



*Empowered lives.
Resilient nations.*

MAKING ENERGY MARKETS WORK FOR THE POOR: LARGE-SCALE DISSEMINATION OF BIOGAS PLANTS 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 4

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 Biogas Sector Partnership Nepal (BSP-Nepal), the Netherlands Development Organization (SNV), Kreditanstalt für Wiederaufbau (KfW), the Alternative Energy Promotion Centre (AEPCC) and the Agricultural Development Bank Ltd. In addition, the project would not have been possible without the co-operation and the contribution of the Government of Nepal.



Alternative Energy Promotion Center

Making Renewable Energy Mainstream Supply to Rural Areas of Nepal

“UNDP partners with people at all levels of society to help build nations that can withstand crisis, and drive and sustain the kind of growth that improves the quality of life for everyone. On the ground in 177 countries and territories, we offer global perspective and local insight to help empower lives and build resilient nations.”

Cover photo courtesy of UNDP/Energy Access for Poverty Reduction

Contents

Acronyms	iii
Synopsis	v
Acknowledgements	vi
Preface	vii
1. Background	1
1.1 Current energy access situation in Nepal	1
2. Programme overview	2
2.1 Programme objectives	2
2.2 Programme methodology	2
2.3 Implementing agencies	2
2.4 Programme funding	3
2.5 Programme implementation to date	4
3. Implementation strategy	4
3.1 Product specifications	4
3.2 Promotion and marketing	4
3.3 Ensuring biogas company performance: quality control	4
3.4 Financing mechanisms	5
3.5 New measures to make biogas plants more affordable	7
3.6 Capacity development	7
3.7 Programme costs	7
4. Programme impacts	9
4.1 Programme outreach	9
4.2 Impacts in terms of Millennium Development Goals (MDGs)	9
4.3 Policy-level impacts: government commitment and national ownership	12
4.4 Expanding the market for biogas	12
5. Programme sustainability	12
5.1 Involving the private sector	12
5.2 Financial sustainability through carbon financing	13
5.3 Market saturation and 'reaching the unreachable'	13

January 2012

Copyright © United Nations Development Programme. All rights reserved. Articles may be freely reproduced as long as credit is given to UNDP. Requests for all other uses, e.g. the sale of the materials or their inclusion in products to be sold, should be addressed to communications.toolkit@undp.org.

Articles in this publication do not necessarily reflect the official views or policies of the United Nations Development Programme, nor do the boundaries and names shown on maps imply official endorsement by the United Nations.

ISBN 978-974-680-325-0

6. Lessons and good practices in expanding energy services to the poor **14**

- 6.1 Government and donor commitment 14
- 6.2 Promoting a viable market and an accountable private sector 14
- 6.3 Ensuring quality service 14
- 6.4 Capacity development of stakeholders to play key roles in biogas dissemination 14
- 6.5 Information dissemination 15

7. Conclusions **15**

References **16**

Acronyms

AEPC	Alternative Energy Promotion Centre
BCC	Biogas Coordination Committee
BSP	Biogas Support Programme
BSP-Nepal	Biogas Sector Partnership Nepal
BUS	Biogas Users' Survey
CBO	community-based organization
CDM	Clean Development Mechanism
CoC	code of conduct
CO₂	carbon dioxide
CTEVT	Council for Technical Education & Vocational Training
DDC	District Development Committee
DGIS	Directorate General for International Cooperation (Ministry of Foreign Affairs, the Netherlands)
GHG	greenhouse gas
GoN	Government of Nepal
KfW	Kreditanstalt für Wiederaufbau
MDG	Millennium Development Goal
MFI	microfinance institution
NBPA	Nepal Biogas Promotion Association
NPR	Nepalese rupee (currency)
RE	renewable energy
SNV	Netherlands Development Organisation
USD	United States dollar (currency)
VER	voluntary emission reduction

Synopsis

Project title: Biogas Support Programme (BSP)

Country and region of implementation: Nepal (nation-wide)

Focus area (technology/energy service): Promotion of dung-based biogas plants for household cooking, lighting and production of slurry for use as improved organic fertilizer

Contact details:

Saroj Rai
Executive Director, BSP-Nepal
Bagdol Lalitpur,
P.O. Box 9751, Kathmandu
srai@bspnepal.wlink.com.np
Tel. +977 1 55 24 665
<http://www.bspnepal.org.np>

Duration: 2003-2012 (Phase IV)

Costs: Approximately USD 19.07 million for Phase IV

Project brief: The Biogas Support Programme (BSP) applies a market-based approach with a pro-poor focus to disseminating biogas plants in Nepal. The programme encourages private sector participation through a variety of supportive measures, and ensures private sector accountability for constructing high-quality biogas plants and providing technical back-up services. Important to programme sustainability are the wide-ranging capacity development measures it undertakes before turning activities over to private sector and government agencies. The programme has instituted a number of innovative measures to make the technology affordable for the poor. These include providing an additional subsidy for communities that are poor, disadvantaged or based in remote locations, and encouraging microfinance institutions to extend convenient loans to the poor. BSP has played a key role in establishing the Alternative Energy Promotion Centre (AEPCC), the national apex body for promotion of renewable energy solutions in Nepal. As of December 2010, 225,356 biogas plants have been constructed throughout all 75 districts in the country. Currently, nearly 20,000 plants are being constructed every year.

Acknowledgments

Making energy markets work for the poor: Large-scale dissemination of biogas plants 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.

We express special gratitude to the main researchers and writers of the case study, Saroj Rai and Bala Ram Shrestha, whose expertise and knowledge established the basis of this report. UNDP would also like to express its gratitude to the staff of BSP-Nepal for their assistance in collecting and compiling necessary information for the analysis.

Special thanks to Thiyagarajan Velumail, supported by Soma Dutta, Lara Born and Butchaiah Gadde, for his technical leadership and guidance in the conduct of the 17 case studies.

Felicity Chard, David Galipeau (Chair), Daniela Gasparikova, Arun Kashyap, Faris Khader, Maya Nyagolova and Ashley Palmer of the UNDP-APRC Knowledge Products Review Committee (KRC) kindly provided a final review and endorsement of this publication.

The case study also benefited from the rich and fruitful interactions of the 9-12 November 2009 writeshop participants, including Praveen Arakkal, Exedito Belo, Lara Born, Ivo Besselink, Mamta Chander, Karma Chogyal, Beau Damen, Soma Dutta, Butchaiah Gadde, Geraldine Huet, Thomas Lynge Jensen, Xin Liu, William Mohns, Wattanee Niyomyath, Sunjita Pradhan, Kamal Rijal, Bhupendra Shakya, Bala Ram Shrestha, Kiran Man Singh, Dean Still, Yusuke Taishi, Pia Treichel, Kapila Subasinghe, Vernon Ray Vinluan, Veronica Villavicencio, Julien Wallet-Houget and Sirintharat Wannawong. Special thanks to the writeshop moderators Kamal Rijal and Thiyagarajan Velumail. In addition, the case study benefited greatly from an intensive peer review. Special thanks are due to Hongpeng Liu, Wim van Nes and Manuel Soriano of the Technical Advisory Committee for providing a detailed review that guided the finalization of the case study. We would also like to acknowledge Soma Dutta's support to the case writer in preparing the final case study.

