found acceptance among urban stove producers who were initially offered free training and marketing support by KENGO, working with the Ministries of Energy, Agriculture, and Environment and Natural Resources. Although most producers and dealers of the Jiko stove have been men, many women in small urban areas have benefited immensely from the technology. A recent study reported that women selling and using the Jiko stove in arid and semi-arid areas significantly improved their standards of living through gains in time and income.

Rural stoves programmes

The success of the charcoal-burning Kenya Ceramic Jiko stove in urban areas affected subsequent programmes to introduce rural wood-burning stoves, primarily by creating false expectations among donors and implementing agencies. Over the years, improved stoves have been more difficult to introduce in rural areas because stoves cost money and the traditional three-stone cooking system is free. Rural people are generally very poor and women and children mostly collect their fuel wood for free, so there is less incentive than in urban areas to spend money on a stove for reasons of fuel conservation. Promotion and sales of the stoves have also been difficult because production and distribution of rural stoves have been conducted by women's groups with little or no experience in competitive marketing.

In 1986 ITDG joined with KENGO to initiate a new project focusing on the stove needs of households in rural areas. This study found that the most acceptable and efficient stove was the Maendeleo or Upesi stove designed and tested by GTZ at the Appropriate Technology Centre as part of the Women and Energy Project of Maendeleo ya Wanawake organization. Groups of women potters around Kisumu were trained to produce the already successful Kenya Ceramic Jiko as well as the Upesi stoves. The same women's groups were also involved in tree planting and agricultural activities for income generation.

In many rural areas, the Ministry of Agriculture's extension officers in home economics and agriculture were already engaged in "kitchen improvement" and nutrition projects. They became key promoters of improved stoves, because of the health and hygiene benefits of the stoves. Through funding from GTZ, the officers bought and distributed stoves at a nominal controlled price. The price was based on an estimation of what rural women would be willing to pay. Thus was established a secure marketing channel for the women's groups, and a steady but small income from stove production, irrespective

BUILDING A BETTER STOVE: THE UPESI

The Upesi stove, sometimes called the Maedeleo, was developed by the Ministry of Agriculture in Kenya, ITDG (the Intermediate Technology Development Group) and GTZ (the German Agency for Technical Cooperation). It uses a standard ceramic liner that can be produced by artisans and women in the informal sector. The liner is then installed into a hearth made from mud and stone.

The stove is designed to burn wood, although it can also burn crop waste, such as maize stalks and cobs, and animal dung. It uses about 40 per cent less fuel than three-stone open fires, with up to 60 per cent less smoke.

Many users say they are able to cook much faster on a Upesi than on an open fire. They also cite improved kitchen health, safety and hygiene as other advantages. In addition, the market for the stove has grown considerably, which is a good sign that the Upesi meets the needs of its users for a clean, efficient and fast-cooking stove.

of the quality of the stoves. After about eight years, however, support from GTZ ended and the government's home economics officers were unable to continue their marketing services on a large scale.

The Upesi Project

In 1995, ITDG's Rural Stoves West Kenya ended and a new phase focusing on commercialisation was initiated as the Upesi Project. The new project launched an intensive campaign to improve the sustainability of stove-related income-generating activities among women's groups.

The intended outputs of the project were as follows:

- Adaptation and production of quality Upesi stoves by the women's producer groups and local institutions.
- Strengthening of the capacity of women's producer groups and distributors in the marketing of stoves.
- Development of concrete commercialisation strategies to expand consumers' stove choices and increase incomes.
- Establishment of a network of key actors in energy saving technologies and marketing.
- Broad dissemination of stove production and commercialization techniques throughout East Africa and internationally.

The project worked primarily with eight women's groups, with differing levels of marketing skills and knowledge. Some were in villages where fuel wood could be collected free, while others were in wood buying areas. The women, who previously had been involved in various agricultural and pottery activities for income generation, took the initiative to approach development agencies working in energy and seek technical support in developing alternative income generating activities.

The Upesi stove was selected for production through field trials that showed it could provide fuel wood savings of up to 43 per cent compared to a three stone fire, and appeared to have a life span of four years. Some stoves have reportedly been used for up to seven years. During the field tests, the affordability of the stove was determined on the basis that "if an ordinary lady can sell bananas or a chicken to afford a stove, then the price is ok". Thus KShs. 70 was considered an acceptable price for an installed stove. Later, the Upesi project raised the price to KShs. 120, to reflect actual production costs.

Stakeholder participation

Important factors responsible in the Upesi Project have been stakeholder participation and the project's responsiveness to the knowledge and changing needs of the beneficiaries. Working partnerships among project sponsors in the region provided learning opportunities for ITDG to develop improved project strategies, and helped to establish a relatively stable background for the project.

Of particular significance was the fact that the women's groups involved had themselves approached the development agencies. Project beneficiaries were involved from the beginning in the design, development, selection and field testing of the stoves. Every revision of the marketing strategy was done in consultation with the women groups and the women came up with the content of promotional materials including posters and radio advertisements.

KEYO WOMEN'S GROUP

This group was named by founder-member Lucia Alai. Keyo is the name of a huge tree commonly grown on homesteads in the area. The idea was to avoid a name with filial or clan connotations, in order to encourage open membership. The group, which began with five members, got involved with stoves in 1986, after seeking technical assistance from a CARE-Kenya Project in the area. Their stoves were initially marketed through home economics officers with GTZ funding. Today, the group has approximately 28 members producing, selling and installing stoves. They have links with artisans in Kisumu town who buy their stoves in bulk. Some members have benefited from bicycle loans, which have eased their marketing efforts.

Lucia Alai is the person in charge of liner production in the group. She grew up without formal education, learning basic literacy and numeracy through an Adult Education programme. At the start of her involvement with stoves, she was a peasant farmer with a jobless husband, barely able to make ends meet, providing her own farm labour. Today, Lucia is a qualified production trainer and has visited Tanzania on a training mission. She is able to pay over KShs 7,000 per year for farm labour and inputs, and school fees amounting to KShs 2,500. She also employs labourers to work clay for her liners. At the start of the stove business, Lucia says, her neighbours and in-laws despised her choice of occupation saying it was "playing with clay like children". Now Lucia is a respected member of the community, and several previous detractors have joined the group.

Women's participation was enhanced by the fact that they had been in contact with women leaders in the field, the home economics officers. These government extension officers may have distorted the earlier stove market through subsidised distribution, but they were certainly key agents in creation of awareness of the benefits of improved stoves in the rural areas.

One of the primary barriers to participation by women was that they did not have enough time and could not be away from home for long periods. Because of women's many domestic and community responsibilities, it was important to ensure that any new activity was compatible with their other ongoing duties. Many women became involved in stove production due to pottery skills acquired in connection with household activities, but needed training in marketing skills. Yet any new training and marketing activities needed to fit with their existing responsibilities.

Commercialisation strategies

The marketing approach for the Upesi project was developed over a period of five years. The producer groups represented isolated focal points in vast rural areas. Most of the potential users were far from the producers, the road network was poor, and motorised transport was generally unavailable. A strategy was needed to ease the transition from a controlled market to a relatively free market, where the prices reflected the full costs of production, marketing and provided a reasonable profit margin. The new strategy was piloted with the Keyo Women's group, after which it was adapted to the very different conditions of each producer group. The strategy was based on insights gained from a visit to an ITDG stove project in Sri Lanka, as well as a marketing study in the project area.

Identification of key stakeholders for support was an important part of the strategy. The relevant government departments, major NGOs and existing stove producers in the area were informed of the project's intentions and its interest in developing marketing plans.

Training was also seen to be critical as there were a number of different actors or intermediaries involved in the marketing chain, including stove producers, distributors, retailers, promoters and installers. These intermediaries typically became involved in the project after seeing a stove demonstration, or through others already producing or selling stoves. Producers were trained in group dynamics, stove production, costing and pricing, record keeping, forging marketing links, and responding to consumer demands. For retailers, there was in-depth training in customer relations and sales promotion, as well as costing and pricing.

Promoters and installers were trained in stove-promotion messages, carrying out successful demonstrations, and establishing linkages with communities. The idea was to have as many people as possible spreading information and carrying out demonstrations of the stoves. Thus a team of promoters was identified to visit homes, churches, market places, grain milling centres, schools and other public places. Other organizations such as the Anglican Church of Kenya in Eldoret diocese, the Marantha Mission of Kenya and the Ministry of Energy were involved in creating awareness and providing possible linkages.

ITDG sponsored radio promotions in local languages, which added value to the stove's image. Drama and songs were used for awareness creation. ITDG also provided advertising billboards. Posters, banners and flyers were produced in collaboration with intermediaries, to ensure that the selling messages were appropriate. The promotion was aimed at creating an attractive modern image for the stove and creating awareness of its benefits.

Stove producers and distributors were encouraged to use non-motorised transportation to link up to major roads. Over 40 bicycles were provided through a mutually agreed repayment scheme. All the transportation equipment carried Upesi promotional messages.

Marketing incentives included providing quality stamps for producers, and promotion signs for distributors with over 150 stoves. Promoters selling 100 stoves per month were given a bicycle loan and a certificate. Other incentives included tee-shirts and trophies.

Benefits to women users

The primary intended beneficiaries of the Upesi project were women and their families in rural households of western Kenya. At the final project evaluation, 16,000 stoves had been manufactured, purchased and installed.

