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# ENERGY TO MOVE RURAL NEPAL OUT OF POVERTY: THE RURAL ENERGY DEVELOPMENT PROGRAMME MODEL IN NEPAL

**Towards an 'Energy Plus' approach for the poor:  
A review of good practices and lessons learned from Asia and the Pacific**

Case Study 10

ENVIRONMENT AND ENERGY



*We would like to take this opportunity to recognize the partners who have made financial and other contributions to the energy sector project described in this report. These include the Alternative Energy Promotion Centre (AEPCC), the World Bank and the Agricultural Development Bank of Nepal. In addition, the project would not have been possible without the co-operation and the contribution of the Government of Nepal and the participating District Development Committees and Village Development Committees.*



## **Alternative Energy Promotion Center**

**Making Renewable Energy Mainstream Supply to Rural Areas of Nepal**

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*Cover photo courtesy of UNDP/Energy Access for Poverty Reduction*

# Contents

<b>Acronyms</b>	<b>iii</b>
<b>Synopsis</b>	<b>v</b>
<b>Acknowledgement</b>	<b>vi</b>
<b>Preface</b>	<b>vii</b>
<b>1. Background</b>	<b>1</b>
1.1 Economic development in Nepal	1
1.2 Renewable energy in Nepal	1
1.3 Barriers to expanding energy access	2
<b>2. Programme overview</b>	<b>3</b>
2.1 Institutional arrangements	4
2.2 Programme funding and costs	4
<b>3. Implementation strategy</b>	<b>5</b>
3.1 Programme activities	5
3.2 Capacity development	6
3.3 Enterprise development	7
3.4 Local participation and social inclusion	7
3.5 Standardization and quality management	8
<b>4. Impacts</b>	<b>9</b>
4.1 Tangible achievements	9
4.2 Impacts on MDGs	11
4.3 Expansion of the RE private sector	12
4.4 Internalization and institutionalization of REDP modalities	12
<b>5. Programme sustainability measures</b>	<b>13</b>
5.1 Productive uses of energy	13
5.2 Strengthening institutions as an exit strategy	14
5.3 Functional collaboration with partners	14
5.4 Accessing CDM funds	15

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<b>6. Lessons and good practices in expanding energy services for the poor</b>	<b>15</b>
6.1 Explicit policy commitment to renewable energy	15
6.2 Synchronization with existing governance strategies	15
6.3 Community-led development	16
6.4 Developing national capacities	16
6.5 Information dissemination	16
<b>7. Conclusions</b>	<b>17</b>
<b>References</b>	<b>18</b>
<b>Annex: REDP achievements at a glance (December 2010)</b>	<b>19</b>

## Acronyms

<b>ADDCN</b>	Association of District Development Committees of Nepal
<b>AEPC</b>	Alternative Energy Promotion Centre
<b>APRC</b>	Asia-Pacific Regional Centre
<b>CDM</b>	Clean Development Mechanism
<b>CEF</b>	Community Energy Fund
<b>CER</b>	certified emission reduction
<b>CO</b>	community organization
<b>CO<sub>2</sub></b>	carbon dioxide
<b>DDC</b>	District Development Committee
<b>DEES</b>	District Energy and Environment Section
<b>EDF</b>	Enterprise Development Fund
<b>GoN</b>	Government of Nepal
<b>ICS</b>	improved cookstove
<b>KfW</b>	Kreditanstalt Für Wiederaufbau (German Development Bank)
<b>kg</b>	kilogram
<b>kW</b>	kilowatt
<b>MDG</b>	Millennium Development Goal
<b>MHFG</b>	Micro-Hydro Functional Group
<b>MHP</b>	micro-hydro plant
<b>MW</b>	megawatt
<b>NGO</b>	non-governmental organization
<b>NPR</b>	Nepalese rupee (currency)
<b>REDP</b>	Rural Energy Development Programme
<b>RESC</b>	Rural Energy Services Centre
<b>RE</b>	renewable energy
<b>REF</b>	Renewable Energy Fund
<b>RET</b>	renewable energy technology
<b>SHS</b>	solar home system

<b>SNV</b>	Netherlands Development Organization
<b>SO</b>	support organization
<b>TRC</b>	Technical Review Committee
<b>UNDP</b>	United Nations Development Programme
<b>USD</b>	United States dollar (currency)
<b>VDC</b>	Village Development Committee
<b>Wp</b>	watt-peak

# Synopsis

**Project title:** The Rural Energy Development Programme (REDP)

**Country and Region of Implementation:** Nepal

**Focus area:** Enhancement of livelihoods in remote rural communities through decentralized energy systems, with community-managed micro-hydro plants as an entry point

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**Duration:** August 1996–April 2011 (Phases I, II and III)

**Costs:** Approximately USD 35 million for Phase III (2007-2011)

**Project brief:** REDP was launched in 1996 with the objectives of expanding energy access to remote rural communities, strengthening capacities of energy institutions and establishing a national rural energy policy framework. The programme operated at the community, district and national levels. It focused strongly on capacity development, community mobilization and livelihoods enhancement, using community-managed micro-hydro plants as an entry point for holistic development of remote rural communities.

Upon its conclusion in April 2011, more than 550,000 people living in remote areas had benefited directly from REDP. The programme installed 307 micro-hydro plants, 3,099 solar home systems, 6,811 toilet-attached biogas plants and 14,255 improved cookstoves. It also helped to promulgate the national Rural Energy Policy (2006), which adopted good practices and lessons learned from REDP. REDP supported the Alternative Energy Promotion Centre (the lead national agency for renewable energy) in institutionalizing the Rural Energy Policy and in establishing rural energy systems in all districts of Nepal.

# Acknowledgments

**Energy to move rural Nepal beyond poverty: The Rural Energy Development Programme model in Nepal** is one of 17 case studies which, together with a report titled 'Towards an 'Energy Plus' approach for the poor: A review of good practices and lessons learned from Asia and the Pacific' and an Action Agenda Note, comprise a review of good practices and lessons learned in energy service delivery to the poor. Commissioned and facilitated by the United Nations Development Programme Asia-Pacific Regional Centre (UNDP APRC), this case study identifies key characteristics that have helped poor households and communities gain access to modern energy services, and to derive valuable lessons for future energy access activities. This case study is the product of an intensive collaborative process and we wish to acknowledge the many contributors, without whose generous support this work would have been impossible.

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## Preface

Asia-Pacific has achieved remarkable economic growth and socio-political progress in the past two decades, with almost every country in the region experiencing a concomitant decline in poverty.

Despite this progress, 800 million people in the region remain without access to electricity and almost 2 billion rely on the traditional use of biomass for cooking. While good progress has been made with expansion of electricity, many remote rural areas remain un-electrified, as connecting them to the national grid remains very expensive.

The poor often live in subsistence economies that do not generate cash surpluses, limiting their purchasing power and opportunities to shift to modern energy services. As a result, they have to invest more of their income and time in obtaining energy, and tend to use traditional energy services and fuels. Women and children are particularly affected, spending many hours a day collecting fuelwood and preparing meals in the kitchen. Smoke from inefficient stoves in poorly ventilated homes kills 1.6 million people worldwide every year; the majority of victims are women and children younger than five years. Indoor air pollution is the fourth-biggest killer in the developing world.