UNDP APRC in Bangkok was responsible for the facilitation and conceptualization of the 17 case studies and the associated report. We thank the core team, comprising Saana Ahonen, Aalok Awalikar, Lara Born, Soma Dutta, Butchaiah Gadde, Thomas Lynge Jensen, Pratima Mathews, Wattanee Niyomyath, Thiyagarajan Velumail and Julien Wallet-Houget. Thanks to Sirintharat Wannawong, who has been instrumental in supporting the entire process administratively.

Finally, UNDP would like to thank Nikolai Beresnev and Collin Piprell for their excellent editorial support, and KEEN Publishing Co. Ltd. (Thailand) for logistical support and graphic design.



Martin Krause

Team Leader
Environment & Energy
UNDP Asia-Pacific

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. In Nepal, for example, only 40 percent of the population has access to electricity due to the mountainous nature of the country. Rural electrification stands at 29 percent, but even urban areas face acute power shortages. Some 88 percent of the population relies on traditional biomass fuels for cooking and heating.

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 a successful practice of encouraging private sector participation in the construction of more than 200,000 biogas plants in Nepal. Additional subsidies and microfinance loans for the poor improve the affordability of the technology, leading to its large-scale dissemination to poor and disadvantaged communities.



Nicholas Rosellini

Deputy Assistant Administrator & Deputy Regional Director
Regional Bureau for Asia and the Pacific

1. Background

Nepal is a landlocked country in South Asia, bordered by the Republic of India and the People's Republic of China. It is a multi-ethnic, multi-lingual, religiously-diverse country with an adult literacy rate of 58 percent and a life expectancy of 67 years.¹ Thirty one percent of the Nepalese population lives below the poverty line, and per capita income is USD 473.² Its Human Development Index of 0.428 ranks Nepal at 138 out of 169 countries.³ Agriculture employs 76 percent of the workforce, services 18 percent and manufacturing/craft-based industry 6 percent.⁴

Nepal has experienced rapid political change during the last two decades, ending a decade-long internal conflict in 2006 with a peace agreement signed between the major political parties. On 28 December 2007, the Interim Parliament declared Nepal a federal democratic republic. An interim constitution is currently in place, and the Constituent Assembly is in the process of drafting a new one.

1.1 Current energy access situation in Nepal

Nepal has a long history of hydropower and has the world's second-highest hydroelectricity potential. However, this resource accounts for only 1 percent of Nepal's total energy supply.⁵ Most of Nepal's energy comes from traditional fuels (68 percent wood, 15 percent agricultural wastes and 8 percent dung), with fossil fuels such as petroleum and coal accounting for the remaining 8 percent.

Limited access to energy. Per capita, Nepal is one of the world's lowest energy-consuming countries. Currently, about 40 percent of the population – and fewer than 50 percent of the country's 3,915 villages – has access to electricity, with as many as 16 hours of electricity outage per day in dry seasons.⁶ Lack of access to commercial energy forces rural communities to rely on traditional fuels for cooking and lighting needs.⁷

High costs of traditional energy use. Women and girls are usually responsible for food preparation and fuelwood collection, spending up to five hours per day on the latter task.⁸ Given the on-going deforestation in Nepal, distances between fuelwood sources and households are increasing, forcing women and girls to spend more time and effort on this activity or (if fuelwood is bought) increasing expenditures. Households also use dung-cakes as fuel, diverting dung from its traditional use as farm-yard manure. Heavy reliance on traditional fuels poses serious threats to the health of rural populations, particularly women and children, who are most exposed to indoor air pollution caused by the burning of biomass in inefficient stoves in poorly ventilated kitchens.

Prevailing responses. These patterns of energy generation and consumption – coupled with difficult geographical terrain in hilly and mountainous areas, socio-economic underdevelopment and a sparsely distributed population – present formidable challenges in providing modern energy solutions, particularly in rural and remote areas of the country. The Government of Nepal (GoN) is addressing these challenges in the following ways:



A woman controlling the valve of a biogas pipeline.

UNDP/Energy Access for Poverty Reduction

¹ UNICEF, 2011.

² Ministry of Finance, 2009.

³ UNDP, 2010.

⁴ Ministry of Finance, 2009.

⁵ USAID, 2011.

⁶ National Planning Commission, 2007.

⁷ For example, in 2006, 83.2 percent of the national population was using wood, dung and charcoal as primary cooking fuels, with only 16.2 percent using electricity, gas and kerosene (UNDP, 2009).

⁸ Bajgain and Shakya, 2005.

- **the Ninth Plan (1997-2002)** addressed the need to provide sustainable and affordable access to energy in rural areas by emphasising the development of renewable energy (RE) resources and new technologies for rural energy needs; and
- **the Rural Energy Policy**, promulgated by the GoN in 2006, promotes the private sector's role in expanding energy solutions. It also seeks to replace the inefficient and unsustainable use of biomass energy with cleaner energy sources. It promotes community-managed energy service delivery, as well as productive uses of energy for poverty alleviation.⁹

2. Programme overview

2.1 Programme objectives

Launched in 1992, the Biogas Support Programme (BSP) is currently in its fourth phase (2003-2012). Its overall goal is construction and dissemination of biogas plants in rural Nepal as a mainstream RE source, and enhanced commercialization and sustainability of the biogas sector. This goal seeks to address poverty, social inclusion and regional imbalance issues in Nepal.

2.2 Programme methodology

BSP provides a combination of subsidies and loans which make it affordable for rural households to purchase biogas plants from private sector suppliers. Subsidies are routed through biogas companies, while wholesale loans are provided to microfinance institutions (MFIs), who then on-lend to households. Additional subsidies are available for poor, remote and disadvantaged groups.

Apart from providing financial incentives for take-up of biogas plants, BSP engages in plant promotion, marketing, quality control, and technical training of MFIs and plant suppliers.

2.3 Implementing agencies

BSP was initially funded and managed by the Netherlands Development Organisation (SNV). Since 2003, it has been implemented by Biogas Sector Partnership Nepal (BSP-Nepal), a national non-governmental organization (NGO). BSP-Nepal has a tripartite agreement with donors and the GoN.¹⁰

The Alternative Energy Promotion Centre (AEPC) is BSP's executive agency. It provides supervisory and regulatory oversight through the Biogas Coordination Committee (BCC), a programme steering committee chaired by the AEPC.¹¹ The AEPC administers programme subsidies and the Biogas Credit Fund.

BSP-Nepal implements the programme in cooperation with Nepal Biogas Promotion Association (NBPA), an umbrella organization of approximately 85 private sector biogas companies and 17 workshops that manufacture plant appliances and accessories (e.g. stoves, lamps, gas taps and dome gas pipes). NBPA provides skill-enhancement packages for masons and technicians, and undertakes promotional work for the programme.¹²

Qualified biogas companies are responsible for plant construction and after-sales technical support. They also undertake a number of promotional activities.

Grameen banks and other MFIs are responsible for providing loans for the purchase of biogas plants to rural households. Since BSP's inception, the Agricultural Development Bank Ltd. has served as the lead bank in loan provision.