According to the evaluation, users of the Upesi stove derived the following benefits:

- Savings of up to KShs. 7,200 per year (rural wages average KShs. 800 per month).
- Health cost savings of KShs. 260 per year.
- Time savings of about 10 hours per month.
- Smoke reduction of 60 per cent.
- Reduction of acute respiratory infections in children by 60 per cent and in mothers by 65 per cent.
- Reduction of conjunctivitis in children under five by 70 per cent and in mothers by 67 per cent.

Income generation

A total of eight producer groups, or at least 50 women, were trained directly by the project, and so were at least 23 promoters, eight retailers and five distributors. On average, stove producers devoted two to three days a week to stove production. Every active group member could sell 510 stove liners and earn KShs 15,300 in a year, or KShs. 1,275 per month. If producers sold directly to the users, then they could make

an extra KShs. 50 per stove for installation. Stove promoters made an average of KShs. 15,000 per year. As a result of stove-related activities, these women were able to enjoy a significantly higher standard of living.

Acquired production and marketing skills also enabled women to travel to distant places to provide training to others. Women from the Keyo Women's group have trained producers in Tanzania on a fee basis. Active women in the producer groups have also learned new skills useful for other business ventures. With increased confidence and social status, several women have since become active in community development committees. Thus stove production has also provided a launching pad for realising other ambitions.

Over all, wider commercialisation of stoves can have a significant impact on community poverty alleviation. With increased income, women are able to help support their families and pay for children's school fees, thus reducing school dropout rates. This is particularly significant for girls as they are always the first casualties when parents cannot afford school fees. Children of stove producers are also learning important skills for income generation, and acquiring knowledge about energy and environmental conservation as they observe and help their mothers. In addition, women producers provide employment opportunities to others who work as labourers in the procurement, processing or transporting of clay, liners and fuel wood for firing the liners.

Environmental conservation

The issue of fuel wood shortages in Kenya cannot be over-emphasised. Any technologies that improve the efficiency of fuel wood use have real benefits to society. In west Kenya, the Upesi project has introduced an awareness of the need to conserve energy not only among those households that bought the stoves but also in many others exposed to stove demonstrations and promotional talks in public gatherings and at show grounds.

In much of the project area, fuel wood is harvested from live trees and sold in the market. The project evaluation revealed fuel savings of 90 kilogrammes per month for each household using Upesi stoves, representing 40 per cent savings in fuel use, which can have a positive environmental effect in terms of less felling of trees. The Upesi Project has also influenced an international research institute to support improved stoves as part of an effort to replenish and conserve the Kakamega forest in West Kenya.

Equally important is the tree planting encouraged as part of the project. In 1999, stove producers planted 2,500 seedlings, while other intermediaries planted another 3,773 seedlings as part of the move to replenish the wood used for manufacturing the stoves.

It should be noted, however, that clay procurement for increased levels of stove production could have adverse environmental impacts on soils and riparian ecosystems. To enhance environmental sustainability, therefore, it will be necessary to include training in land reclamation and soil conservation. It may be necessary to carry out an environmental impact assessment on this.

Project continuity

The project made significant progress in establishing a market for improved stoves through a network of promoters, retailers and artisans who buy from existing producer groups and then construct and install stoves for customers. The current market appears to be viable since the stoves are produced and sold through a market chain in which every actor earns a reasonable income.

Through the project, individuals and groups in the marketing chain have acquired a variety of potential income-generating skills, and it may be assumed that they can survive independently of ITDG. Internalisation and ownership of new knowledge and skills has been shown by the participant's adaptation of knowledge to changing circumstances. In the case of the Upesi stove, women producers and artisans have been able to come up with at least seven new innovative stove designs to meet consumer demand.

Other indicators of project viability include the following:

- Almost all (97 per cent) of the stoves installed are still in use.
- Seven out of eight women's groups trained are still producing stoves.
- Since 1999, groups have started producing their own promotional materials.
- New partnerships have been forged on training and information sharing, with strong networks emerging across the East African region.
- Local women are able to offer training to potential producers on request, even in Tanzania and Uganda.
- Women have begun to venture into male-dominated artisanal work, which diversifies their income-generating potential.
- Awareness of the improved stoves has spread over wider areas in the region, thus enhancing the potential market.

One variable, however, that may adversely affect expanded stove production is the availability of clay and other raw materials. This threatens basic continuity of the activities, and also the quality of the products.

LESSONS AND CHALLENGES

The project has demonstrated that rural stoves can be commercialised to provide multiple benefits to women, children and other poor people. Increased income-generating opportunities for women have benefited whole communities. By learning new skills related to stove production and marketing, women can considerably increase their incomes. As more actors enter the field of rural stove production and sales, promotional network densities will be increased, which can further enhance marketing and income opportunities.

The fact that improved stoves were originally introduced into the project region on a subsidised basis probably slowed down commercialisation, as the stakeholders had to completely change their way of thinking about the stove business.

Other constraints also affected the efficiency and cost-effectiveness of the project.

- The conventional flow of manufactured products is from urban to rural areas. The Upesi project was attempting a new feat—to produce and sell new stoves commercially within rural areas, and also sell them in some urban areas.
- Stove installation services have to be marketed and coordinated together with the sale of the clay stove liner. This makes the Upesi stove an awkward retail item.
- The project had to create from nothing rural stove purchasing agencies, and then offer subsidised training to the interested parties.
- The producers and promoters had a low capital base and no access to micro-credit schemes, and therefore could not buy stoves in bulk. Although there are many micro-credit financiers in the country, they have made limited inroads into the rural areas.
- Transport continues to be a major constraint and improved roads, rather than bicycles, are needed.
- Quality control has been a problem when new groups have entered the field without sufficient training. Although it is an indicator of success that stoves are considered a viable income-generating activity, poor quality discredits good technology and erodes the market for the improved stoves.

The experience in West Kenya has proved that introduction of rural stoves is not as straightforward as dissemination of urban stoves. It may be relatively easier for producers to change their habits because of immediate and easily quantifiable gains. Users, however, especially those with access to free wood and little incentive to save fuel wood, may take longer to appreciate the benefits of improved stoves.

Overall, commercialisation of a new technology for the rural poor has proved to be a tedious and expensive process. The lessons learned from the strategies explored in the Upesi project can help make replication of the experience elsewhere less expensive. This is an important area for donor funding; there is a pressing need for documentation of useful experiences.

By working with interested women's groups and involving them in the design and field-testing of the stoves, the project was able to take advantage of women's knowledge and experience.

NDIRANDE NKHUNI BIOMASS BRIQUETTE PROGRAMME

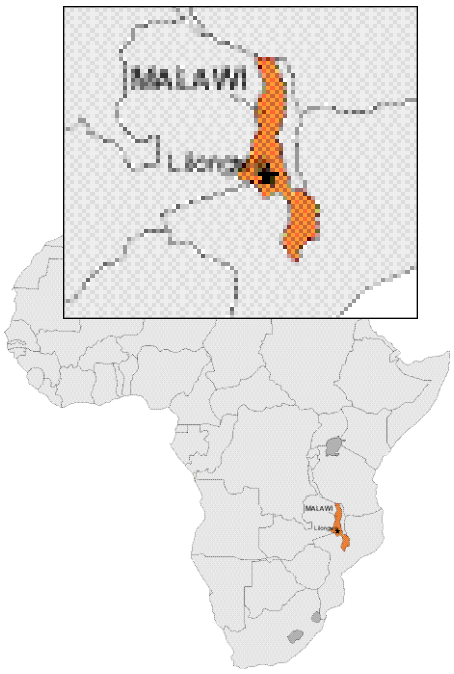
MALAWI

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 government, 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 availabili-

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.

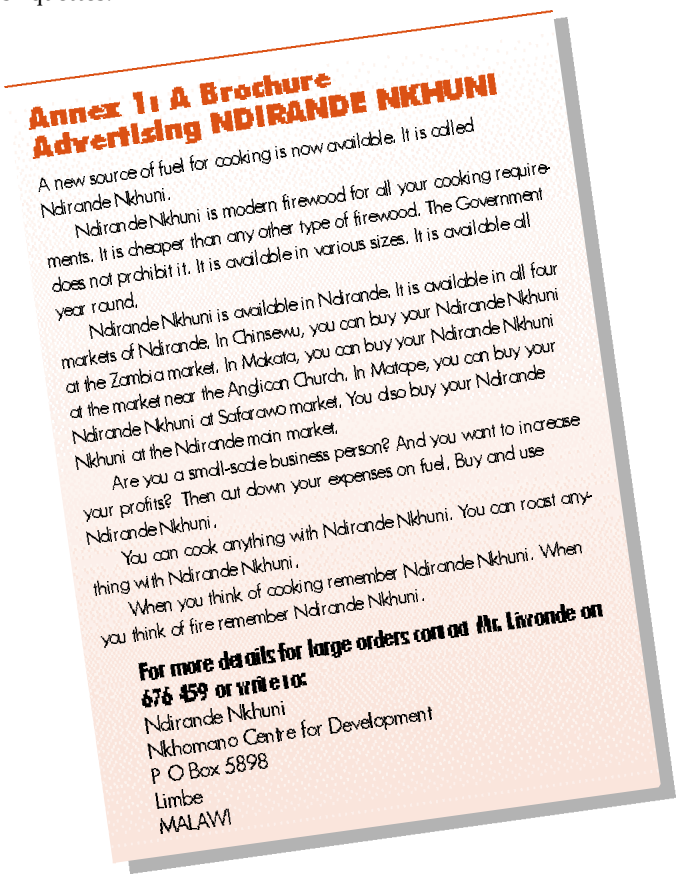
Above all, the involvement of family members — the boys and girls in making and selling the briquettes, the men in promoting marketing and raw material collection—has led to the success of this project. The monetary benefits of about MK400-500/week (US $5.30 to $6.60) generated by the groups have led 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.