Asia-Pacific countries have applied many cutting-edge practices in providing energy access to the poor, including innovative financing mechanisms. Apart from satisfying basic needs, energy services can act as an instrument to empower women and disadvantaged communities; as an entry point to mobilize communities to take charge of their own development; and, most importantly, as a means to livelihood enhancement and poverty reduction. However, the scale of expansion of energy access projects has been far from sufficient.

UNDP has been working with its country partners to address these energy poverty issues, aiming to meet user needs, broaden energy supply options and link these efforts in achieving the Millennium Development Goals. Between 2009 and 2011, the UNDP APRC reviewed 17 energy access programmes and projects implemented by various development agencies and the private sector in the region. These projects were documented as 17 case studies (including this report), a report titled 'Towards an 'Energy Plus' approach for the poor: A review of good practices and lessons learned from Asia and the Pacific' and an Action Agenda Note. Together, these documents provide practical guidance for policymakers and development practitioners in designing and implementing future programmes and projects that ensure the delivery of low emission, affordable and reliable energy services for poverty reduction.

This case study documents the Rural Energy Development Programme (REDP) in Nepal, which achieved widespread expansion of energy services and helped to formulate the national Rural Energy Policy. Three hundred and seven micro-hydro plants, 3,099 solar home systems, 6,811 toilet-attached biogas plants, and 14,255 improved cookstoves were installed, and 550,000 people living in remote areas obtained electricity under REDP. Through its focus on productive uses of electricity, income generation and enterprise development, REDP helped poor communities to remedy two pervasive problems that kept them impoverished: their low productivity and their limited range of productive options.



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# 1. Background

## 1.1 Economic development in Nepal

Nepal is a landlocked mountainous country with a total area of 147,181 km<sup>2</sup> that lies between the People's Republic of China and the Republic of India. More than 30 percent of Nepal's population of 29 million subsists below the national poverty line, and the country has one of the world's lowest rates of per capita electricity consumption.

**National stability, rural development and addressing rights of vulnerable groups.** Nepal has experienced rapid political change in the last two decades, with a long period of conflict brought to an end in 2006. The Common Country Assessment of the United Nations Agencies in Nepal suggested that one cause of the conflict was the State's failure to deliver rural development and to mainstream vulnerable groups. In line with this thinking, the United Nations Development Assistance Framework has adopted a two-pronged approach to development in Nepal:

- building an equitable society that provides for everyone's needs, including sufficient food, adequate health care, basic education and employment; and
- ending the marginalization that has prevented vulnerable groups (including women, *Dalits*, *Janajatis* and *Madhesis*) from satisfying these needs.<sup>1</sup>

In the current transition to democracy, the Government of Nepal (GoN) faces high expectations regarding the development agenda, including provision of energy infrastructure.

## 1.2 Renewable energy in Nepal

Renewable energy technologies (RETs) can contribute to rural development by providing energy services and enhancing opportunities for improved livelihood and income generation. RETs have been promoted in Nepal since the early 1970s; by 2008, approximately 12 MW of micro-hydro power had been developed, supplying about 120,000 households. Around 10 percent of the national population uses renewable energy (RE) resources as a primary source of energy.<sup>2</sup>

**Underdeveloped hydro power resources.** Nepal's total hydro power resources are estimated at 83,000 MW, of which about 42,000 MW can be economically tapped.<sup>3</sup> So far, however, only 1 percent of this potential has been developed. Reasons for this include:

- a lack of coherent energy sector policies;
- a long period of social and political conflict;
- inadequate resource mobilization; and
- the multiplicity and overlapping roles of institutions involved in planning and implementation.

**Realizing the national Rural Energy Policy.** In 2006, the GoN promulgated a comprehensive Rural Energy Policy, which sought to promote:

- private sector involvement in expanding energy solutions;
- replacement of inefficient and unsustainable use of biomass energy with cleaner energy;
- community-managed energy service delivery; and
- productive uses of energy to reduce poverty (for more detail, see Box 1).

---

<sup>1</sup> *Dalits* are a group of people who have historically been oppressed by higher-caste groups. *Janajati* are indigenous people, descendants of the Tibeto-Burmans; most are poor, and their representation in the national systems is minimal. *Madhesis* are people living in the Terai, Nepal's southern plains bordering India.

<sup>2</sup> This figure does not include traditional fuels, which are used for cooking and heating by almost 100 percent of mountain households and about 77 percent of hill households (UNDP Nepal, 2007).

<sup>3</sup> UNDP, 2009a.

## Box 1: Rural Energy Policy, Nepal

The Rural Energy Policy was formulated by the National Planning Commission and the Alternative Energy Promotion Centre (AEPCC, the lead national agency for RE). The policy paper was prepared and discussed extensively through regional consultations in the five development regions of Nepal, with more than 450 experts, GoN officials, academics and local people participating in the process.

Development of the policy took almost four years. Its key features include the following:

- pro-poor focus;
- decentralized planning, institutions and operations;
- focus on development and poverty reduction;
- smart subsidy for targeting poor and vulnerable communities;
- mechanisms for the mobilization of internal resources;
- capacity development at all levels;
- research and development of multiple uses of energy resources and electricity;
- mainstreaming gender concerns and vulnerable groups;
- continuing assessment for improvement based on emerging needs of the sector; and
- creation of a Renewable Energy Fund (REF).<sup>4</sup>

However, the implementation of the policy will require an enabling legislation and implementation guidelines. Moreover, at the intra-ministerial level, different agencies (e.g. Ministry of Forestry, Ministry of Environment) are playing overlapping roles which need to be streamlined.

**Local government roles.** In line with the Local Self Governance Act (1999), the District Development Committees (DDCs) and the Village Development Committees (VDCs) play important roles in implementing rural energy systems.

**Donor-funded RE programmes.** Various bilateral and multilateral development partners are promoting RETs in Nepal.<sup>5</sup> Major donor-funded RE initiatives include the Energy Sector Assistance Project (Governments of Denmark and Norway, and KfW), the Biogas Support Programme (SNV and KfW), the Renewable Energy Project (EU) and the Improved Water Mills Programme (SNV).<sup>6</sup>

### 1.3 Barriers to expanding energy access

More than 80 percent of Nepal's population lives in rural areas, where poverty, remoteness and difficult topography present challenges in providing modern energy services.<sup>7</sup> In rural Nepal, 98 percent of consumed energy comes from the traditional use of biomass, and in 2006, only 16 percent of the population had access to modern fuels for cooking

and heating.<sup>8</sup> In 2008, around 40 percent of the country's population had access to electricity, with rural electrification at 29 percent.<sup>9</sup>

**Challenges to providing energy access.** Of Nepal's total land area, 82 percent is mountainous, 14 percent of which is characterized as remote.<sup>10</sup> The expansion of energy services to these areas faces the following hurdles:

- 1) **Widespread poverty leading to low demand.** About one third of the population lives below the USD 1 per day threshold, and poverty is most prevalent in remote mountainous areas. As a result, demand for electricity in these areas tends to be small, resulting in high average cost per unit consumed.
- 2) **Inaccessibility.** Remoteness and inaccessibility lead to higher transportation costs for development interventions and restrict the scope for productive uses of energy.
- 3) **Limited capacity for micro-hydro installation in rural areas.** Nepal has more than 30 years of experience in micro-hydro systems and has more than 30 micro-hydro component manufacturers. However, these are concentrated in and around the capital city of Kathmandu. Personnel trained to survey, design, install, operate and manage RE systems are virtually non-existent in rural areas.