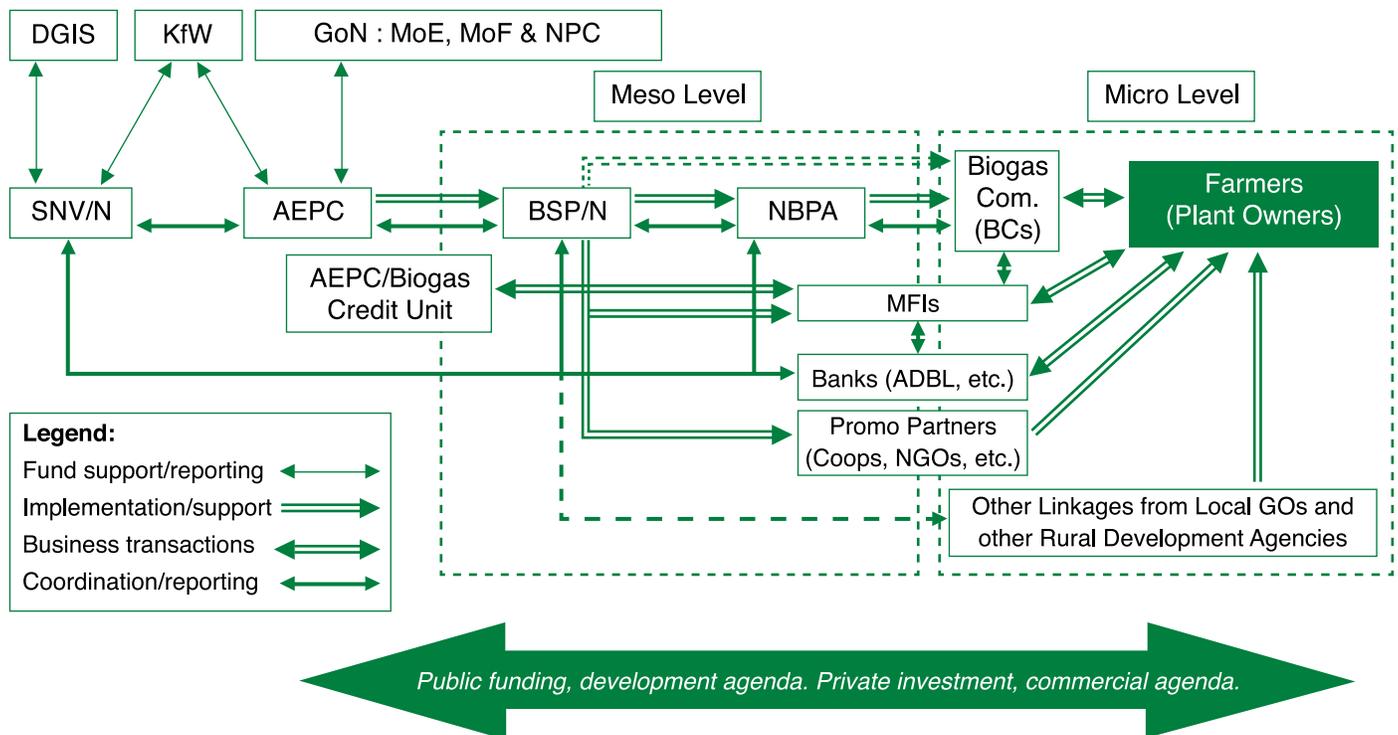
⁹ Central Bureau of Statistics, 2006.

¹⁰ BSP-Nepal, 2006; Karki et al., 2005.

¹¹ BCC includes representatives from the private sector, donors and the National Planning Commission.

¹² NBPA, 2007.

Figure 1: Institutional set-up, BSP Phase IV



NGOs are involved in information dissemination, creating demand for biogas plants, identifying potential beneficiaries and providing links between biogas companies and rural households.

Organizations involved in the programme include the National Cooperatives Federation, Federation of Community Forestry Users-Nepal, National Federation of Saving and Credit Union-Nepal, Central Dairy Cooperatives Association, Nepal Agriculture Cooperatives' Central Federation, Poverty Alleviation Fund, Rural Water Supply and Sanitation Fund Development Board, and numerous district development committees (DDCs).

A visual illustration of the roles of implementing partners is provided in Figure 1.

2.4 Programme funding

BSP is funded by a number of sources, including SNV, Kreditanstalt für Wiederaufbau (KfW, German government-owned development bank), the GoN and Clean Development Mechanism (CDM) revenues.¹³ At the local level, DDCs allocate funds for the biogas promotion, particularly for toilet attachment in biogas plants.

BSP Phase IV (2003-2012) was designed to draw on a total budget of USD 18,510,000. The multi-annual plan prepared in 2006 includes a revised budget of about USD 19,070,000 for the period January 2006 to December 2010. Of the total amount, SNV/Directorate General for International Cooperation (Ministry of Foreign Affairs, the Netherlands) (DGIS) and KfW contributed USD 3,857,000 and USD 8,579,200 respectively. The remainder was covered by the GoN (USD 3,264,800), CDM (USD 305,200) and participation fees (USD 343,000).¹⁴

DGIS/SNV support is set to end in 2012. From there on, the GoN will continue its support and, in addition, CDM funds are expected to support a continued level of programme targets and activities.

¹³ SNV and KfW also provide technical advisory services to other BSP implementing agencies.

¹⁴ These are small contributions (about USD 1.7 per plant) collected from users through biogas companies and directed to user training and promotional activities.

2.5 Programme implementation to date

As of December 2010, 225,356 biogas plants were constructed in 2,769 villages and municipalities (of a total of 3,919) in Nepal. Building nearly 20,000 new biogas plants every year, BSP has reached all 75 districts, directly benefiting around 1.3 million people – with 14,000 people directly or indirectly employed as a result of the programme.

3. Implementation strategy

3.1 Product specifications

BSP promotes household biogas plants ranging in size from 2 to 8 m³.¹⁵ A 4 m³ biogas plant provides enough biogas to cook for about 2.4 hours. Some households also use biogas for lighting (particularly in the mountains, where other fuels for lighting are unavailable). Besides biogas, the plant produces bio-slurry, manure with a higher fertilizer value than dung.

Under the programme, a 6 m³ biogas plant costs about USD 600. This includes a one-year guarantee for appliances, a three-year guarantee for the civil work, and two after-sales service visits (one in the second and another in the third year of construction). Annual maintenance costs after the third year of construction are roughly USD 13. More extensive maintenance, including emptying the plant and gas leak-proofing, is needed roughly once every 12 years.

As mentioned above, private biogas companies are responsible for plant construction and after-sales service. Other components of the programme are described in detail below.

3.2 Promotion and marketing

The programme includes social and commercial marketing and promotion of biogas plants to achieve their dissemination.

Activities in areas with developed markets. In areas with a strong demand for biogas plants, biogas companies and MFIs undertake the bulk of promotion and marketing via leaflets, brochures, posters, biogas models, radio and television promotion, and exhibitions. BSP-Nepal supports these activities with participation in trade exhibitions, market development studies and the celebration of major milestones (e.g. a celebration marking the construction of the 200,000th plant).

Activities in areas with undeveloped markets. In areas where the market is undeveloped, BSP-Nepal works with local governments and national, regional or local networks of NGOs, community-based organizations (CBOs) and cooperatives to create demand through awareness building, training, demonstrations and piloting. Additional support is also provided (a) to biogas companies to partially cover their losses or risks as first movers, and (b) to the users to partially cover their risks as first adaptors. Once the basic awareness is created, the biogas companies move in to assume promotion and marketing functions.

3.3 Ensuring biogas company performance: quality control

The following quality-control measures are included in BSP:

- technical standards have been developed for more than 80 types of biogas plants and are incorporated into agreements with the biogas companies;
- BSP-Nepal inspects a minimum of 5 percent of newly constructed plants and all plants under the two-year guarantee period. Early-warning reports are then sent to biogas companies specifying necessary improvements and repairs;
- biogas companies are classified by BSP-Nepal according to grades 'AAA' through 'E', depending on plant performance in the field. Grades are sanctioned with penalties or bonuses, as appropriate. Poorly-performing companies (graded 'D' or 'E') are provided with counselling support aimed at improving their performance. If a biogas company holds an 'E' grading for two years, it has to leave the programme; and

¹⁵ Subsidies for 10, 15 and 20 m³ biogas plants have been phased out over the years.