Annex 1: A Brochure Advertising NDIRANDE NKHUNI

A new source of fuel for cooking is now available. It is called Ndirande Nkhuni.

Ndirande Nkhuni is modern firewood for all your cooking requirements. It is cheaper than any other type of firewood. The Government does not prohibit it. It is available in various sizes. It is available all year round.

Ndirande Nkhuni is available in Ndirande. It is available in all four markets of Ndirande. In Chinsewu, you can buy your Ndirande Nkhuni at the Zambia market. In Makata, you can buy your Ndirande Nkhuni at the market near the Anglican Church. In Matope, you can buy your Ndirande Nkhuni at Safarawo market. You also buy your Ndirande Nkhuni at the Ndirande main market.

Are you a small-scale business person? And you want to increase your profits? Then cut down your expenses on fuel. Buy and use Ndirande Nkhuni.

You can cook anything with Ndirande Nkhuni. You can roast anything with Ndirande Nkhuni.

When you think of cooking remember Ndirande Nkhuni. When you think of fire remember Ndirande Nkhuni.

For more details for large orders contact Mr. Livonde on 676 459 or write to:

Ndirande Nkhuni
Nkhomano Centre for Development
P O Box 5898
Limbe
MALAWI

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.

… the entrepreneurship approach has been key to briquette-making in Ndirande. Focusing on provision of household energy alone was not attractive to participants.

MULTIFUNCTIONAL PLATFORM FOR VILLAGE POWER

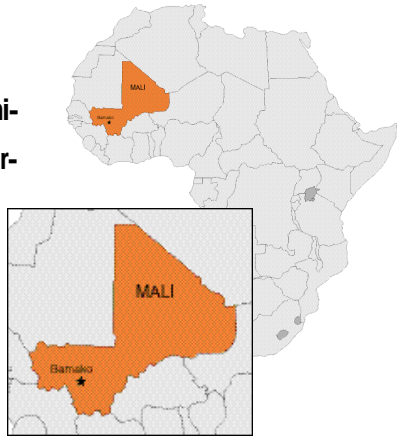
MALI

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.



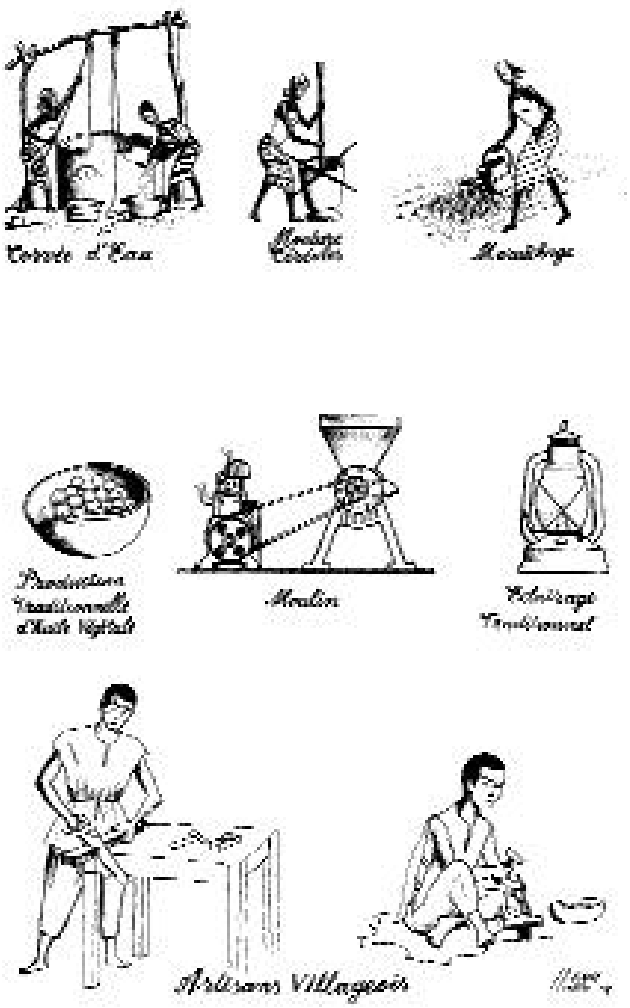
Mali is one of the poorest countries in sub Saharan Africa. Over 80 per cent of Mali's nine million people live in rural areas in about 11,000 villages, most of which are remote and isolated. The average size of a village is about 1,000-2,000 inhabitants. Rural transportation and communications networks 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.

AVANT LA PLATEFORME MULTIFONCTIONNELLE



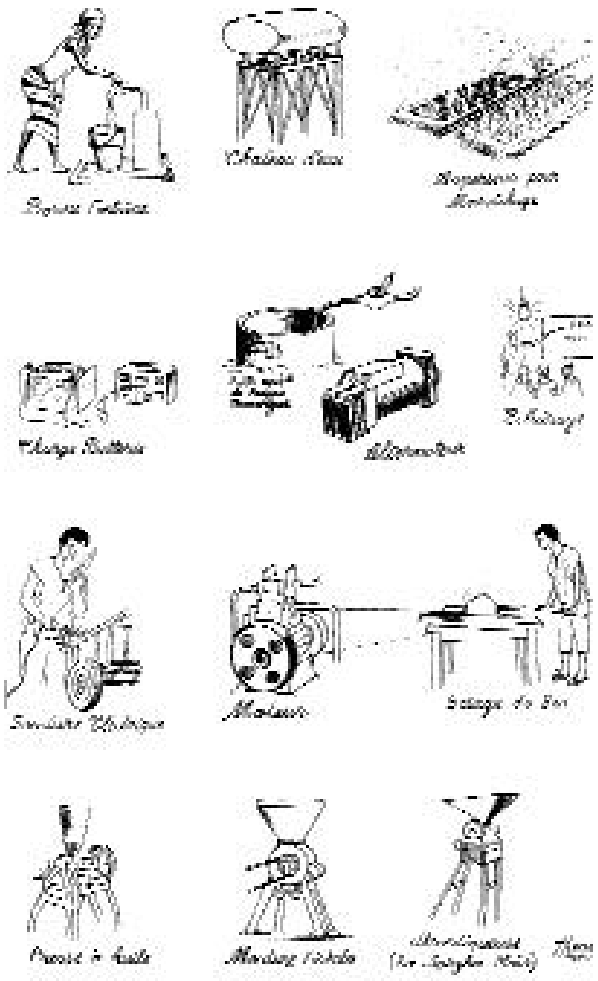
BEFORE THE MULTIFUNCTIONAL PLATFORM

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 modular. 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



AFTER THE MULTIFUNCTIONAL PLATFORM

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

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

TYPE OF TRAINING	TYPE AND NUMBER OF BENEFICIARIES	TRAINERS	EXPECTED RESULTS
Feasibility Study	Buyers and managers of platforms [8,000 in 60 villages]	Project Staff and partners	Ability to make decisions on the acquisition of a platform, using baseline information produced.
Conduct of Feasibility Studies	NGO and consulting partners —per zone [40]	Project Coordination Unit	Ability to perform village–specific feasibility studies and undertake follow-up activities based on the results.
Operation and Management of Platform	Women's management committees (average eight women per platform) [350]	Training specialists, NGOs, Consulting Groups	Ability to manage the operation of the platform and present results to Women's Association.
Literacy and Numeracy	Women's management committees and operatives (on average 20 per platform) [800]	Training specialists, NGOs, Consulting Groups	Effective use of bookkeeping and record keeping tools.
Entrepreneurial Activities	Women's committees (on average eight per platform) [350]	DEFSAM, APROFA (programmes supporting women's enterprises)	Diversification and increase of income generated by platforms. Increased time gain by clientele.
Training of Fabrication Artisans	Fabrication Artisans	Association of Artisans ACMGS	More people able to produce batches of platform parts and components.
Training of Maintenance Artisans	Maintenance artisans [eight]	Project Coordination Unit and artisans already trained by project	Reduction of downtime and effective preventive maintenance service.
Training of Rural Artisans	Rural artisans [10]	Rural training centres	Increased availability of end use services to villages.

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 association, 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

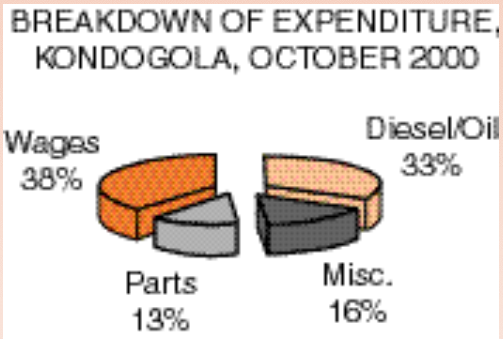
EXPENDITURE

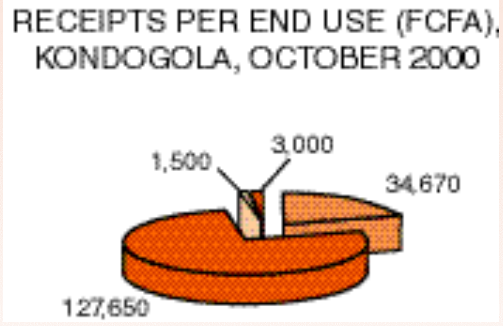
Diesel/oil	40,750
Miscellaneous	20,150
Parts	16,000
Wages	47,915
Total	124,815

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





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 processing, 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.