<sup>4</sup> REF is a GoN-managed multi-donor fund that supports RE activities.

<sup>5</sup> These include Canada, the Kingdom of Denmark, the Federal Republic of Germany, the Kingdom of the Netherlands, the Kingdom of Norway, the European Union (EU), the Asian Development Bank (ADB), the United Nations Development Programme (UNDP) and the World Bank.

<sup>6</sup> KfW is Kreditanstalt Für Wiederaufbau (German Development Bank). SNV is the Netherlands Development Organisation.

<sup>7</sup> UNFPA Nepal, 2008. Modern energy services are defined as including: (a) electricity; (b) modern fuels to meet cooking needs (electricity, liquid fuels including LPG, natural gas, kerosene, ethanol and biofuels, but excluding traditional biomass such as firewood, charcoal, dung, crop residues and coal); and (c) mechanical power for productive, non-industrial applications such as water pumping and small-scale agro-processing.

<sup>8</sup> UNDP, 2009b. 'Traditional use of biomass' refers to the use of basic technology such as a three-stone fire or other inefficient cookstove, and not to the resource itself.

<sup>9</sup> MoF, 2009; UNDP, 2009b.

<sup>10</sup> Dutta et al., 2007.

**Adverse impacts of a lack of electricity.** Among other impacts, a lack of electricity presents the following obstacles to meeting the Millennium Development Goals (MDGs) in Nepal:

- a lack of access to drinking water;
- a lack of lighting necessary for education;
- a lack of access to information via media (television, radio, internet);
- a lack of refrigeration for health clinics; and
- a lack of productive activities such as water pumping for irrigation and agro-processing.<sup>11</sup>

**Adverse impacts of the traditional use of biomass.** Traditional use of biomass for cooking and heating has the following adverse impacts:

- surveys show that women devote an average of three to four hours each day on fuel collection. Together with other household duties, this leaves little time for community participation, income generation and leisure pursuits;
- women are also disproportionately exposed to serious health risks associated with biomass use, including respiratory and eye ailments from indoor air pollution and physical impacts of carrying heavy loads; and
- deforestation remains a serious problem in mountain and hill areas. Only 29 percent of the country remains forested, compared to 37 percent in 1990.

## 2. Programme overview

Operating between August 1996 and April 2011, the Rural Energy Development Programme (REDP) was a joint GoN – UNDP – World Bank initiative.<sup>12</sup> REDP consisted of three phases, with Phase III (the focus of this report) running from 2007 to 2011.<sup>13</sup>

**Programme goals.** The principal objective of Phase III was the improvement of capacity of local communities for sustainable, community-managed and equitable rural energy service delivery for poverty alleviation, livelihood improvement and environmental protection.

**Programme outputs.** Among other outputs, Phase III sought to:

- develop local capacities in 40 districts to increase energy access through a community-managed model; and
- link improved energy access to poverty reduction through productive uses of energy, particularly among women and vulnerable communities.

**Achievements to date.** Between 1996 and 2011, REDP delivered 5.5 MW of community-managed micro- and mini-hydro power plants, 6,811 toilet-connected biogas plants, 14,255 improved cookstoves (ICs) and 3,099 solar home systems (SHSs). It also provided support to the AEPC in implementing the Rural Energy Policy in all 75 districts, and worked towards registration of micro-hydro plants (MHPs) as Clean Development Mechanism (CDM) projects.



*Electricity line distribution in 100 kw Bom Khola MHP in the town of Lukla, 'the gateway to Mount Everest'.*

UNDP/Energy Access for Poverty Reduction

<sup>11</sup> 84 percent of Nepal's population is employed in the agriculture sector (UNDP Nepal, 2007).

<sup>12</sup> Upon the completion of REDP, a new Renewable Energy for Rural Livelihood programme ([www.rerl.org.np](http://www.rerl.org.np)) was launched on 1 April 2011 by the GoN, the UNDP and the World Bank.

<sup>13</sup> In Phase I (1996-2003), REDP was piloted in five districts, with funding from UNDP and the GoN. In Phase II (2004-2007), REDP was extended to another 25 districts, and World Bank joined as a donor.

## 2.1 Institutional arrangements

**Decentralized programme management and collaboration with partners.** REDP was a collaborative programme, with multiple partners working at various levels and a strong focus on decentralized programme management. REDP operated at three levels:

- the central level provided policy support. AEPC, under the Ministry of Environment, served as REDP's government executing agency;
- at the district level, DDCs focused on building and strengthening institutions, policy and operational frameworks to plan and monitor REDP activities; and
- at the community level, VDCs were responsible for planning, implementation, operation and maintenance of the community energy systems.

**Central level.** REDP was managed by a Project Management Office. A Project Advisory Committee, with representatives from relevant ministries, departments, the World Bank and UNDP, provided overall policy guidance. A Project Executive Board made management decisions. REDP's management role was limited to facilitation, technical assistance, monitoring and evaluation.

**District level.** A District Energy and Environment Section (DEES) of the DDC operated in each of the 45 districts. DEESs were responsible for coordination, planning, local resource mobilization and day-to-day district operations. This included promoting collaboration among various partners and mobilizing support organizations (SOs), financial institutions, and the private sector. DEESs were supported by District Energy and Environment Management Committees.

**Community level.** Community mobilization functions – including the dissemination of REDP information, helping communities develop action plans, accessing resources from various sources and monitoring local-level work – were performed by SOs. SOs were local non-governmental organizations (NGOs) selected based on relevant project experience and experience with participatory development approaches.

Private sector firms such as the Rural Energy Services Centre (RESC) provided technical support services to communities for feasibility studies and installation, operation and maintenance of RE systems.

Community organizations (COs) were mobilized by SOs and provided an institutional platform from which communities could conduct a variety of activities. Functional groups worked on interventions such as income generation, forestry, biogas and poultry farming. The Micro-Hydro Functional Group (MHFG) was responsible for activities related to MHPs, starting with identification of a feasible site for the installation. Once a community-managed MHP had been running successfully for six months, COs were encouraged to register the MHFG with the local government as a micro-hydro cooperative.

## 2.2 Programme funding and costs

REDP activities were funded by numerous partners, including the GoN, UNDP, World Bank, DDCs, VDCs, the Agricultural Development Bank of Nepal, communities and the private sector. Total programme cost for the Phase III was USD 35 million, which consisted of the following contributions:

- UNDP – USD 3.4 million;
- World Bank – USD 16 million;
- GoN – USD 5 million; and
- community – USD 10.6 million.<sup>14</sup>