- the annual 'partner satisfaction' and Biogas Users' Surveys (BUSs) provide regular user feedback.

With its strong emphasis on quality control under the programme, BSP-Nepal has been awarded ISO 9001:2008 (Quality Management Systems) certification.

3.4 Financing mechanisms

Summary

A combination of the following subsidies and loans improves the affordability of biogas plants:

- the regular BSP subsidy amounts to roughly 30 percent of the plant cost (see Table 1);
- 20 percent of the cost can be contributed by the user in kind (e.g. unskilled labour or locally available construction materials);
- the remaining 50 percent of the cost must be paid by the user in cash; for this purpose, they are eligible for a loan provided through a Biogas Credit Fund; and
- poor, disadvantaged and remote communities are eligible for additional subsidies, ranging between USD 8 and USD 45 (see Table 1).

Table 1: BSP subsidy structure for FY 2009/2010 (USD)¹⁶

Plant size (m ³)	Geographic area	Total plant cost (without subsidy)	Regular subsidy	Additional subsidy for low penetration districts	Additional subsidy for poor and other disadvantages groups
2	<i>Terai</i> ¹⁷	339	339	8	27
	Hill	378	378	8	32
	Remote	419	419	8	45
	Very remote	1,156	1,156	8	45
4	<i>Terai</i>	410	410	8	27
	Hill	455	455	8	32
	Remote	504	504	8	45
	Very remote	1,407	1,407	8	45
6	<i>Terai</i>	484	484	8	27
	Hill	536	536	8	32
	Remote	592	592	8	45
	Very remote	1,641	1,641	8	45
8	<i>Terai</i>	567	567	8	27
	Hill	634	634	8	32
	Remote	699	699	8	45
	Very remote	2,019	2,019	8	45

¹⁶ Converted from EUR to USD at an exchange rate of EUR 1 = USD 1.4 (www.xe.com).

¹⁷ Plains and foothills.

Regular subsidies

Regular BSP subsidies are routed through the biogas companies. Companies' participation in BSP is subject to clearly defined criteria. Their performance is further enhanced by the systems of product standardization, quality testing of accessories and appliances, and quality monitoring of plants in the field. Around 30 percent of the subsidy is provided by the GoN, with an annual increase of 1 percent.

Loans through Biogas Credit Fund

Despite the subsidy, most rural households find it difficult to pay the upfront cost of the biogas plant. To address this, BSP works with Grameen banks and other MFIs in extending loans for the purchase of biogas plants. The AEPC operates the Biogas Credit Fund (a revolving fund of USD 3.5 million), which is used to provide wholesale loans to MFIs at a rate of 4 percent interest per annum, which the MFIs then on-lend to farmers at a maximum 14 percent interest rate. The average loan per biogas plant is around USD 358. The economics of loan repayment are further described in Figure 2.

Four types of MFIs are involved in the programme: 1) Grameen banks and their branches; 2) cooperatives; 3) financial intermediary NGOs; and 4) rural self-help groups or CBOs. These MFIs operate on a 'credit-plus approach', providing credit through group collateral and a host of services such as information and counselling. Currently, 238 MFIs are providing loans through the Biogas Credit Fund.¹⁸

The loans have played a critical role in making biogas plants affordable to rural communities. To date, about 30 percent of the biogas users have made use of loans, and this trend is growing.

Figure 2: Economics of a farmer-owned biogas plant

An owner of a 6 m³ biogas plant needs a start-up loan of about NPR 16,000 (USD 201).¹⁹ The repayment of a two-year loan at a 13 percent interest rate requires the household to pay a monthly instalment of NPR 761 (USD 9.6). This is equivalent to the cost of 30 litres of milk or 9.5 litres of kerosene. If the loan is for five years, the monthly repayments are equivalent to 15 litres of milk per day or six litres of kerosene. These figures are often used by BSP staff in their biogas plant promotions.

Plant Size (m ³)	Total Cost (NPR)	Subsidy	User's In Kind Contribution (NPR)	User's Cash Contribution (NPR)	Estimated Loan Required (NPR)	Payback Period (Years)	Interest Rate (%)	Equal Monthly Instalment (NPR)	Daily Litres of Milk @NPR 26/Litre	Monthly Litres of Kerosene @NPR 60/Litre
2	27,275 - 33,631	9,700 - 18,700	4,451 - 5,771	9,160 - 13,124	8,000	2	10	369	0.47	6.15
							13	380	0.49	6.34
							16	392	0.50	6.53
						5	10	170	0.22	2.83
							13	182	0.23	3.03
							16	195	0.25	3.24
4	32,825 - 40,223	9,700 - 18,700	6,113 - 7,103	14,160 - 17,112	12,000	2	10	554	0.71	9.23
							13	571	0.73	9.51
							16	588	0.75	9.79
						5	10	255	0.33	4.25
							13	273	0.35	4.55
							16	292	0.37	4.86
6	38,423 - 46,894	9,700 - 18,700	7,578 - 9,818	18,376 - 21,240	16,000	2	10	738	1.03	12.31
							13	761	1.06	12.68
							16	783	1.09	13.06
						5	10	340	0.47	5.67
							13	364	0.51	6.07
							16	389	0.54	6.48
8	44,765 - 55,194	9,000 - 16,000	8,686 - 11,246	25,948 - 28,199	20,000	2	10	923	1.28	15.38
							13	951	1.32	15.85
							16	979	1.36	16.32
						5	10	425	0.59	7.08
							13	455	0.63	7.58
							16	486	0.68	8.11

¹⁸ BSP-Nepal, 2011.

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

3.5 New measures to make biogas plants more affordable

Despite the availability of the regular subsidy and loans, BSP has failed to reach the poorest households. BSP clients are typically not the poorest in rural communities, and own at least two cattle. A 2008 study revealed that 70 percent of the biogas plants were owned by *Brahmins* and *Chhetris*, well-off caste groups that constitute just over 30 percent of the population.²⁰ At the other end of the spectrum, *Janajatis* and *Dalits* comprised 50 percent of the national population, but only 24 percent and 8 percent of these groups (respectively) owned biogas plants.²¹ Other disadvantaged ethnic groups comprised about 19 percent of the population and owned just 2 percent of the biogas plants.

In light of these findings, a primary objective of Phase IV has been to make BSP more pro-poor and inclusive. Towards this end, new initiatives have included:

- introduction of an additional subsidy for the poor;²²
- improved availability of micro-credit;
- additional subsidies for the *Dalits*, *Janajatis* and conflict victims; and
- introduction of a 2 m³ biogas plants that can be run with dung from one cow.

In addition, technological innovation has enabled BSP to reach remote communities living at altitudes as high as 3,000 metres.

BSP is also conducting research activities targeting the following groups:

- people living above 3,000 metres;
- poor people living in clusters that can benefit from a community biogas plant; and
- people who raise only pigs and no cattle.

3.6 Capacity development

About 25 percent of the total BSP budget (excluding the regular subsidy) is spent on capacity development, including research and development.