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

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 reduction. 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 agricul - tural 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, environmental 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 cookstove 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.

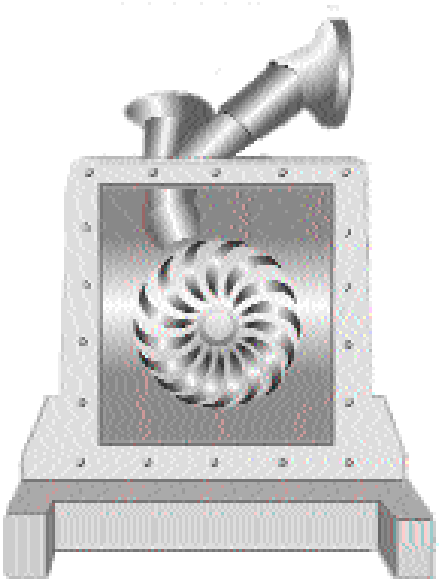
Bhoemu Lama lives in the village of Katunje in Kavre, a district neighbouring Kathmandu. Prior to her involvement in the REDP programme, she ran a small tea shop. After undergoing an entrepreneurship organized by the programme, she took a loan totalling Rs.12 7,000 (approximately $120) from her community 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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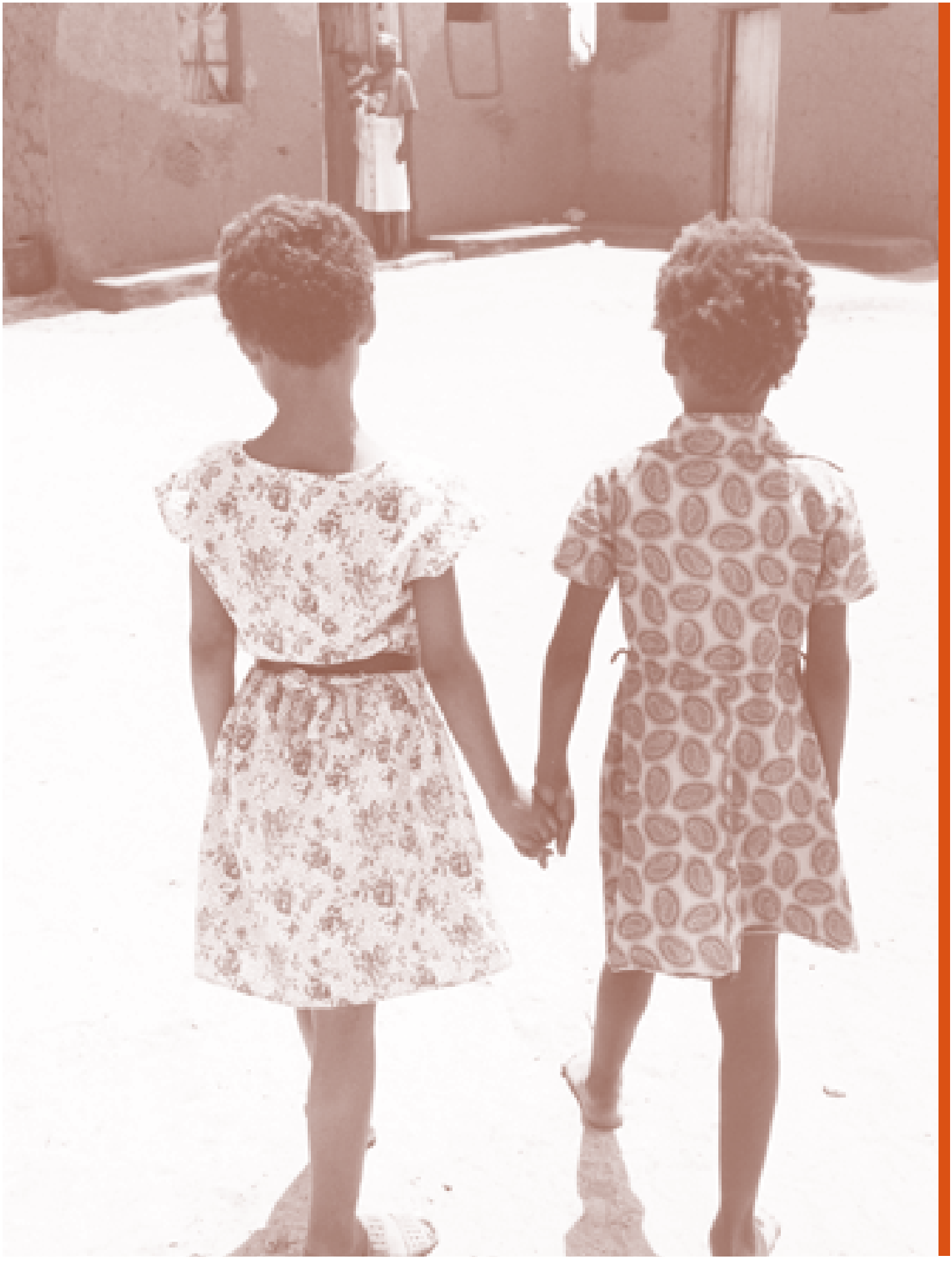


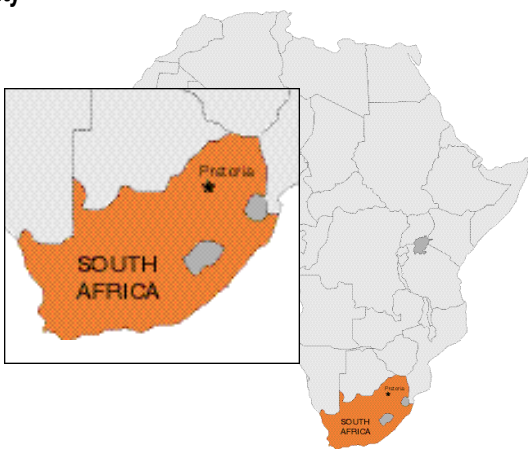
IMPACT OF WOMEN'S ENERGY GROUP ON NATIONAL POLICY

SOUTH AFRICA

WENDY ANNECKE

This case study describes the efforts of women in South Africa to influence national energy policy-making. In 1993 a small group of women activists in South Africa attended a National Energy Forum and were struck by the lack of women at the meeting and in its task groups. They requested that more women be able to attend the Forum and initiated a support group for women participants. By the end of the year, having learned some important lessons, the group decided to consolidate their experiences and form a network, the Women's Energy Group (WEG). Starting in 1994, this group contributed to a draft discussion document—the Green Paper—that was prepared to establish energy priorities for the new South African Government, and argued determinedly for national policies targeted to women's needs. In the end, most of their suggestions were diluted or omitted in the final energy policy adopted in 1998—the Energy White Paper—but their efforts helped put the issue of women's energy interests on the national policy agenda.

Greater attention is now being paid to women's needs, and to addressing gender imbalances in the energy sector. In 1994, a female Deputy-Minister of Minerals and Energy was appointed and in 1999, after the second democratic elections, a woman was appointed as Minister of Minerals and Energy. The new Minister appointed a transformation officer whose responsibilities include addressing past inequities in race and gender, and who introduced a gender equality pledge for all departmental employees within the ministry. In addition, the Minister introduced an annual award on Technology for Women in Business and held a workshop on the contribution of the energy sector to much-needed rural transformation. The growing awareness of women's energy needs came as a result of a number of initiatives and lobbying efforts, including actions by the Women's National Coalition and the Commission for Gender Equality, as well as the Women's Energy Group.



South Africa has large energy reserves. It has abundant supplies of low-grade coal which underpin its position as the largest generator of electricity on the African continent. Nuclear power accounts for about three per cent of the electricity supply, and hydro power storage stations are used to meet peak load requirements. South Africa imports petroleum, and has plans to import natural gas from Mozambique and Namibia. Solar and wind power resources, as well as hybrid systems, have potential but are not yet widely used.

During the apartheid years, energy policies were driven more by a desire for security and self-sufficiency than by concerns about meeting the energy needs of the majority of the population. Until the late 1980s, little thought was given to the needs of the domestic sector. A million middle-class households had electricity but this represented only 25 per cent of the population. By 1994, only 44 per cent of households were electrified, mostly in urban areas; only 12 per cent of rural households had access to electricity. Since the early 1990s there has been an electrification drive that has added two and a half million households to the grid, bringing the number of urban households with access to electricity to 68 per cent and the number of rural households to 48 per cent.

In South Africa the period from 1990-1994 heralded an unprecedented wave of democratisation that provided opportunities for previously disadvantaged groups—including women—to have greater input into government planning than ever before. New policies that addressed the needs of all citizens were required in every sector, and in 1994 the new democratic Government of National Unity asked each sector to begin putting appropriate policies into place. The energy sector first produced a Green Paper, which was a discussion document, and later the final energy policy document, the White Paper, which was published in 1998. The Energy White Paper marked a paradigm shift from the previous emphasis on energy security and self-sufficiency towards a focus on equity, efficiency and environmental sustainability in energy service provision.