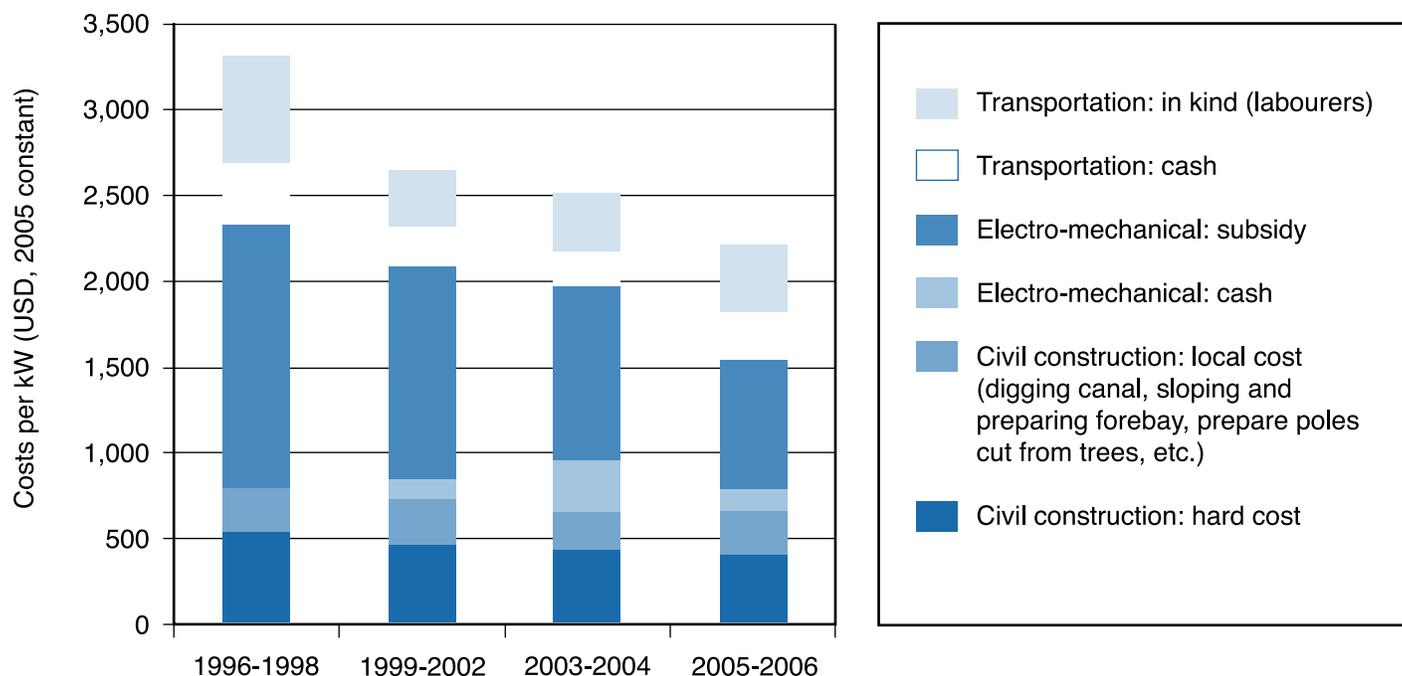
To ensure local ownership, each MHFG established a Community Energy Fund (CEF) to manage funds received for the construction of MHPs. Subsequently, all REDP donor grants and GoN subsidies were transferred to the CEF, which was managed by the community.<sup>15</sup> Other sources of funds for CEF included loans, equity, donations and electricity tariffs collected from household and enterprise consumers.

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<sup>14</sup> Total donor funding for REDP (Phases I, II and III) was around USD 30 million (USD 21.3 from World Bank and USD 8.7 million from UNDP).

<sup>15</sup> REDP funds were channelled to CEF through a District Energy Fund, a component of a DDC-managed District Development Fund.

**Figure 1: Hard-cost components of REDP-installed MHPs (USD, 1996-2006)<sup>16</sup>**



Source: UNDP, 2010.

Individual MHP installations were usually funded in the following manner:

- GoN subsidy and donor grants – 50 percent;
- DDC and VDC equity investment – 10 percent;
- in kind community contributions (labour and locally available construction materials) – 20 percent; and
- financial community contributions (cash and/or a bank loan) – 20 percent.

## 3. Implementation strategy

### 3.1 Programme activities

**Overview.** REDP activities included the following:

- policy feedback for enabling policy and regulations;
- institutional development at community, district and central levels;
- capacity development of stakeholders, including GoN agencies, locally-elected bodies, NGOs, the private sector, academic institutions and the community;
- community mobilization;
- installation, operation and management of MHPs and other RETs;
- livelihoods promotion and environmental management; and
- research, innovations, documentation and dissemination.

<sup>16</sup> 'Hard cost' refers to cost of equipment, transportation, construction and installation.

**Installation of MHPs.** REDP promoted installation of MHPs (generally 10-100 kW), which had the following uses:

- lighting homes;
- powering enterprises such as agro-processing mills, carpentry, battery chargers, cable television network, communication centres and computer institutes;
- powering household radios, televisions and computers;
- powering irrigation pumps, and refrigerators for storing medicines and vaccines; and
- providing energy for income-generating activities such as handicrafts, tailoring, sewing, knitting, blacksmithing and poultry farming.

**Other promoted technologies** included toilet-attached biogas plants (4-6 m<sup>3</sup>) for cooking and lighting, SHSs (10-30 Wp) for lighting and battery charging, and ICSs for more efficient, less-polluting cooking.

**Other developmental and environmental activities.** Communities were also encouraged to engage in the following activities:

- tree planting;
- renovation of drinking-water supply taps and wells;
- construction of rural trails and roads; renovation of irrigation canals and ponds; and
- construction of toilets.

**In summary,** REDP supported rural community efforts to enhance livelihoods through income generation; social-capital building; improved health; labour-saving devices and practices; awareness creation; natural resource optimization (water, land, forest, animal waste and solar energy); savings and credit operation; and skills enhancement.

**Six basic principles.** All REDP community mobilization activities pivoted around six *mul-mantras*, or basic principles:

- organization development;
- skill enhancement;
- capital formation;
- technology promotion;
- environment management; and
- empowerment of vulnerable groups.

### 3.2 Capacity development

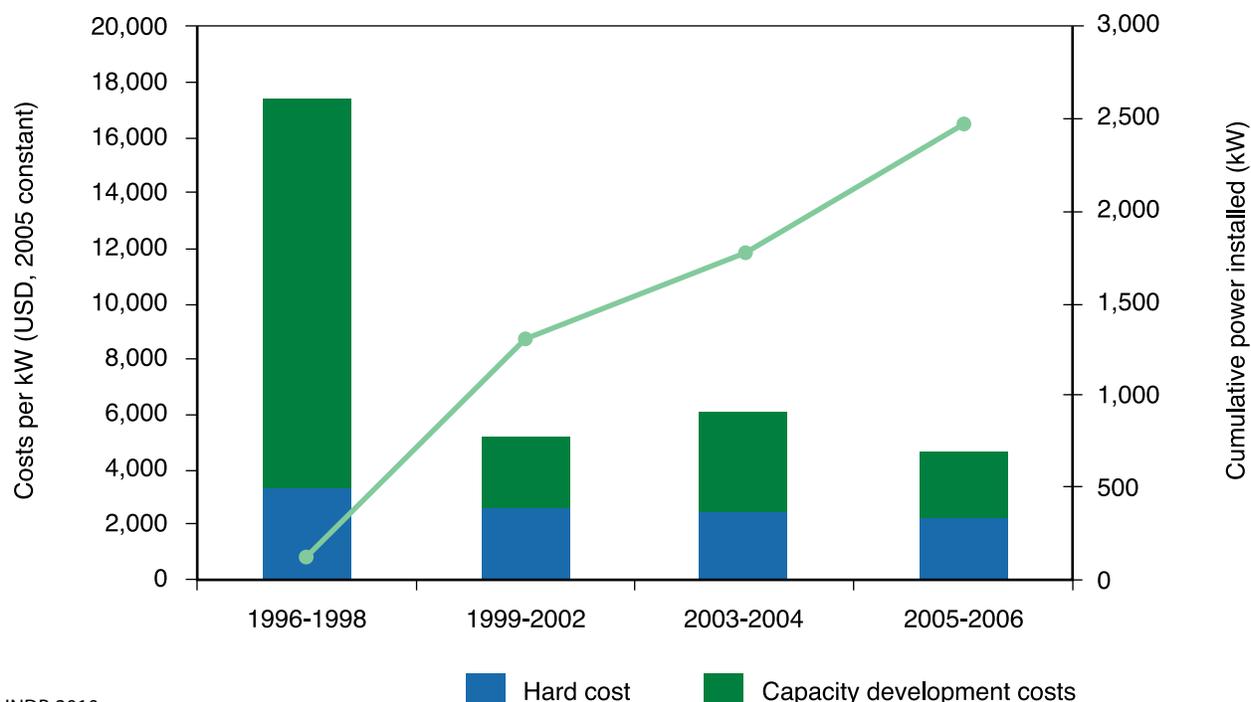
From its inception, REDP prioritized capacity development at community, district and central levels. The programme's capacity development activities included the following:

- training of community representatives in the operation and management of MHPs and other RETs, establishment of RESC, income-generating activities, book-keeping and decentralized planning;
- priority capacity development for women, *Dalits*, minority ethnic groups and the very poor;
- training of private manufacturing and installation companies; and
- workshops, consultative meetings and study tours for staff and other stakeholders such as government officials, school teachers, and journalists.



*Mass Meeting in the rural community.*

**Figure 2: Decreasing cost of capacity development for MHP implementation**



Source: UNDP, 2010.

**Declining capacity development costs.** A recent UNDP study showed that REDP capacity development accounted for 56 percent of total programme cost.<sup>17</sup> Between 1996 and 2006 this cost (per kW) fell by 84 percent, from about USD 14,000 to only USD 2,200 per kW (see Figure 2).

REDP capacity-building prepared communities to mobilize resources more effectively. This was one of the programme’s most successful features. Communities were encouraged to seek funds and in kind contributions from various sources, including local government agencies, other donor-funded projects, international and local NGOs, and voluntary contributions from relatives working abroad.

### 3.3 Enterprise development

REDP promoted enterprise development, particularly energy-based enterprises.<sup>18</sup> To this end, REDP encouraged each MHFG to create an Enterprise Development Fund (EDF), by making an initial contribution of NPR 10,000 (USD 125.9) per kW, with a maximum contribution of NPR 250,000.<sup>19</sup> EDF was then used to provide loans for enterprise development to needy villagers on lenient terms.

**CO savings and credit operations.** COs generated weekly savings (at times amounting to thousands of rupees). These funds were used to provide loans to members for income-generating activities, with poor households receiving priority credit.

### 3.4 Local participation and social inclusion

**Empowering vulnerable communities.** One of REDP’s six basic principles was the empowerment of vulnerable groups. This principle was pursued via the following measures:

<sup>17</sup> UNDP, 2009a.

<sup>18</sup> REDP’s motto ‘One household, one enterprise’ promoted the goal of having every single household covered by the programme earn an additional monthly income of at least NPR 25, allowing it to pay its monthly electricity tariff for the minimum connection of 25 watt (sufficient for a 25 watt incandescent bulb or three 8 watt CFLs). For example, raising chickens and selling at least one of per month delivered more than NPR 200 to a household.

<sup>19</sup> NPR 1 = USD 0.01259, as of 23 September 2011 (www.xe.com).

- REDP activities had to include the participation of every household in the community;
- REDP community mobilization required that one man and one woman from each household joined a CO;
- separate male and female COs were organized and met weekly to receive targeted capacity development inputs;
- human-resource development initiatives targetted women as a priority; and
- vulnerable group representatives were included in MHFGs at the community level and in DEESs at the district level. At the central level, they had access to a mechanism to register and deal with community-level grievances.

**Ensuring equitable community ownership.** Transparent and consensus-based decision-making processes helped in ensuring equitable opportunities for all households in a community. All households contributed equally and thus owned the RE system and shared the benefits (electricity, tariff revenue, etc.) equally.

Mechanisms instituted by communities to help poor households to access electricity included the following:

- where poor households were unable to contribute cash or raise collateral for a bank loan, they could contribute in kind and labour; and
- where they could not pay the electricity tariff in cash, in some months, they were allowed to work at canal cleaning and/or repairing and earning a wage that went towards their monthly payment.

### 3.5 Standardization and quality management

**Guidelines and manuals.** REDP developed guidelines and manuals for various areas of programme implementation, including community mobilization and MHP installation and operation. These materials helped to ensure uniform programme execution, management, monitoring and evaluation at all levels, promoting MHP quality assurance.

**Other measures** to ensure quality included:

- each DEES included two engineers responsible for the technical soundness of MHPs. They conducted technical feasibility surveys, prepared project design reports, provided technical backstopping to the community in the seeking and evaluation of bids, supervised installation of MHPs, inspected electro-mechanical equipment, transmission and distribution lines, and verified power output;
- AEPC pre-qualified 20 manufacturers and suppliers of RE technologies. To be eligible for REDP funding, communities had to contract one of these companies;
- AEPC appointed pre-qualified consultants and firms for other technical work, including technical feasibility surveys and power output verification. Output verification was necessary to determine exact plant capacity before calculating subsidies and before releasing the final 10 percent of the contracted sum to manufacturers/suppliers;
- MHFG organized a monthly mass meeting of all CO members. The MHFG chairperson and manager presented the community with updates on what was accomplished (funds mobilized, materials procured, etc.), which were discussed before decisions were taken with the consensus of the community;
- after an MHP was commissioned, the MHFG conducted a public audit attended by all CO members, representatives of DDC, DEES, manufacturers and suppliers to discuss technical matters and financial expenses incurred; and
- in later stages of the programme, a grievance mechanism was introduced, appointing a focal person in each MHFG, SO, DEES and REDP.

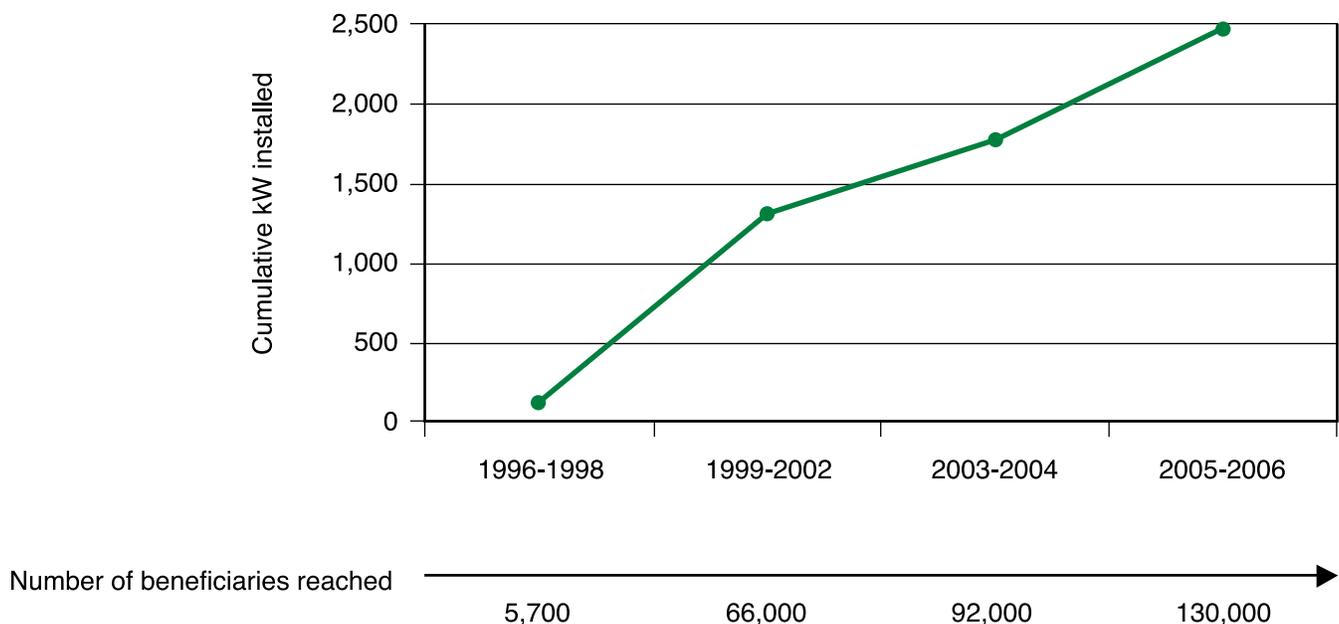
The above measures ensured that almost all installed MHPs functioned satisfactorily. In cases where an MHP was damaged or even destroyed, host communities repaired or rebuilt it in due course.