BSP offers a wide range of services to its implementing partners, including:

- skills training for masons, supervisors and managers;
- additional support to women trainees (masons, supervisors and managers), including interest-free working capital, advance subsidies, material support, quality control, institutional support, exposure visits, marketing incentives to work in remote areas, coaching and counselling, and annual reviews; and
- the AEPC, SNV and BSP-Nepal work together to develop capacity of MFIs, helping them expand their portfolio to include biogas plants. Activities include training, orientation and building linkages with biogas companies.

3.7 Programme costs

BSP has been operating since 1992. Figure 3 shows the average per-plant expenditures of the subsidy, programme support activities and programme management over 1997-2009.²³ It can be seen that while programme management and programme support activities expenses have not changed significantly, the subsidy has been gradually reduced. After the programme entered the CDM regime, however, the subsidy has been upwardly revised.

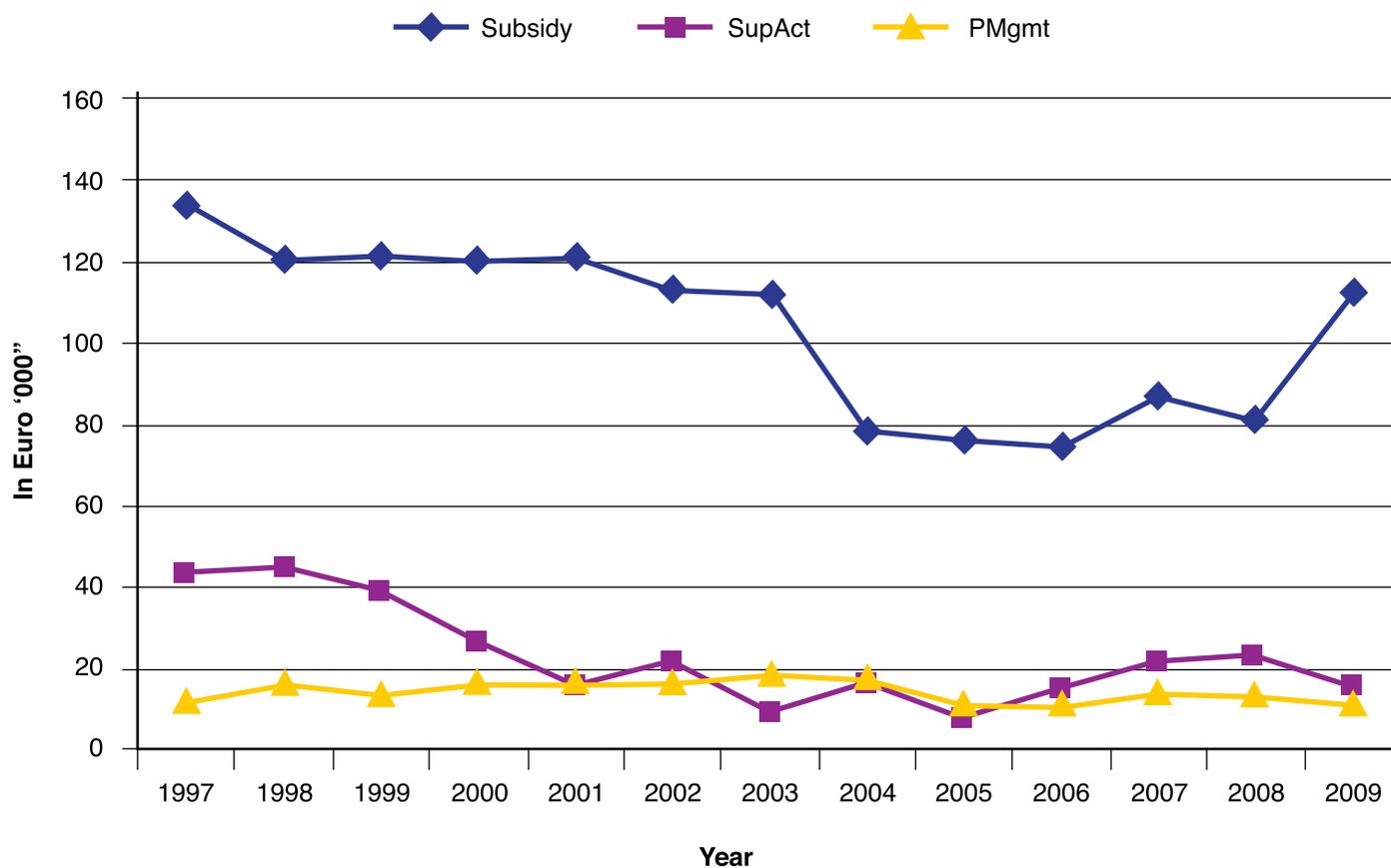
²⁰ Socially and politically, *Brahmins* and *Chhetris* have long been the dominant caste groups in Nepal.

²¹ *Janajati* are indigenous people, descendants of the Tibeto-Burmans. Most are poor, and their representation in national systems is minimal. *Dalits* are a group historically oppressed by the upper castes.

²² The subsidy was piloted in 2006, and included in the national subsidy scheme in 2008-2009.

²³ Programme support activities include quality control and monitoring, training, promotion, slurry management, and research and development. Programme management expenditure include staff cost, office running costs, and costs of fixed assets.

Figure 3: Average annual per-plant expenditures of BSP (1997-2000), EUR 1,000



Note: Subsidy = subsidy expenditure. SupAct = programme support activities expenditure. PMgmt = programme management expenditure.

Analysis of the expenditure pattern in programme management shows the following distribution (Table 2).

Table 2: Expenditure pattern in programme management budget, excluding subsidy (2005-2007)

Item	% of total
Staff	36
Monitoring	12
Research	8
Training (capacity development) and awareness creation	18
Operational expenses (e.g. house rent, utilities, supplies and vehicles)	26
Total	100%

4. Programme impacts

4.1 Programme outreach

As of December 2010, 225,356 biogas plants have been constructed in all 75 districts in Nepal. Around 1.3 million people have directly benefited from the programme.²⁴ National Census figures from 2001 indicate that 50 percent of the beneficiaries are women and 39 percent are children younger than 15 years.

4.2 Impacts in terms of Millennium Development Goals (MDGs)

Impacts on income and livelihoods (MDG 1)

BSP has had the following impacts on income and livelihoods of rural biogas users:

Reduced expenditure on fuel. The use of biogas plants can entail direct monetary savings in areas where fuelwood or kerosene are purchased for cooking. On average, each household uses around 4,411 kg of fuelwood per year. BSP statistics show that after adopting biogas, this quantity has been reduced to 1,831 kg, saving the household about USD 218 per year.²⁵

Less drudgery, more time and income generation. Reduced firewood collection means reduced loads carried by women and children. The saved time and after-daylight activities made possible by biogas lamps can be used for income generation.



A family undertaking maintenance of their biogas plant.

UNDP/Energy Access for Poverty Reduction

However, BSP experience with productive use of energy from biogas plants has not been very positive. BUS 2008/2009 showed that 28.6 percent of biogas users used the saved time for income-generating activities, while the majority (70.2 percent) used it for recreation and socialization.²⁶

Notably, while there are obvious benefits in using freed up time for income generation, it must be remembered that women in Nepalese rural societies are already over-loaded with household chores and might not want to engage in additional income-generating activities.

Productivity gains via the use of biogas slurry as fertilizer. Biogas plants save cattle dung from being burned as fuel, instead providing a high-quality fertilizer (slurry), helping to increase agricultural productivity. BUS 2008/2009 revealed that about 89 percent of farmers used the slurry. Only about 27 percent, however, reported increased crop yield; this may be due to the improper use of slurry.²⁷ This is a potential future focus area for the programme.