The policy priorities stated in the Energy White Paper were: increasing access to affordable energy services; improving energy governance; stimulating economic development; managing energy-related environmental impacts; and securing supply through diversity

Each policy priority was then detailed in terms of demand, supply and cross-cutting issues. It is clear that the intention was to enable the whole country, rather than just businesses, to gain access to energy. For the first time, energy services for low-income households were addressed in a South African policy document. Yet, the articulation of the new policy is still somewhat weak:

> Government supports the concept of "energisation," i.e., the widening of access to a safe and effective energy package within the grasp of low-income households, and will promote its implementation where appropriate.
> (White Paper 1998: 38)

This, along with other aspects of the Energy White Paper—such as its acknowledgement of the need for social forestry programmes, subsidisation of the extension of the grid and the electrification programme to previously disadvantaged customers, and its support for renewables to supplement grid electrification—have had an impact on women. The changes have been felt differently by individual women depending on whether they received grid connection, or whether they could afford to buy electricity and the appliances necessary for cooking and cooling. Some have benefited from solar lighting but still have to use wood or kerosene for cooking.

Identifying women's needs and challenges

Apart from fuel wood, which can still be collected in some areas without monetary costs (although with increasingly high time and opportunity costs), all energy resources have to be purchased. Over 50 per cent of the South African population is poor and struggles to pay for energy. Thus, there is a need for sustainable income generation, as well as safe, affordable, accessible and secure energy sources. These were the needs highlighted by women at a national energy workshop held in Johannesburg in 1999.

Safety. At present the majority of women use fuel wood, coal or kerosene for cooking, none of which are safe fuels. The negative impacts on health of having to carry fuel wood over ever-increasing distances are well known, as are the respiratory and eye disorders which are exacerbated by extended periods of contact with smoke from burning fuel wood or coal. Using kerosene may also have a negative effect on air quality, but the primary health hazards associated with its use are the poisoning of children through accidental ingestion, and the potential for fires that start in urban slum areas and spread rapidly, leaving devastation in their wake. When women at the national energy workshop said they wanted safe fuels, they also said they wanted to be safe themselves when they go to purchase fuels or collect wood; they currently face threats from muggers, rapists and murderers.

Affordability. South Africa both manufactures and imports oil for kerosene, and recent increases in oil prices have led to a 70 per cent increase in the price of kerosene over the last year, so that many women have had to revert to using biomass fuels. Women have called for a stable kerosene price that does not include a Value Added Tax. The extension of the grid has been a positive programme, and connections to the electricity grid are heavily subsidised. Nonetheless, many low-income households cannot afford to use electricity for anything other than lighting. The cost of appliances also creates barriers to increased use. In rural areas where the grid will not be extended within the next five years, solar home systems are being installed by means of public/private joint venture schemes. At present the costs of installation and maintenance are borne by the households. These costs are much higher than for grid connections,

and many of the poorer households are excluded because they cannot afford the payments.

Accessibility. Kerosene is widely available, but the distribution systems for coal and liquefied petroleum gas (LPG) are limited primarily to urban areas, which means that these fuels are not accessible to most women and are generally not affordable when they do reach rural areas. Another accessibility issue relates to dwindling wood supplies. It is believed that South Africa may have sufficient wood supplies, but the cost of moving the wood from areas of supply to areas of fuel wood demand is prohibitive. Lastly, the women at the national energy workshop wanted to be assured of a secure supply of the fuel of their choice, so that if they invested in appliances and connections, the energy resource required—whether electricity, biogas, kerosene, or low-smoke fuel—would be consistently available.

Formulating gender sensitive energy policies

The challenge for the government and energy suppliers lies in delivering appropriate energy services to all areas. What is appropriate may vary widely, and thus should be determined by involving all interested stakeholders. The requirements of small businesses, agriculture, health and education facilities, as well as households, need to be considered.

In the early 1990s, an integrated energy planning (IEP) methodology was used to try to produce the strategies necessary for equitable access to energy, and a research team produced many reports using this framework in an effort to contribute to the development of new policy. A member of the research team, however, produced a critique of the IEP framework suggesting that it was insensitive to gender as it "overlooks the fact that women are the primary users and managers of energy at the household level, treats "the poor" and "households" as homogenous categories and thus both ignores the different needs and interests within these categories and fails to address the unequal gender relations within households" (Makan 1994: 5). She also argued that the reports' recommendations remained largely gender-blind on the grounds that the research was informed primarily by secondary sources and was based on quantitative and statistical research methods (Makan 1995: 188). Yet these sources and methods need not be gender-blind—quantitative research and statistics can be used to argue in support of actions to meet women's needs. The IEP framework could be conceptualised differently to include a gender-sensitive analysis of suppliers and users, and to examine the relationships between users within households. This would provide the disaggregated data necessary to develop policies equitable to women.

In trying to think through what a gendered approach to domestic energy policy and planning might entail, Makan identified several elements that need to be considered. Because of the division of labour, men and women have different roles, and different access and control over resources in the household, community and society in general. As a result, differing needs and interests on the basis of gender (as well as other factors such as income, class, age, etc) should be addressed in national policy.

Makan warned against taking a sectoral approach to energy provision. She recognised that integration with other development initiatives was critical, and noted that such an integrated approach would include ensuring that women were able to own land and have access to financial resources (Makan 1994: 11). She also encouraged policy researchers to challenge conventional social relations in order to meet women's needs, noting that one of the reasons it is difficult to address gender inequity through policy is that conventional policy statements tend to identify women's current roles, running the risk of further entrenching existing divisions of labour rather than attempting to address unequal power relations.

Women's Energy Group activities

Development of technical expertise, alliances and lobbying skills. The initial priorities of the Women's Energy Group members were to develop their own and other women's technical expertise, to develop alliances in order to be heard, and to learn to lobby successfully. The group's technical focus, its determination to build the capacity of women to engage in technology development, and its strategy of lobbying decision-making groups, were evident in its constitution, which was adopted in 1994. The constitution also clearly stated the rights and responsibilities of members: everyone had to share information and teach each other technical skills.

The group was inclusive, acting as a link between energy professionals and broad political organizations. Women from a number of different spheres, from grassroots organizations to parliamentarians, were mobilised to participate.

From the beginning the WEG members operated without adequate funding or facilities. The group's coordinator found that although everyone she met in NGO forums and in government departments thought that formation of the group was a good idea, she had difficulty finding funding to run it. As 1994 was the year of the first democratic elections, there was a great deal of work to do. Women in the energy sector were under enormous pressure to act on a number of fronts, including analysing the gender-blind research agenda and methodology used in policy development and addressing issues of affirmative action in organizations. At the same time, the political events taking place in the country demanded that WEG members pressure political bodies to place women and energy issues on their agendas, and include women in the policy-making process. In the first year there was much enthusiasm and participation from the growing membership.

The WEG's first activities included disseminating informa-

tion to men and women at the local level and lobbying for women and energy issues to be taken up by local government structures. Public presentations were particularly successful. Feedback from many listeners indicated that this was the first time that they had understood the importance of energy issues and realised that they could make conscious choices with regard to energy use and efficiency. On their part, members of the WEG learned that to be successful in politics they needed to move faster and be ready to seize opportunities. This was difficult, as all the women were volunteers under pressure in their full-time work; many lacked political training, and some had pressing commitments at home. Still, each member did what she could and by the time new government policies for the energy sector began to be discussed, the WEG was recognised as a force to be reckoned with and a necessary participant in the policy-making process.

Energy Green Paper drafting and consultations. Starting in 1994, WEG members contributed to the writing of what became known as the Green Paper discussion document, a lengthy exposition on the status of the energy sector that also described key issues and presented various scenarios for debate and discussion. The draft policy document included a section on domestic and household energy use, which reflected some of the progressive research that had been done since the late 1980s, and brought it into the national decision-making process for the first time.

It was envisioned that public comments would be solicited on the contents of the Green Paper and that consultations would be held to discuss it. WEG members were invited to a workshop to plan this series of consultations—the first in the history of the sector. The process was conceptualised by the organizers as a series of one-time workshops for various stakeholders such as big business, and "small users of energy," which would culminate in a National Energy Summit. Representatives of all stakeholder groups would attend this National Energy Summit which, it was hoped, would produce consensus on goals for the sector (Marqard 1999: 35). The WEG objected to this process as unrealistic, especially for those unfamiliar with the energy sector and unable to digest the 200-pages of technical language in the discussion document. The WEG was subsequently contracted to design and conduct workshops which would mobilise and prepare "the poor" for the Summit.

In preparation for community consultations, the discussion document was simplified and printed in the vernacular, and workshops for community organizations were arranged in centres around the country. These were aimed not only at women, but also at small-scale farmers, and poor urban and rural men and women running small enterprises. The people who attended the workshops were politically aware and articulate. They were interested in learning about energy and the policymaking process, and in taking an active role in this process.

Some community groups could not imagine how to address women's access to energy other than by ensuring that women were appointed to all decision making bodies. Others recognised that widening access to energy depended on access to other rights as well. They proposed far-reaching measures: that women must be able to own land; women must have the same rights as men to inherit land; oppressive customary laws must be changed; and women must be represented in all development structures. (James 1999: 40).

A few days before the Summit a joint preparatory meeting was held for the 150 community participants to enable delegates to discuss strategies for their participation in the important meeting. The community representatives participated as planned at the Summit but felt that they were being marginalised. During the plenary they took issue with the technical language, which they felt excluded them. They argued that their voices were not being taken seriously by the 300 more powerful delegates, and threatened a walkout if the situation did not improve. Overall they felt they were not really listened to at the meeting.

From this experience WEG members learned that:

1. It is unrealistic to expect that marginalised people, and particularly previously-oppressed women, should be able to consolidate their positions and engage with powerful groups over an issue as complicated as energy within a short time. A beginning has to be made, however, and once this has happened it can be built on over time, through energy agents, extension workers, teachers, and civic and business organizations. What is required is an ongoing educational and consultative process.
2. The WEG should not have been confined to commenting on traditional domestic and household issues and mobilising the poor, as this diluted their focus from gender issues to general social equity issues and entrenched their low position on the status ladder.
3. More experts in technical fields were needed as members of the WEG, in line with its initial focus.
4. The WEG members needed time to think carefully about how to articulate policies that would address gender inequality and the quality of life of women, and then lobby for these.