## 4. Impacts

### 4.1 Tangible achievements

REDP activities reached more than 550,000 people from 100,000 households. Among these, 275,000 people (42,828 households, 64 percent of them from vulnerable communities) obtained access to electricity. The following figure presents the cumulative installed MHP capacity and the number of MHP beneficiaries reached under REDP during 1996-2006.

**Figure 3: Cumulative installed MHP capacity and beneficiaries reached (1996-2006)**



Source: UNDP, 2010.

The following outcomes were achieved by the programme (with quantitative outputs in terms of RE systems, environmental initiatives and human resource development provided in the Annex).

#### Increasing stakeholder capacity by:

- strengthening local NGOs as SOs;
- promoting local electro-mechanical workshops as RESCs;
- strengthening the capacity of local government bodies (DDCs and VDCs) to undertake decentralized rural energy planning, programming and monitoring;
- developing local community capacity to plan, implement and manage rural energy systems, and, more importantly, to envision a process of sustainable development for themselves; and
- upgrading private-sector capacity to deliver RETs.

Various kinds of REDP training were given to 34,050 people, including 15,000 women. This included 2,596 people trained in MHP operation, maintenance and management.

Another benefit of working closely with local communities became evident during the conflict years when the staff of donor-funded projects, government offices, NGOs and banks had to be relocated from villages to nearby cities and towns for security reasons. REDP SOs, however, were locally hired and continued to work at project sites, albeit at a reduced pace.

### Enhancing rural livelihoods by:

- increasing income from off- and on-farm activities;
- promoting end-uses of energy from MHPs and other RE systems; and
- increasing capital from CO savings and credit operations.

According to REDP data, 264 micro-enterprises were established in programme areas (see Table 1). However, these figures do not take into account enterprises developed after REDP has withdrawn its support from the area. It can be safely predicted that the total number of established micro-enterprises has exceeded 500.

A recent REDP survey showed that in REDP-supported communities 100 percent of the *Dalit*, *Janajati* and ethnic and religious minorities were connected to energy services.<sup>20</sup> In addition, 25 percent of energy-based enterprises were owned by *Dalit*, *Janajati* and ethnic minorities, and 41 percent were owned by women entrepreneurs. Women comprised at least 50 percent membership of most MHFGs.

### Improving quality of life through access to electricity by:

- establishing infrastructure such as electricity, schooling, potable drinking water and micro-enterprises;
- improving health due to reduced drudgery, labour and smoke inhalation, and improved sanitation;
- improving education of children through availability of better lighting (extension of study hours);
- increasing awareness and connectivity among rural communities through telecommunications, computers and televisions; and
- improving the environment in and around homes and communities by reducing pollution and deforestation.

**Table 1: Energy-based enterprises established under REDP**

Type of enterprise	Number
Agro-processing mill	129
Poultry farming	27
Rural carpentry	25
Cable television network	17
Communication centre	12
Computer institute	11
Battery charging	7
Video hall/recreation centre	6
Freezer	3
Cotton beater	3
Noodle making	3
Grill/mechanical workshop	3
Coffee pulping	2
Bakery	2
Grocery	2
Lift irrigation	2
Electric service centre	2
Goat rearing	2
Others	6
<b>Total</b>	<b>264</b>

<sup>20</sup> Typically, these communities comprised 40 percent higher castes, 15 percent *Dalits*, 37 percent ethnic minorities and 8 percent 'others'.

## 4.2 Impacts on MDGs

In 2005, Winrock International applied a before-and-after analysis to assess and quantify REDP's contribution towards achieving the MDGs. Changes in MDGs were assessed by analyzing two sets of data (1996 and 2005) from 1,503 households from 20 communities.<sup>21</sup> The impacts described below therefore relate to the period 1996-2005, unless specified.

### Income and livelihood impacts (MDG 1)

An average household income in REDP communities increased by 52 percent (NPR 48,000 to NPR 73,000), compared to a national average of 46 percent. Share of households with an annual income of less than NPR 50,000 decreased from 59 percent to 54 percent, and those with an annual income of less than NPR 10,000 from 15 percent to 12 percent. Share of households with an annual income of more than NPR 100,000 grew from 9 percent to 24 percent.

REDP households also experienced kerosene savings of 54 percent, and a 23 percent reduction in diesel consumption. Expenditure on batteries was reduced by 15-30 percent.<sup>22</sup> On average, three people gained direct employment from each 25 kW MHP.<sup>23</sup>

### Education impacts (MDG 2)

The percentage of illiterate people in programme areas decreased from 37 to 25 percent. For the same period, the percentage of children aged between 6-14 years without primary education dropped from 25 percent to 7 percent.

The educational participation of girls also improved, with the ratio of girls to boys enrolled in school increasing from 0.80 to 0.87.

### Gender equality and empowerment of women (MDG 3)

Daily time spent on fuelwood collection and agro-processing was reduced (for both men and women) by an average of three hours. Participation of men in household chores such as cleaning, agro-processing and cooking increased, reflecting changing gender relations within households.

The participation of men and women in community-level activities almost doubled. In women's COs and in some MHFGs, women were serving as chairpersons and managers.

Women's involvement in small-scale and cottage enterprises also increased. The number of such enterprises grew from 400 to 700.

### Health impacts (MDGs 4, 5 and 6)

The average mortality rate of children under five decreased from 9.4 percent to 5.3 percent. Similarly, maternal mortality rate decreased from 5.3 to 4.3. These improvements could be attributed, in part, to reduced indoor smoke resulting from the use of biogas plants and ICSSs, and MHP-generated electricity displacing kerosene for lighting.

The share of households with toilets increased from 42 to 70 percent. The share of households with access to tap water increased from 58 to 82 percent, compared to the national average increase from 32 to 42 percent. The average walking distance to fetch drinking water was reduced from about 400 to 175 metres.