Improved employment and business opportunities. Over 90 biogas companies are working under the programme. While many of these existed before BSP, new ones are proliferating. In the 2008-2009 period, about 19,500 biogas plants were constructed, a 30 percent increase over the previous year (see Figure 4). It is envisaged that the market will continue to grow at an estimated rate of 20 to 30 percent annually over the coming years.

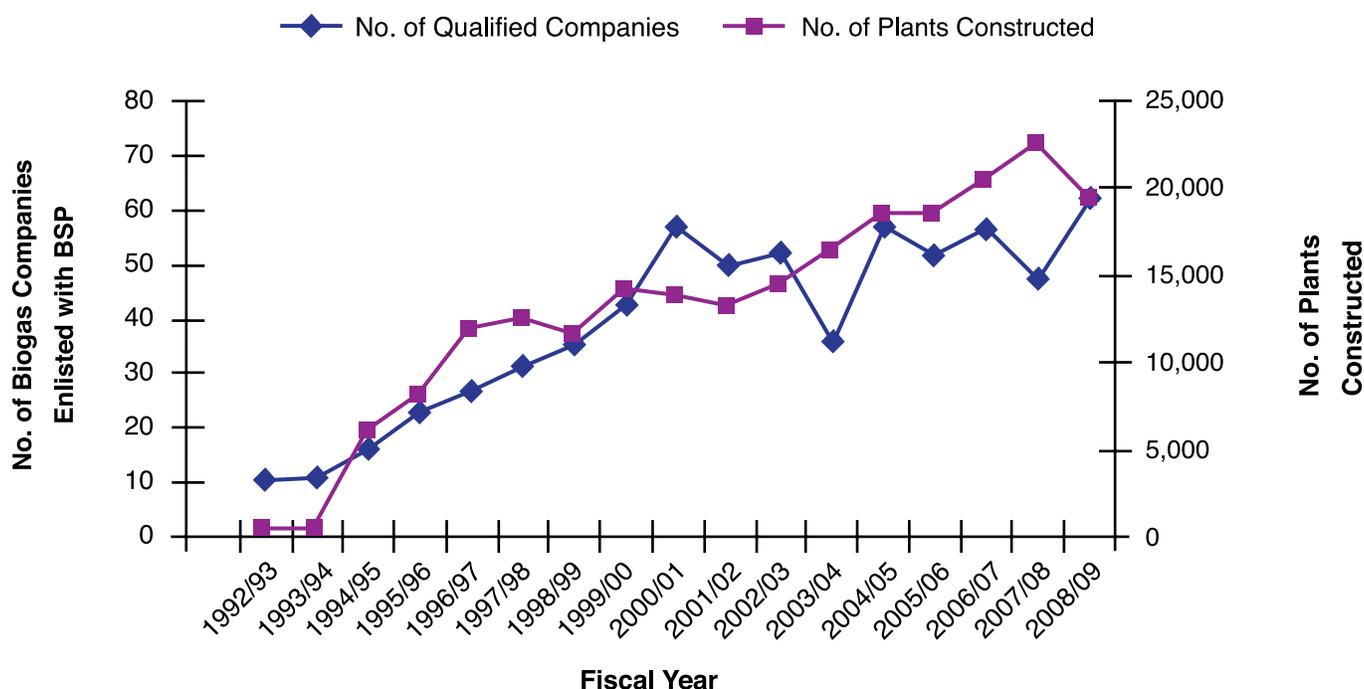
²⁴ BSP-Nepal, 2011.

²⁵ IRMC, 2009.

²⁶ IRMC, 2009.

²⁷ IRMC, 2009.

Figure 4: Biogas companies and biogas plant construction under BSP



The biogas companies employ 2,000 masons, who in turn employ trainee masons. BSP works towards improving the wages, working conditions, skills and employability of biogas masons in a number of ways (see Box 1), with 14,000 people are directly or indirectly employed as a result of the programme.²⁸

Box 1: BSP impact on biogas masons

In collaboration with the national Council for Technical Education and Vocational Training (CTEVT), BSP has launched an initiative for skill testing and certification of masons. This system motivates masons to improve their skills by attending classroom sessions and to pursue on-the-job training before taking the CTEVT skill-certification exams for Level 1, 2, 3 or 4. As masons move from Level 1 to 4, they become eligible to employ trainee masons for biogas plant construction. In this way, the system transforms poor masons into entrepreneurs. The chain continues to grow as ever-more trainee masons are transformed into entrepreneurs.

Almost all masons come from socially and economically disadvantaged communities. Unfortunately, even though a national minimum wage system has been legislated, only the organized employment sectors honour it. Consequently, masons, particularly those in rural areas, are typically over-worked and underpaid. To ensure this does not occur, BSP works with the biogas companies to protect the biogas masons' basic rights. Specifically, biogas company quotations clearly stipulate the minimum wage paid to masons, and a minimum-wage payment mechanism is incorporated into the companies' codes of conduct (CoCs).

Impacts on education, health and gender equality (MDGs 2, 3, 4, 5 and 6)

Health and convenience. Avoidance of carrying heavy fuelwood loads is particularly beneficial for pregnant women. By improving their health, this can indirectly help reduce child mortality.

²⁸ IRMC, 2009.

More disposable time. Most women (69 percent) use the freed time for much-needed leisure, recreation and socialization, while 28.6 percent use it for income-generating activities.

Reduced indoor pollution. The benefit most often cited by the women themselves is reduced indoor air pollution. BUS 2008/2009 showed that about 98 percent of users observed reduction in indoor air pollution after installation of biogas plants.²⁹ Reduced indoor pollution contributes to reduced child mortality rates.

Redistribution of household gender roles. Biogas plants lead to changes in work distribution within households. Encouraged by improved kitchens and the absence of smoke once biogas replaces firewood, men are also cooking. Whether this translates into women's empowerment or more gender equality remains unclear.

Involvement in supply-chain roles. BSP has instituted measures to encourage the involvement of women in supply-chain functions, including:

- extra incentives for women participants in user training;
- separate awards for best mason/supervisor/entrepreneur for women and men; and
- encouraging women's self-help groups to provide loans for biogas plant purchases.

Results are promising: 50 women's cooperatives are now providing loans for biogas plants, six women-owned biogas companies are in operation, and 13 women work as biogas technicians.³⁰

Increase in study time. Biogas lamps provide brighter light than kerosene lamps, which helps children study after nightfall. About 11 percent of users have been using biogas plants for lighting, mostly in mountainous regions.³¹

Improved sanitation. A major benefit of biogas plants is improved sanitation. Toilet-linked biogas plants are often a starting point for communities to start using toilets, reducing pollution of open spaces and water bodies, resulting in reduction of diseases, particularly cholera and eye and respiratory illnesses. BUS 2008/2009 showed that the introduction of toilet-linked biogas plants increased the number of households using toilets from 49 percent to about 76 percent.

Impacts on environment (MDG 7)

BSP-provided biogas plants help achieve the following local and global environmental benefits:

Reduced greenhouse gas (GHG) emissions. On average, a biogas plant replaces 2.5 to 3 tonnes of fuelwood and 6.5 litres of kerosene annually. This is equivalent to a reduction of around 3 tonnes of CO₂ of GHG emissions.³²

Reduced indoor air pollution. As mentioned earlier, this benefit was reported by 98 percent of the households.