The Green Paper consultative process was demanding and time consuming. The WEG lost its focus on women, gender and technical skills when it had to organize around broader generalised categories which included the poor, previously disadvantaged people and low-income households. Because of the nature of the facilitation work and country-wide venues, only two women, who were contracted to conduct the exercise, were fully involved and understood the dynamics among community-based organizations and among men and women. This left some WEG members feeling left out and believing that women's interests had not been sufficiently protected. Most members agreed, however, that the WEG's participation in the Green Paper process and the National Energy Summit was meaningful and had prepared them for the next step which was the drafting of the White Paper for the Minister's approval.

The Energy White Paper

After the National Energy Summit, an editorial team consisting of six men and two women was chosen to write the White Paper. The Women's Energy Group sought to increase the number of women on the team, but without success. A stormy writing process ensued, including many debates about what should be included. Finding themselves in a small, male-dominated forum, the women involved were unable to hold onto decisions and progress that had been made in the Green Paper and the Summit. According to the two women, they were gradually eased out of the decision-making process. (James 1999: 41). Because the editor did not think that women deserved specific mention or targeted policies to assist them, most suggestions for gender sensitivity and policies to benefit women were simply edited out, despite heated arguments from the WEG members.

The draft White Paper produced by the committee underwent further writing and editing within the Department of Minerals and Energy before it was finally published, but women and gender issues did not re-appear. Although the final 1998 White Paper reflects a significant shift from the old supply-side paradigm to considerations of demand-side management and social equity, it contains only a watered-down version of what had been suggested earlier with regard to women and gender issues.

The White Paper is primarily a product of the gender-blind integrated energy planning policy research process critiqued by Makan. It focuses little attention specifically on women, and mentions women infrequently (six times in 120 pages), despite an explicit acknowledgement of women's subordinate position. In the section on low-income households there is a paragraph which reads:

> 6.1.1 A further important factor to consider when formulating energy policy is that most household energy users are women. The gendered division of labour traditionally means that women are a "disempowered" class. They are responsible for managing household resources and doing menial work in the home—using appliances to perform energy tasks and purchasing fuels. However, unless they are breadwinners and command power in the household by virtue of holding an income-earning position, it is often the man who makes decisions about appliance purchases. Past formulation and implementation of energy policy has given virtually no consideration to women's needs in this context. (White Paper 1998: 37).

No attempt is made to construct a policy statement to address women's disempowerment. There is only one policy statement that mentions women directly, but it is not concerned with women alone. It falls under the section on Human Resources:

> 8.6 A recent study of government energy institutions as well as the electricity, petroleum and nuclear sub-sectors showed that 46 per cent of staff were black, and only seven per cent occupied managerial positions. Women were under-represented in the sector, comprising 11 per cent of the total workforce and accounting for five per cent of total management. Black women were particularly under-represented, comprising one per cent of the total workforce and accounting for one per cent of total management. (White Paper 1998: 109)

The policy statement to address this imbalance reads as follows:

> The Department of Minerals and Energy will strive to increase the number of black people and women on all policy development structures, forums, parastatal boards and similar structures. A target of at least 30 per cent women and 50 per cent black participants and two per cent disabled persons by the year 2000, is envisaged, in line with the White Paper on Affirmative Action Policy. (White Paper 1998: 110)

These targets have not yet been met, but some progress is being made.

Another example of the White Paper's recognition of the importance of women is to be found in the section on households:

> 3.3.1 Energy services for low-income households have not been adequate since the previous governments' emphasis was to create a modern industrial urban society to meet the needs of the industrial sector and a privileged white minority. Households suffering unemployment and poverty rely on less convenient and often unhealthy fuels. Grid electrification may not satisfy all the energy needs of low-income households. Although most consumers are women, past energy policy has largely ignored their needs. Energy policy has also not adequately addressed energy conservation by high-income electricity-dependent households. (White Paper 1998: 13)

In this case, however, there is no specific proposal to address women's needs.

There are many other instances in the White Paper where women could have been mentioned and targeted for assistance but were not. For example, the section on rural fuel wood states:

> 7.7.3 Government will facilitate the production and management of woodlands through a national social forestry programme for the benefit of rural households, where appropriate. (White Paper 1998: 92)

The need to have women closely involved in such programmes has been well established, especially since women do not always have the same right to land, inheritance and crops as men do, and a policy that supports these rights would make a worthwhile contribution to more equitable energy services.

Throughout the White Paper of 1998 women are included in the categories "the poor" or "low-income households," ignoring the careful qualitative and quantitative research that has provided ample evidence that "the poor" and "women" are not homogenous categories. Although most women are likely to have less access to and control over resources than men, some women are more powerful and better positioned than others. Furthermore, research has shown that there may be very different attitudes, and degrees of access and control over energy services, within "low-income households." The Green Paper discussion document recognised this and suggested that recognition of these factors should be included in energy policy statements. The Women's Energy Group argued for policies to target women's needs directly, but in the final instance their suggestions were not included in the White Paper.

LESSONS AND CHALLENGES

The context for attempting to engender energy policy in South Africa was important because the rapidly-changing situation offered opportunities that had to be recognised and responded to promptly. The political terrain changed so fast that the Women's Energy Group had to struggle to keep up with the changing demands of politicians and thus lost its original focus on building technological capacity among all women. Several women, including the voluntary coordinator, were drawn into parliament or institutional positions and had less and less time for WEG activities. In addition, the rush of research projects for the Green Paper and the White Paper process sapped the capacity of WEG members.

Involvement in the energy policy process taught WEG members a great deal, despite the difficulties involved. In a workshop held at the end of 1995, the members drew up a list of what they had accomplished, what obstacles they encountered and what they had learned.

1. The presentations to mass-based organizations and consultative workshops created a public profile for the WEG and, according to feedback, were informative and initially empowering for those who attended. The lack of channels and structures through which poor people and especially women could be heard, however, proved to be an obstacle to getting their issues on the political agenda. Members believed that marginalised people were deliberately excluded from policy processes, and that to include them would mean building capacity and new structures at the local level over time. The group saw a need to work consistently at the local level and find ways of providing information derived from that work to the Department of Minerals and Energy.
2. It would probably be most successful to have a mobilised and vocal group of lobbyists continually in touch with community organizations and able to feed the Department and other government organizations with frequent "sound bites" of information on women's interests. This was an impossible task for most WEG members, who had full-time jobs and other commitments.
3. Rather than being supported by "progressive" actors in the energy sector, as they expected, the women encountered barriers to entry and resistance to change. The WEG members found that men who supported them privately or who made favourable public statements often changed their positions when it came to allocating resources or putting their promises in writing. Women and gender issues were generally dismissed as unimportant.
4. Lots of stamina was needed to deal with the energy sector. The WEG members had to support each other in order to face the barrage of scepticism they met from engineers involved in the energy sector who were not gender sensitive or easily moved from their narrow focus. The group had to find ways to work with this and change the views of men.
5. The WEG did not know enough about institutions and issues in the energy sector, which range from social forestry and petroleum supplies to electricity generation and the technicalities of photovoltaics. There was a need to build capacity among members. Although women realised their limitations and wanted to share their expertise and improve their knowledge, they often lacked the time or resources to do so.
6. The WEG needed alliances to increase its effectiveness. The group's links with other stakeholders were new and tentative. They did not have an "old boys" network to fall back on, and relied on newly made contacts among politicians, business people and community organizations. These needed to be consolidated, but there were few opportunities for casual interaction, and the WEG could not offer other parties access to power or a constituency since it needed to build one first. Its membership was small (40 women) and other sectors such as health and water, which had mobilised women earlier, commanded greater attention.
7. In its desperation to be recognised the WEG got involved in everything. This was a mistake and at the workshop WEG members argued that they needed to be more strategic. The original vision had been formulated by women engineers around technical capacity issues and this was indeed an area which needed attention. Later, the members who got involved in the policy-making process were social and political scientists and the vision of the group shifted. The WEG needed to assess the areas in which members

were working and prioritise specific areas for action—however difficult that might be in light of other urgent claims.

8. The group lacked support within the energy sector. Funding for space and resources were not forthcoming. When a participatory process or a voice from the poor was needed, the WEG was called in, but when significant national decisions about the electricity grid and domestic connections were made, it was not. The WEG workshop decided to raise funds for a part-time coordinator, but was not successful and, without a dedicated leader, the group disintegrated.

The WEG members also drew up a list of what they had achieved, showing how they had influenced events in a number of significant ways. The group had rapidly developed and raised the profile for women and energy in South Africa, brought together a broad spectrum of women from communities, industry, government, and research institutions, and got women committed to transforming the energy sector. They put women's interests on the policy agenda, got women nominated to positions of power, for example, in the Electricity Control Board, and demonstrated that there were competent women in the energy sector. In terms of public outreach, they pioneered the design and development of consultative workshops, became known by communities, and established a potential national energy network. Perhaps most importantly, the WEG served as a catalyst for poor people to speak and wealthy ones to listen, using a participatory methodology that achieved a high profile and acceptance in the energy sector. The group built capacity among its members as well as other people in the sector, and ensured that women contributed to the discussion document and the White Paper—even if this was diluted in the end.