### Environmental impacts (MDG 7)

The average monthly demand for kerosene among the 1,503 surveyed households decreased from 3 to 1.4 litres per household, thereby saving 29,000 litres of kerosene per year. Monthly household demand for batteries also decreased. Fuelwood consumption was significantly reduced, with monthly demand falling from about 10 to less than seven *bharis* per month.<sup>24</sup>

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<sup>21</sup> Winrock International, 2008.

<sup>22</sup> Winrock International, 2008.

<sup>23</sup> Pokharel, 2006.

<sup>24</sup> 1 *bhari* is approximately 35 kg.

It should also be noted that adverse environmental impacts of MHPs are negligible compared to those of large hydro power plants.

### Building partnerships and linkages (MDG 8)

REDP was a workable public-private partnership model for development of RE systems. Community-managed MHPs were funded and owned by the private and public sectors (individual MHFG members, donors, DDCs and VDCs). The private sector (RESC) and NGOs were the service providers. This partnership model was institutionalized in the 2006 Rural Energy Policy and the district-level rural energy policies of all 40 District Development Councils.

REDP was also entrusted with implementing the Khimti Neighborhood Development (KiND), the first public-private partnership project under the GoN, UNDP and Himal Power Limited.

REDP provided technical assistance to various UNDP country offices and other international agencies. The REDP approach has been replicated or studied by UNDP offices in the Islamic Republic of Afghanistan, the Kingdom of Cambodia, the Republic of Tajikistan and the Democratic Republic of Timor Leste, thereby promoting South-South cooperation.

REDP also collaborated with the World Food Programme in delivering 237 public-use ICSs to primary schools in seven far- and mid-western development regions.

### 4.3 Expansion of the RE private sector

The private sector's involvement in Nepal's RE sector consists of conducting surveys and manufacturing, installing, repairing and maintaining RE systems. REDP accelerated the installation of MHPs, SHSs, biogas plants and ICSs, thereby increasing business opportunities. In addition, private sector electro-mechanical workshops were promoted as RESCs in each programme district. The number of pre-qualified consultants and firms has grown from fewer than 15 in 1996 to over 100 today.

### 4.4 Internalization and institutionalization of REDP modalities

AEPC has internalized REDP good practices and modalities in the dissemination of RE in Nepal. This includes the creation of DEESs and District Energy and Environment Units in 72 DDCs.

AEPC has adopted the following REDP modalities for application in all donor-funded RE projects, irrespective of their own implementation procedures:

**Technical Review Committee (TRC).** REDP required that all detailed project reports for RE systems, particularly MHPs, were approved by the TRC before subsidies and grants were released to the MHFG. TRC is an independent committee comprising representatives of AEPC, REDP and the Nepal Micro-Hydro Development Association. In 2003, AEPC made TRC approval mandatory for all MHPs seeking REF subsidies.

**Enterprise Development Fund (EDF).** From 2009-2010, the AEPC subsidy policy adopted the EDF modality introduced under REDP. Accordingly, aside from the subsidy based on power output, each MHP was provided with an additional NPR 10,000 per kW (up to a maximum of NPR 250,000) for EDFs providing loans to local entrepreneurs.

**Social mobilization package.** Recognizing the importance of social mobilization in promoting RETs, programmes such as the Energy Sector Assistance Project have incorporated a social mobilization component.



*Penstock pipe.*

UNDP/Energy Access for Poverty Reduction

## 5. Programme sustainability measures

### 5.1 Productive uses of energy

Among other factors, MHP sustainability depended on the availability of funds to meet recurring expenses for operations, repair and maintenance, community activities and cash dividends to investors (individual households, DDCs and VDCs). For this purpose, MHFGs established and operated CEFs.

**Promoting income-generating activities to increase CEF revenues.** CEF revenue mainly comprised tariffs from households and commercial users of electricity. Revenue from households was difficult to increase given the limits on how much electricity could be generated and low household income levels. Revenue from commercial users could be increased by selling excess power during the daytime; however, this was constrained by a lack of infrastructure within communities to undertake income-generating activities. REDP adopted two approaches in dealing with these issues:

- **‘One household, one enterprise’.** CO savings and credit operations and the EDF provided combined support for enterprise development. Once poor households started generating additional incomes, they were also more capable of paying the electricity tariff, improving programme sustainability.
- **Information and training.** REDP proactively provided information, enterprise development training and exposure visits for potential entrepreneurs to promote establishment of electricity-based micro-enterprises. In some instances, producers were provided assistance in linking with city markets. One such endeavour successfully linked rural craft producers in the village of Piththali, Kavrepalanchowk, with the Kathmandu-based Mahaguthi for the sale of traditional Nepalese crafts such as *thankas* (religious paintings), *lamapats* (wood carvings) and hand-loomed bags.

Given increased public awareness and expansion of rural infrastructure, enterprise development became easier in later REDP years. As a result, communities in REDP sites took up income-generating activities and enterprises more rapidly. A positive trend was visible in terms of regular payment of electricity tariffs, increased intake of nutritious foods and vegetables, improved hygiene and school attendance among children, improved housing, and a greater number of retail shops.

**Further promotion of productive energy use.** Given its limited resources, REDP collaborated with the Poverty Alleviation Fund and the UNDP-funded Micro Enterprise Development Programme, which will continue to support communities as post-REDP initiatives.

#### Box 2: REDP Plus model: developing a consolidated livelihoods package

REDP initiated innovative livelihood initiatives in the following three MHP sites.

**Package A at Mangpang Khola MHP, Budathum VDC, Dhading.** This package focused mainly on promoting energy-based enterprises by encouraging women, *Dalits*, and ethnic and poorer households to access the EDF.

**Package B at Girindi Khola MHP, Dagatundada VDC, Baglung.** Here, MHFG was mature enough for legalization, and the focus was on providing energy inputs to existing local resource-based enterprises such as a stone-crushing factory and a beaten rice processing unit.

**Package C at Chauri Khola Micro-Hydro Cooperative, Pokharichari VDC, Kavre.** MHFG was registered as a cooperative, with the focus on assisting it with diversifying activities and services.

These livelihood packages aimed to reap benefits from both electricity and economic growth. This key REDP Plus component ensured optimum end-use promotion, diversified business development and long-term organizational sustainability.

## 5.2 Strengthening institutions as an exit strategy

During Phase III, REDP exit strategy focused on ensuring sustainability of REDP activities at all levels (community, district and central). To this end, efforts to institutionalize REDP activities achieved the following:

**Community level.** REDP withdrew its support from a community after ensuring that MHPs were operating successfully (normally a year after commissioning). Social capital built under REDP helped to sustain COs and functional groups (particularly MHFGs and registered micro-hydro cooperatives) with an operational CEF staffed by a trained operator and a manager.

**District level.** REDP facilitated the establishment and strengthening of DEESs within DDCs in 45 districts. During the later stages of the programme, more and more DDCs began assigning DEESs additional functions, including the appraisal and supervision of rural electrification. In addition, DDCs in Dhading, Tanahun and Dadeldhura districts allocated their own resources to promote RETs in non-REDP communities.

**Central level.** The Rural Energy Policy was formulated in the light of REDP good practices and lessons learned. REDP supported AEPC in the implementation of the Rural Energy Policy in all districts. The GoN, through the Ministry of Environment, endorsed the DEESs as district-level entities for implementing its energy and environmental activities.

The following table presents the shifts in responsibility at various institutions with REDP implementation.