Avoided deforestation and forest degradation, through reduced use of fuelwood.

Reduced use of chemical fertilizers. The use of slurry helps to reduce chemical fertilizer use, reducing land degradation.

Building partnerships and linkages at the national level (MDG 8)

BSP is a successful public-private partnership involving the GoN, the private sector, NGOs, CBOs, banks, financial institutions and international development partners. It is a donor-supported, government-led programme implemented by an NGO, using the private sector as product suppliers and involving hundreds of MFIs, NGOs, CBO and local government organizations. Following up on the success of BSP in Nepal, SNV and other development partners are working towards replicating the programme in other countries. BSP staff have been involved in training and construction of biogas plants in eight countries in Asia and Africa.³³

²⁹ IRMC, 2009.

³⁰ Shakya, 2009.

³¹ BUS, 2007/08.

³² BSP, 2006.

³³ People's Republic of Bangladesh, Kingdom of Cambodia, Federal Democratic Republic of Ethiopia, Republic of Indonesia, People's Democratic Republic of Laos, Islamic Republic of Pakistan, United Republic of Tanzania and Socialist Republic of Viet Nam.

4.3 Policy-level impacts: government commitment and national ownership

Creation of the AEPC. In the early 1990s, when BSP was launched, the biogas sector in Nepal was hampered by the absence of a government body that would take the lead in policy formulation, sector coordination and resource mobilization. In 1996, BSP played a key role in creating the AEPC, which is now the peak government body for promoting RE solutions in Nepal.

National ownership. In 2003, when SNV decided to hand programme management over to a national body, the AEPC became the executing agency for BSP, and BSP-Nepal was created to implement BSP under the AEPC. This change-over was instrumental in institutionalizing the national ownership of BSP.

Market-based approach plus 'additional subsidies'. The introduction of additional subsidies for the poor, disadvantaged and remote groups (including indigenous communities) initially appeared at odds with the market-based approach embraced by BSP. Such measures were essential, however, given the need to include these groups in the programme.

Model for private sector delivery of RE technology. BSP has demonstrated that biogas is an appropriate technology for rural Nepal, and that the private sector can deliver the technology effectively. The model has been instrumental in launching RE programmes with the same modality, such as the Solar Home System Programme.

4.4 Expanding the market for biogas

Over the past 17 years, BSP has undergone the following phases of market growth:

- **Phases I & II** (1992-1997): market development and regulation.
- **Phase III** (1997-2003): market expansion.
- **Phase IV** (2003-2012): market consolidation.

Initial market growth followed by decline. As shown in Figure 4, the first 10 years of the programme saw a steady increase in construction of biogas plants. After 2000-2001, market growth slowed down. Phase IV originally set a target of 200,000 plants within six years; in fact, just over 100,000 were built. The main reasons for this shortfall include political conflict, rises in raw-material costs, a decline in the level of subsidy and market saturation.

More recent market upturn. Since 2003, however, the BSP market has consolidated. Contributory factors include the end of the political conflict, an increased regular subsidy (adjusted upwards for inflation), introduction of new modalities for the private sector aiming to improve enterprise performance (including enforcement of CoCs), increased availability of MFI credit, and additional subsidies for poor, socially oppressed and indigenous communities.

5. Programme sustainability

Currently, BSP is poised to expand further, reaching out to poorer and more geographically remote populations. Its socio-economic and environmental benefits are clear. There are also good prospects that BSP will become substantially (or even fully) financially self-reliant through carbon funding. These and other measures contributing to BSP sustainability are described in detail below.

5.1 Involving the private sector

From the outset, BSP has adopted a market-driven approach focused on developing the private sector and using it for large-scale dissemination of biogas plants.

Starting with one biogas company (a joint venture involving three public organizations), the programme now includes 90 licensed private sector biogas companies (with about 200 offices and 16 workshops) and more than 200 MFIs. Newly established companies work as dealers under licensed counterparts. Except in a few areas where the services of an NGO or

consulting firm might be more appropriate, most activities are turned over to the private sector or government agencies (following capacity development).

Should donor funding come to an end, it is likely that the demand for biogas plants would shrink due to price increases. However, the level of investment by the private sector (including the biogas construction companies, the plant accessories and appliances fabricating companies) has reached a point where there is little possibility they would abandon the market altogether. While weaker companies could disappear or merge with larger ones, most would remain and continue doing business, albeit on a reduced scale. Availability of loans from MFIs would continue and might even increase as, lacking a subsidy, people would resort to larger loans.

5.2 Financial sustainability through carbon financing

Clean Development Mechanism. Under BSP Phase IV, 19,396 plants have been constructed and registered with the CDM Executive Board.

BSP is the first programme in Nepal to have registered two CDM projects. An Emission Reduction Purchase Agreement for the two projects was signed with the World Bank for the trading of the emission reductions for seven years, starting in 2004/2005, at the rate of USD 7 per tonne-CO₂ equivalent of GHGs. The annual carbon revenue (net of verification expenses) from these two projects amounts to about USD 360,000; under these projects, 73,500 new plants have been constructed (in addition to those already registered).³⁴

A new approach was developed – Methodology III.E: ‘Switch from Non-Renewable Biomass for Thermal Applications by the User’ – and BSP is currently registering new CDM projects within a Programme of Activity framework. Annual CDM revenues are likely to rise to as much as USD 3.5 million by 2014, which would meet about 30-50 percent of the annual BSP budget (including subsidies).

Tapping the VER market. If CDM projects fail or do not eventuate, entering the voluntary emission reduction (VER) market is a feasible option. As an example, a Gold Standard VER Biogas Project has been implemented by APEC, BSP-Nepal and WWF since 2007, with funding from WWF.³⁵

5.3 Market saturation and ‘reaching the unreachables’

The market-driven, private sector-led approach has worked well in the more affluent parts of the country. Making it work in remote areas, however, means meeting the challenges of poor socio-economic conditions and lack of road networks.³⁶ In recent years, BSP has worked hard to find ways to reach the so far ‘unreachable’ Nepalese in remote areas. This includes increasing linkages with microfinance and other rural development activities and introducing additional subsidies (discussed above).

Market saturation is being reported in some pockets of Nepal’s Terai and lower hill regions. Programme penetration is being intensified in these areas, in an attempt to reach the poorer and more disadvantaged groups.



Undertaking maintenance of a biogas plant.

UNDP/ Energy Access for Poverty Reduction

³⁴ After the first two years, reporting, verification and payment were delayed due to non-issuance of certified emission reductions, on the grounds that the monitoring data was generic and not project-specific. Re-submission of the emission reduction report is in process.

³⁵ The project aims to build 7,500 biogas plants in conservation area buffer zones of 10 districts, following the modality applied by BSP. VER market is being used to raise revenue, to be used to part-finance the construction of biogas plants. The project is registered with the Gold Standard Foundation and field verification is complete.

³⁶ Without passable roads, the cost of cement, reinforcing rods, etc. rises to 10 or 15 times of that found in areas around road-heads.

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

6.1 Government and donor commitment

BSP is one of the longest-running programmes in Nepal, largely due to on-going donor support. This support has been encouraged by the GoN commitment, reflected in the increasing financial contribution to the BSP subsidy and adoption of programme modalities within the national RE programme.

BSP experience shows that financial incentives for biogas users are a key ingredient in enabling access to clean energy. Apart from its contribution to the BSP subsidy, the GoN has provided value-added and import tax exemptions for items imported exclusively for the biogas plant system (e.g. the main gas valve and pressure gauge).