Overall the WEG accomplished a great deal in a short time. Although the group was distracted from its primary focus it did not lose sight of how important it is for women to be competent in technical fields. In a brief period the WEG managed to ensure that there was increased participation of women in decision-making processes in the energy sector. The WEG also attempted to find ways in which women could support each other—although the timing was not quite right for it to link strongly with ENERGIA, an international network focusing on gender and energy issues, which might have offered support for WEG efforts.

Exhaustion, a change of focus, dwindling membership as experienced women moved into institutions, lack of success in engendering the policy process, taking on too much and a lack of leadership, funds and resources all contributed to the disintegration of the WEG. Women in similar positions would do well to decide on a few strategic areas and concentrate on building the capacity and alliances needed to reach their goals.

The first two energy Ministers under the new government were not interested in gender issues and failed to take much of WEG's work into account. Only when a woman minister was appointed in 1999, were gender considerations put back on the agenda. So far these have not been translated into practice, but the burdens of some poor women are being addressed to some extent by the grid and non-grid electrification programmes, and by extension of the fossil fuel distribution systems.

Women in the energy sector in South Africa should mobilise to entrench gender issues while there is the opportunity to do so. The re-launch of a women's energy group, this time linked to an international network, the appointment of gender-sensitive women to senior positions, and the emphasis on women and energy at the African Ministers' Conference held in Durban, South Africa, in December 2000, all indicate new opportunities for furthering the position of women and gender considerations in the energy sector.

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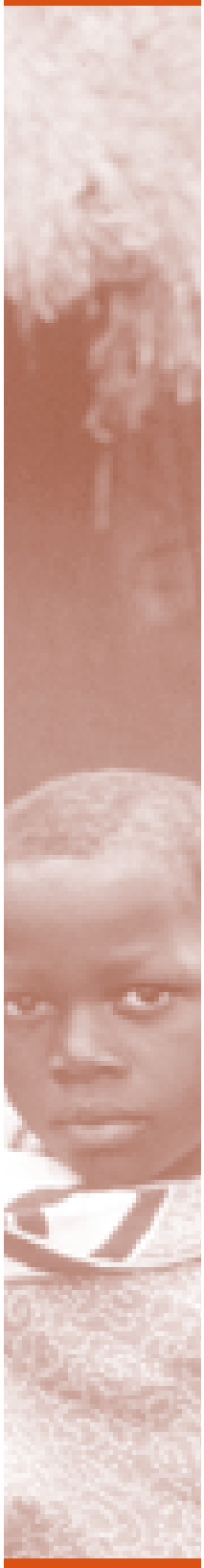
…women do not always have the same right to land, inheritance and crops as men do, and a policy statement towards upholding these rights would [make]… a worthwhile contribution to more equitable energy services.



PHOTOVOLTAIC PROJECT FOR RURAL ELECTRIFICATION

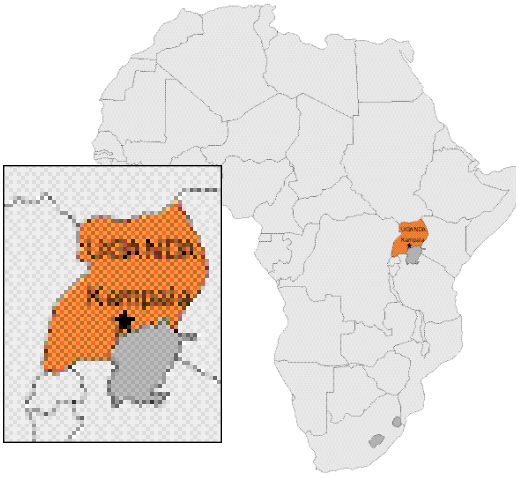
UGANDA

MAY CHRISTINE SENGENDO

The UGANDA PHOTOVOLTAIC PILOT PROJECT FOR RURAL ELECTRIFICATION (UPPPRE) was designed as a three-year pilot project, funded by UNDP/GEF, with a goal of promoting the use of solar photovoltaic technology in Uganda. The project aimed at overcoming financial, social, and institutional barriers that hinder the widespread dissemination of this technology. The strategy was to establish viable financial and institutional mechanisms for offering solar photovoltaic systems on a commercial basis to households, businesses and communities.

The project, which started in 1998, focused on rural areas, and areas on the outskirts of cities, that were projected to remain off the national electric grid for a period of at least five years. The project has led to installations by solar companies of 576 solar home systems and 42 institutional systems. Some of the institutional systems have been installed in collaboration with the Ministry of Health and local government agencies to provide clinic lighting and vaccine refrigeration.

During the implementation stage, special efforts were made to encourage women entrepreneurs to purchase solar systems by offering credit through a women's bank. These efforts have not been very successful, however, because of high interest rates, short repayment schedules and collateral requirements.



Uganda is an East African country with abundant sunshine due to its location on the equator. It has a population of approximately 19 million, which is increasing at a rate of about 2.8 per cent annually. Close to 90 per cent of the people in Uganda live in rural areas, and annual per capita income is estimated at US$170.

Biomass, in the form of fuel wood, charcoal, agricultural residues and animal dung, provides 96 per cent of the total energy consumed in the country. Wood is the most widely used fuel, especially in rural areas. Significant quantities of fuel wood are consumed for household uses, as well as for tobacco curing, tea drying, fish smoking, brick-making, baking, and cooking in hotels. Men specialise in commercial fuel wood harvesting, while women and children collect fuel wood for domestic use.

Petroleum-based products provide only about four per cent of Uganda's energy needs. About 85 per cent of petroleum use is for transportation. Petroleum is imported, and product availability is affected by foreign currency constraints. High prices have caused many industries to switch from petroleum to other products (particularly wood fuel and electricity). In households, kerosene is used mainly for lighting, and dry-cell batteries are used to run electrical appliances.

Less than five per cent of Uganda's population has access to grid-based electricity. Electricity accounts for only about one per cent of the total energy consumed in Uganda and five per cent of commercial energy consumption. Power generation is mostly from hydro electric stations, and although there are possibilities for extending the grid, the high cost of establishing electricity connections is a major constraint in a country with a widely dispersed population.

Uganda's rural electrification strategy aims at reducing inequities in access to electricity and associated limits on opportunities for increased social well-being, education, health and income generation. The strategy suggests the need for policies to support decentralised electricity development, and accessible financing mechanisms.

Renewable resource technologies (other than hydro) utilise biogas, solar, wind and geothermal resources, as well as crop wastes and industrial biomass residues. These mostly involve new technology innovations, and currently contribute only one per cent of the total energy consumed in Uganda. They are viewed as luxury items, requiring relatively high capital costs for manufacturing, as some of the mechanical parts have to be imported, and equally high retail costs. Moreover, there is little awareness in some areas of Uganda about the existence of renewable energy technologies and their availability for purchase.

Focus on women in project implementation

The UPPPRE project was targeted generally towards individuals, communities and government institutions with the ability and willingness to pay market prices for solar photovoltaic (PV) services. The majority of the participants in the design phase of the project were men because most of the solar companies in Uganda are headed by men. Project staff nevertheless made an effort to involve female electricians, installers and researchers in the design process, and to encourage training of women entrepreneurs and technicians.

In Uganda, the National Gender Policy now requires all policies, programmes and projects to consider gender issues, based on findings that men dominate the decision-making positions and that women shoulder most productive, reproductive and community management responsibilities, many of which are not remunerated or reflected in national statistics. In the case of the UPPPRE project, therefore, emphasis was placed on women in order to address their roles, needs, rights and responsibilities, and to address discrimination against them as project actors and beneficiaries.

UNDP also encouraged project staff to seek guidance on how to make the project's activities more gender sensitive. As project implementation started, the project staff and solar companies came to realise that women had particular needs related to the use of solar equipment for lighting, domestic activities and income generation.

Women were viewed primarily as users rather than manufacturers or distributors of the solar equipment. Moreover, despite project efforts to actively involve women as users at the village level, more men were present whenever consultations and public seminars were conducted. Men were involved in the project not only as users but, more significantly, as manufacturers and agents of solar companies. In the manufacturing and assembling group for solar photovoltaic systems, there are 32 registered members, including only one woman.

During the implementation stage, the project particularly targeted women by involving the Uganda Women Finance Trust in a special lending programme for the purchase of solar PV systems.

Another strategy for gender sensitivity was to promote a woman to the post of Assistant Project Manager. Although representation of women in such decision-making positions does not necessarily ensure inclusion of women's needs and priorities in the design and implementation of projects, use of female personnel is one the initial strategies used for integrating women's concerns into project activities.

Stakeholder participation

The design and implementation of the project was undertaken within the framework of Uganda's Ministry of Energy and Mineral Development. The project is administered through the Directorate of Minerals and Energy, which is headed by the Commissioner for Energy and is responsible for activities related to new and renewable sources of energy.

Private sector companies were directly involved, most of them small enterprises that sell and install PV systems. The project worked closely with members of the Uganda Renewable

Energy Association, a group of 25 private companies, training institutions and consultants.

In addition, UNDP Kampala provided a grant of US$1 million to the Government of Uganda to facilitate the development of credit mechanisms for purchases of solar PV systems in collaboration with local financial institutions, including the Uganda Women Finance Trust and the Centenary Rural Development Bank.

One of the first activities for UPPPRE was to increase awareness in rural areas about environmental issues in general, and about the availability, advantages, and costs of household and community-based PV systems, in particular.