**Table 2: Strategic shift of responsibilities due to REDP**

	Responsibilities prior to REDP	Comments
<b>Central government</b>	Policy formulation and implementation.	Policy formulation.
<b>Local government (district level)</b>	No role for local government authorities in energy planning and promotion.	Planning and provision of energy services at district and village levels.
<b>Communities</b>	No community involvement.	Operation and management of energy systems through COs.
<b>NGOs</b>	Not active in energy services development.	Community mobilization in energy service provision in rural areas.
<b>Private sector</b>	Few companies involved in manufacturing and installations of RETs in Kathmandu and other major cities.	Technical services provided through private-sector organizations in rural areas for survey, installation, operation, repair and maintenance of RETs.

Source: UNDP, 2009a.

## 5.3 Functional collaboration with partners

To ensure the sustainability of its activities, REDP forged collaborations with other programmes, including the Poverty Alleviation Fund, Energy Sector Assistance Programme, Biogas Support Programme, Support for Poor Producers in Nepal and the Improved Water Mills Programme.

As an example, key areas of a memorandum of understanding between REDP and the Poverty Alleviation Fund were:

- strengthening linkages for livelihood promotion among the poor;
- strengthening COs;
- preparing community action plans;
- cost-sharing in micro-hydro projects in the form of community equity funds for the poor;

- enhancing end-use applications of energy; and
- strengthening capacity of DDCs in monitoring and promotion of RETs.

## 5.4 Accessing CDM funds

AEPC, with REDP assistance, developed the first micro-hydro-based CDM project in Nepal. AEPC, as the 'project entity', signed the Emission Reduction Purchase Agreement (ERPA) for a CDM project on 30 June 2007 with the Community Development Carbon Fund/World Bank as trustee. The unit price for each certified emission reduction (CER) was agreed at USD 10.25 per tonne of CO<sub>2</sub> for a total target of emission reductions of 191,000 tonnes of CO<sub>2</sub> equivalent, with the possibility (following a review) of an additional 100,000 CERs in 2012. The project will increase electricity access for rural communities by adding 15,000 kW of power generation capacity from MHPs by 2012. Of this, REDP-established MHPs will contribute 6,500 kW. After several rounds of review, the project was registered as a CDM project on 18th October 2010.

# 6. Lessons and good practices in expanding energy services for the poor

The REDP experience encompasses all three dimensions of expansion: scaling up (Phase I), replicating (Phase II) and mainstreaming (Phase III). Both external and internal factors contributed to the success of the programme, as discussed below.

## 6.1 Explicit policy commitment to renewable energy

The GoN accorded a high priority to RET promotion, which is reflected in its Five-Year Plans and annual programmes.

Formulation of the original REDP document benefited greatly from extensive GoN and UNDP experience with RET promotion, decentralized governance and the energy-environment-poverty nexus.

The Rural Energy Policy drew on REDP's demonstrable success, which made winning consensus on the policy document from policy-makers relatively easy. Final approval and adoption of the document can be attributed to strong support from AEPC, UNDP and the REDP team.

## 6.2 Synchronization with existing governance strategies

In the 1990s, when REDP was designed and launched, the GoN was already pursuing a development strategy that emphasized decentralization and community mobilization:

- the Eighth Five-Year Plan (1992-1997) presented an opening for NGO involvement in the delivery of services to local communities;
- the Electricity Act (1992) created, through the deregulation of up to 1,000 kW capacity, an environment conducive to community and private sector participation in hydro power development; and



*Copier machine powered by electricity from a micro-hydro plant.*

- the Tenth Five-Year Plan (2002-2007) extended greater autonomy to local bodies in line with the Local Self-Governance Act (1999). It also enhanced the institutional capacity of local bodies to enable them to deliver services, enhanced people's participation in the local development process and allowed local bodies to mobilize internal and external resources.

REDP's emphasis on decentralized governance thus took advantage of this enabling environment by collaborating with institutions at all levels (central, district and community).

### 6.3 Community-led development

REDP's community mobilizations strategy sought to motivate communities and develop their capacity to plan, implement and operate MHPs.

**Promoting devolution of control.** In REDP, a handing-over process to the community did not exist, as all applicable programme grants and subsidies were placed into the CEF account, which was managed by the community.

**Limiting REDP roles.** REDP's role was limited to facilitation, technical assistance, monitoring and evaluation. This role was strategically instituted from the onset.

### 6.4 Developing national capacities

**Building leadership in the energy sector.** REDP was systematically building leadership in the energy sector, focusing on the capacities to:

- develop policies and programmes at the central level;
- implement and monitor energy programmes at the local government level; and
- plan, execute and manage their own development among rural communities.

In line with REDP's exit strategy, activities took place to transfer skills and knowledge to AEPC and local elected bodies through training and development of operational regulations, guidelines and manuals on various aspects of MHPs. REDP also supported the private sector and local NGOs by providing technical, social and managerial support services.

### 6.5 Information dissemination

REDP proactively disseminated programme information among community-based organizations, elected bodies, civil society organizations, the private sector, donors and the GoN. REDP advocates included DDC chairpersons from districts with REDP projects. National and international partners helped to document the programme with the publication and dissemination of assessment reports, newsletters, student theses and case studies.

The Association of District Development Committees of Nepal (ADDCN) and the National Association of VDCs in Nepal played an important role in policy advocacy, lobbying and the capacity development of their members, i.e. DDCs and VDCs. With REDP support and in collaboration with concerned ministries, associations and projects, ADDCN organized a National Conference on Rural Energy that concluded with the 13-point Kathmandu Declaration. Furthermore, ADDCN and the Federation of Nepalese Chambers of Commerce and Industry (the umbrella organization for Nepalese business houses) signed a memorandum of understanding to work jointly on the promotion of rural energy systems.

## 7. Conclusions

By promoting RE systems, REDP provided energy access (including electricity) to remote rural communities. By focusing on productive uses of electricity (income generation and enterprise development), REDP helped communities living in poverty to remedy two pervasive problems: their low productivity and their limited range of income-generating options. Most traditional village-level micro-hydro promotion programmes had not utilized energy as a source of income, focusing solely on providing household lighting. REDP, on the other hand, helped communities generate additional income and eliminate poverty. At the same time, by addressing issues of community mobilization, women's empowerment and inclusion of disadvantaged groups, REDP helped to catalyze a process of social transformation and reached segments of the population that most development efforts have bypassed.

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## Annex: REDP achievements at a glance (December 2010)

Rural energy systems installed				
Micro-hydro plants		307 (5,546kW, 55,195 households)		
Toilet-attached biogas plants		6,811		
Solar home systems		3,099		
Improved cookstoves		14,255		
Environmental initiatives				
Nurseries		195		
Community managed forests (no.)		415		
Plantations (hectares)		3,564,371		
Toilets		29,293		
Environment classes and campaigns		2,593		
Trail and road construction (km)		637		
Tap and pond construction (no.)		440		
Human resource development				
Training in technical subjects (no. of people)		3,278		
Training in income generation and micro-enterprises (no. of people)		9,319		
Environment management (no. of people)		2,819		
Institution development (no. of people)		19,265		
Orientation/visit/consultations, etc. (no. of people)		3,025		
Community organization				
Community organization (nos.)		Female	Male	Total
		6,146	6,921	13,067
Community members (no.)	Ethnic	Dalit	Other	Total
	110,266	62,373	95,190	267,829
	25,965,163	13,089,222	19,814,933	58,869,318
	49,363,033	25,277,081	35,426,382	110,066,496



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