6.2 Promoting a viable market and an accountable private sector

As discussed above, BSP encourages private sector construction of biogas plants via the following means:

- subsidies and incentives to biogas companies and users;
- educating and motivating banks and MFIs to provide financing;
- taking responsibility for promotion and marketing in new, underdeveloped areas; and
- turning the latter functions over to the private sector once markets are developed.

BSP's carrot-and-stick approach has been instrumental in developing the market for biogas plants. On the one hand, it invests public funds in market development and subsidizing production of biogas plants. On the other hand, it applies strict qualification mechanisms for biogas companies, including performance evaluation, grading, penalties, rewards, renewals of agreements and disqualifications.

6.3 Ensuring quality service

A reliable quality assurance system for consumers is essential. Elements of the BSP quality assurance system include:

- a three to seven year guarantee on every biogas plant;
- after-sales service;
- user training;
- grading of biogas companies; and
- a strong, transparent policy of rewards and punishment for biogas companies.

Standardization of plant design, construction quality and quality of accessories and appliance are equally important. When a market is still at a developing stage, building consumer confidence is vital. To this end, BSP monitors 100 percent of the plants in a new area; later, as plant numbers increase, they are randomly sampled.

6.4 Capacity development of stakeholders to play key roles in biogas dissemination

Capacity development of implementing partners lies at the heart of BSP's approach. BSP's exit strategy is to progressively downscale its programme activities and institutional structure so that GoN bodies (primarily the AEPC) and the private sector (led by NBPA) take up more and more of the activities currently undertaken by BSP-Nepal. Specialized functions such as subsidy administration and quality monitoring, however, are likely to remain with BSP-Nepal.

For example, almost all training activities (and some promotional activities) previously undertaken by BSP-Nepal have been handed over to NBPA. The strategy here is to develop capacity among biogas companies and NBPA, progressively handing over

more and more activities once these are standardized and capacities developed. NBPA capacity has also been enhanced through capacity assessments, training and strengthening of the organizational structure. NBPA has reached a point where it can collaborate with other organizations such as CTEVT, and continue serving its member organizations in terms of training, skills certification, market development and credit financing.

6.5 Information dissemination

Comprehensive, accurate programme information must be made widely available. This is important to ensure that the final beneficiaries understand the programme provisions and that all stakeholders clearly understand their respective roles and responsibilities.

Enhancing accountability. Disseminating information on biogas companies (along with names and addresses of technicians) in rural areas is helpful, as it enables biogas plant owners to request operation, maintenance and warranty services from these companies.

Generating demand in target areas. Awareness campaigns in remote locations supported by biogas plant demonstrations have helped generate demand.

Making plant economics comprehensible and relevant to users, investors and policy-makers. The strategy of explaining biogas plant economics in terms relevant to the rural economy (e.g. comparing them to milk production and sales) makes the information both useful and readily comprehensible. At donor and government levels, on the other hand, comparative cost-benefit or programme investment analyses for a biogas plant (including all the socio-economic and environmental benefits) are useful.

Publicizing links between biogas and poverty alleviation. Finally, BSP-Nepal believes that all its partners must understand the linkage between poverty and biogas, and appreciate that the programme is directed towards socio-economic development, and not just commercial success and profit-making.

7. Conclusions

BSP works within a triadic institutional framework including the GoN, private sector and NGOs. These three players effectively comprise a system of checks and balances, a pre-requisite for any successful large-scale programme. BSP has been instrumental in shaping the national policy and institutional framework with regard to promoting RE in rural Nepal, including the establishment of the AEPC. BSP has also been the first in Nepal to enter the CDM regime. In summary, BSP in Nepal provides a good example of a country-wide programme with a pro-poor and inclusive orientation operating through a market mechanism.

References

Bajgain, S. and Dr. Shakya, I. 2005. *The Nepal Biogas Support Programme: A successful model of public private partnership for rural household energy supply*. Netherlands Ministry of Foreign Affairs, SNV and Biogas Sector Partnership-Nepal. Available at www.snvworld.org/en/Documents/BSP_successful_model_of_PPP_Nepal_2005.pdf.

BSP. 2006. *Biogas Support Program, Nepal Activity 1: Revised monitoring report* (1 August 2004 to 31 July 2006). BSP-Nepal, Kathmandu.

BSP-Nepal. 2011. 'Achievements'. Available at www.bspnepal.org.np/achievements.

— 2006. *Multi annual plan 2006-2009*. BSP-Nepal, Kathmandu.

BUS (Biogas Users' Survey). 2007/08. *Economic survey*. Ministry of Finance, GoN (FY 2008/09). Kathmandu, Nepal.

Central Bureau of Statistics. 2006. *Statistical pocket book Nepal 2006*. Government of Nepal, Kathmandu. Available at www.cbs.gov.np/statistical_pocket_book_content.php.

IRMC (Integrated Resource Management Consultancy). 2009. *Biogas users survey 2008/2009*. Kathmandu.

Karki, A.B.; Shrestha J.N.; Bajgain S. 2005. *Biogas as a renewable source of energy in Nepal: Theory and development*. BSP-Nepal, Kathmandu.

Ministry of Finance. 2009. *Economic survey – Fiscal Year 2008/09*. Government of Nepal Kathmandu. Available at www.mof.gov.np/publication/budget/2009/surveyeng.php.

National Planning Commission. 2007. *Three Year Interim Plan (2007/08 – 2009/10)*. Government of Nepal, Kathmandu. Available at www.npc.gov.np/en/plans-programs/detail.php?titleid=19.

NBPA (Nepal Biogas Promotion Association). 2007. *Biogas sector in Nepal: Highlighting historical heights and present status*. Nepal Biogas Promotion Association, Lalitpur, Nepal.

Shakya, I. 2009. 'Gender Mainstreaming in the Biogas Program'. Presentation at the International Workshop on Domestic Biogas: 'How to improve and scale up practices?' 10-12 November 2009, Kathmandu, Nepal.

UNDP (United Nations Development Programme). 2010. *Human Development Report 2010*. 'Table 1: Human Development Index and its components. Available at http://hdr.undp.org/en/media/HDR_2010_EN_Table1_reprint.pdf.

— 2009. *The energy access situation in developing countries: A review focusing on least developed countries and sub-Saharan Africa*. UNDP and World Health Organization, New York. Available at http://content.undp.org/go/cms-service/stream/asset/?asset_id=2205620.

UNICEF. 2011. 'Nepal: statistics'. Available at www.unicef.org/infobycountry/nepal_nepal_statistics.html.

USAID. 2011. 'South Asia Regional Initiative for Energy: Nepal'. Available at www.sari-energy.org/PageFiles/Countries/Nepal_Energy_detail.asp.

For more information: <http://asia-pacific.undp.org>

UNDP Asia-Pacific Regional Centre | United Nations Service Building, 3rd Floor, Rajdamnern Nok Avenue, Bangkok 10200

Tel: +66 (0) 2304 9100 | Fax: +66 (0) 2280 2700 | E-mail: aprc@undp.org | <http://asia-pacific.undp.org>



*Empowered lives.
Resilient nations.*

United Nations Development Programme

Asia-Pacific Regional Centre
United Nations Service Building
3rd Floor, Rajdamnern Nok Avenue
10200 Bangkok, Thailand
Email: ap-intact@groups.undp.org
<http://asia-pacific.undp.org>