The strategy of first targeting local leaders in the pilot districts enabled the project to obtain institutional support. Public awareness seminars were held for leaders in the districts of Mbale, Tororo, Pallisa, Mbarara and Bushenyi and other surrounding districts. Working through the district administration, the project was able to set up PV demonstrations in institutions like health centres, and to identify potential customers, trainers and suppliers.

The project also selected and used the services of intermediary agencies that already had good networks in the pilot districts. These non-governmental agencies, including women's organizations, used their existing networks to link solar companies to women and men who would like to purchase solar systems. By August 2000, about 30 seminars and meetings had taken place, involving about 800 participants. Special exhibitions and seminars were organized for clients of the Uganda Women Finance Trust to enable them to make informed decisions about purchases of solar PVs through the credit scheme.

Both men and women from the Uganda Renewable Energy Association participated in awareness raising activities which included advertising through trade fairs, exhibitions and seminars at the district and sub-county level. The project also used advertisements in various newspapers and on radio and television to inform people about the benefits of solar power. The result of the project's information campaign was to generate numerous inquiries at the project offices, and at the offices of the banks involved with the project.

Access to credit

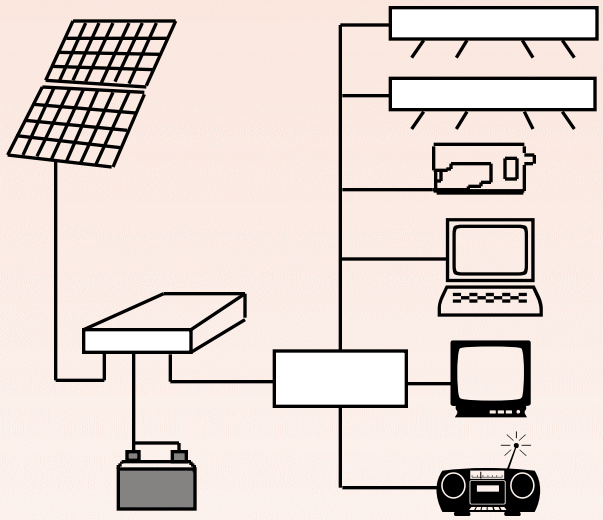
Consultations with credit institutions in Uganda were undertaken in order to identify the most suitable way of providing access to solar PV for those who could not afford direct purchase of the systems.

The project established collaborative credit agreements with the Uganda Women Finance Trust, which was chosen because of its focus on female clients, and the Centenary Rural Development Bank, selected due to its achievements in lending to low-income wage earners in various districts.

The plan was to provide credit to users and vendors. Nine months after the establishment of the credit system, The

CONVERTING SUNLIGHT INTO HOUSEHOLD ELECTRICITY

A household photovoltaic system includes the solar panel, which is usually installed on the roof and converts sunlight into electrical power. This electricity is then passed by wire through a regulator, which keeps the battery from overcharging or draining, converted to the appropriate voltage (if necessary) and delivered through a distribution box to the end-use devices. One panel can be used for lighting or for running small appliances.



Though the initial costs of residential solar systems are high, running costs are low, since no fuel is required. Solar systems are also:

- **Modular, so they can be expanded to meet growing needs, or dismantled and used for other applications.**
- **Long-lived: most panels have 15-year warranties, whereas batteries need to be replaced every few years.**
- **Reliable, as they have no moving parts and are thus unlikely to break down.**
- **Low maintenance.**
- **Capable of charging batteries.**
- **Environmentally friendly, as their operation releases no pollutants or greenhouse gases.**

Source: UPPPRE project brochure.

Uganda Women Finance Trust had only provided credit to one female client and only two solar companies had obtained credit from the Centenary Rural Development Bank.

The banks found it difficult to provide the type of loans that the project had suggested for several reasons.

Banks consider solar PV systems to be consumable goods and require the client to have a regular source of income to cover the repayment of the loan. Most of the clients who inquired about the loans did not have regular income. These borrowers lacked the type of documentation that would enable the lenders to judge credit histories and prospects for repayment. Such uncertainty on the part of banks increases the risk premium attached to these loans. The interest rates charged by the banks for solar system purchasers were 28 per cent to 30 per cent, too high for most customers.

In addition, potential borrowers for solar PV systems under the UPPPRE project were subjected to the banks' collateral requirements, even though under the collaborative agreement these loans were guaranteed by UNDP. The banks did not view the solar system equipment as satisfactory collateral due to its limited resale potential.

Banks also expressed concerns about the high operational costs for such loans. Although the financial institutions have internal information systems to enable them to compute these costs, solar credit requires a long-term payment period which requires a special credit scheme.

Potential solar credit clients mainly have seasonal income based on agriculture-related economic activities and have difficulty borrowing from micro finance institutions due to the short repayment periods allowed (usually only nine months) and requirements for regularly scheduled payments. Solar companies offering credit for equipment purchases have designed mechanisms for "hire purchase" that allow clients to pay over somewhat more flexible time periods. The hire purchase arrangement is very similar to financing for leased equipment, and generally takes into account various possible cash flows that a household can use to meet the payments.

Benefits to women

Women and men who bought solar PV systems have reported improved living conditions. The benefits of solar PV include: provision of energy for equipment that could improve on the quality and effectiveness of work done for purposes of income generation (e.g., refrigeration and battery charging); reduced drudgery while performing daily tasks; improved health conditions; greater opportunities for income generation; and greater conservation of natural resources.

Through public awareness seminars, the project undertook community assessments of needs that could be met through solar power equipment. In rural areas, most of the needs were related to household lighting, especially for working extended hours and reading by school children. People from urban areas reported somewhat different needs, primarily related to income generation and improvements on existing energy services. In these areas, solar systems have been used to provide power for refrigeration, lights, and recreation, such as television and video shows.

Institutional needs for solar PV systems included health related needs, especially refrigerators for vaccine storage, lights for the maternity ward and delivery beds, and lights for night studies at secondary schools.

Besides improving living conditions, the solar PV project has allowed people to acquire new skills. Women technicians have had an opportunity to participate in private sector delivery of PV electrification. Under the project, three female and 30 male technicians were trained in design improvement, and four women and 20 men participated in management and company improvement training at Uganda Management Institute in Nakawa.

Environmental management

The main impact of the project in terms of environment management has been to encourage people to switch from use of wood fuel, kerosene and paraffin to solar photovoltaic systems. This reduces deforestation and emissions of carbon dioxide and other greenhouse gases. The shift from kerosene and paraffin lanterns to solar lanterns also helps to improve the quality of indoor air.

Concerns were raised about the current use of disposable dry cell batteries because they contaminate soil and water sources and thus affect local health conditions. The project made arrangements to establish mechanisms for recycling lead acid batteries used in connection with solar systems, which can cause heavy metal poisoning.

LESSONS AND CHALLENGES

Stakeholder participation. Through publicity efforts, the project has enhanced participation of women as users of solar PV. It has been less successful in engaging women in the manufacturing and distribution of solar systems.

The project offered women training in technical skills and system installation, with the idea that this would produce benefits to women that would extend to other household members and the community at large. Existing levels of participation, however, have not really allowed many women to benefit from the project. More effective strategies and training opportunities are needed to enable increased numbers of women to get involved in the manufacturing and distribution of equipment, and to help them use the systems to improve their incomes and purchasing power. The project should also work on initiatives to involve men and women users in the design and implementation of PV-related projects in order to provide greater benefits to household members and communities.

In addition, more people need to be trained in maintenance and installation of solar equipment, and end-user training should be strengthened through formalised instruction in system management, maintenance, and trouble shooting. The project should help solar companies build capacity, especially with methods and techniques for training solar users. This could be accomplished in part through simple user manuals, preferably in the local language. Such manuals should also include information about equipment specifications.

Financial mechanisms. The financial mechanisms that were designed to work through micro-finance institutions did not prove to be effective in providing credit for solar end users in Uganda, even with a guarantee from the donor organization. The challenges included:

- high interest rates charged by micro finance institutions.
- short repayment periods (six to nine months).
- focus on a regular income for repayment.
- requirement of collateral.

The high prices of solar PV systems make them unaffordable for women from poor households. As a result, beneficiaries tend to be those who are the better-off members of the community. There should be choices available for more affordable, smaller solar panels. Affordability concerns also hinder female and male users from using rechargeable solar batteries (deep cycle batteries), which are highly taxed and therefore expensive.

If the project is to have success in poverty alleviation and improving livelihoods for male and female users, another financing model should be used. Although provision of subsidies would have been the most appropriate short-term strategy, subsidies are problematic because they can create a dependency syndrome among solar users. The project should explore strategies for providing credit facilities through community level cooperative societies and village level micro-finance organizations. Such organizations are near the users and can guide those who would like to borrow money to purchase solar systems and service the loans through payments acquired from agricultural product sales and other seasonal income.

In cases where subsidies can be used, the project should help companies to advocate for improvements in the tax exemption strategy through exemptions from the Value Added Tax. Companies should also lobby the government to formulate a clear criteria for tax evaluation of solar panels and parts.

The project should provide technical support to organizations and companies that can establish or provide energy service facilities that deal with leasing solar systems to potential users. The companies and organizations should promote small solar systems that are affordable to average or low income users, and charge a monthly fee for the service.

Indicators. The project should formulate strategies to use indicators that can show changes in living standards, income, and health, as well as gender elements, on order to track the progress and impact of the project. A monitoring mechanism is also needed to track the activities undertaken by the private sector, the performance of systems, and compliance with accepted standards.

Through public awareness seminars, the project undertook community assessments of needs that could be met through solar power equipment. In rural areas, most of the needs were related to household lighting, especially for working extended hours and reading by school children.

Biographies

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