Scaling up biogas in Nepal: what else is needed?

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Introduction

Biogas is the mixture of gas produced by methane-based bacteria acting upon biodegradable materials in an environment that is lacking air. Biogas is mainly composed of 60–70% methane, 30–40% carbon dioxide and some other gases. Biogas is colourless and burns with a clean blue flame similar to that of liquid petroleum gas (LPG) allowing for virtually smoke-free combustion. Biogas can be used for cooking and lighting, refrigeration, engine operation and electricity generation. To date, biogas is used mainly for cooking (80%) and lighting (20%) in Nepal.

The technology has been available in Nepal since the mid 1970s, but it was not until the early 1990s that the number of installations was substantially scaled up by the Biogas Support Program (BSP). This program was established in 1992 by the Nepalese, Dutch and German governments.

The biogas plants being constructed under BSP has following characteristics:

- Fixed dome – individual plant per household
- Sizes: 4, 6, 8, 10, 15 and 20 cubic metre
- Feed materials: Cattle dung and water
- Feasible up to 2100 metres

Current status

Table 1 shows the number of biogas plants installed in Nepal since 1992:

Table 1 Biogas plants installed in Nepal since 1992

Phase	Biogas plants installed
First phase (1992–1994)	6824
Second phase (1994–Feb. 1997)	13 375
Third phase (March 1997–June 2003)	91 196
TOTAL	111 395

Source: BSP, 2004

Nepal is divided into three east–west bands running the full width of the country; by the end of the third phase, more than 111 000 plants were installed – more on hills and Terai regions as shown in Figure 1.

Livestock plays an important role in the Nepalese farming system, with 2.7 million households owning cattle and buffalo (estimate 2001). The technical potential of biogas plants in Nepal is about 1.9 million: 57% in the plains, 37% in hilly areas and 6% in mountainous regions (BSP 2004).

Currently, the Biogas Support Program has a target of increasing the number of quality biogas plants by an additional 200 000 by 2009 in at least 70 out of the 75 districts of Nepal. BSP has given special attention to developing appropriate biogas plant designs, especially for remote and high altitude areas.

Existing practice

The challenge is to achieve 200 000 new installations in just 6 years; more than the total biogas plants installed since the 1970s to date, and ultimately to reach the total technical potential of biogas in the country. It is thus important to understand the current practices and modalities of the BSP.

Key elements of the sectoral approach adopted by BSP include:

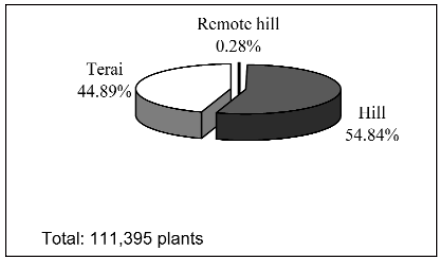

Figure 1 Geographical distribution of biogas production

- A uniform technical design for all biogas plants
- Thorough quality control and monitoring of production, installation and after-sales services
- Continuous R&D efforts to meet the needs of end-users
- Outreach and awareness programmes
- Financial support for end-users through a government subsidy of US$70–US$150 (5000–11 000 Nepali Rupees per plant)
- Stimulation of financial support mechanisms such as micro-credit facilities

Biogas construction companies are responsible for marketing and installing biogas plants and providing maintenance and after-sales services guarantees for at least three years following installation. BSP provides operation and maintenance training to all households on day-to-day maintenance and minor repairs. BSP's policy of regular quality control and supervision of newly constructed plants, as well as after sales service of plants, ensures the quality of plants and services.

According to BSP, around 97% of the total plants installed since 1992 are operational. About 80% of the total plants are of four cubic metre and six cubic metre sizes; a six cubic metre plant requires around 36 kg of cow dung per day in hilly areas (mixed with an equal amount of water) to get a stove burning for 3.5 hours. This

increases with altitute because of the retention time (average duration that dung remains in the digester). Around 60% of the biogas consumed is used for cooking.

Annually, each biogas plant can save more than four tonnes of firewood and 32 litres of kerosene. The annual time saving for firewood collection and cooking averages 1000 hours in each household with biogas plant. Each biogas plant produces about five tonnes of organic, fertilizer annually, which can replace chemical fertilizer. A recent study by Winrock Nepal and others found that each biogas plant can mitigate about five tonnes of carbon dioxide equivalent per year (1,5). The credits thus earned could provide alternative financing for the sustainability of biogas program in Nepal. More information on biogas can be obtained from www.bspnepal.org.

What else is needed?

The existing practice has focused on environmental benefits, subsidy, quality control, awareness creation etc. as the main drivings. There are other pertinent issues which need attention to scale up biogas in Nepal but this article focuses on two aspects: micro-financing and health benefits.

Micro-financing

The average plant costs about NRs. 25,000 (NRs.74~US$1), which is too costly for some potential users to pay upfront in a country where 38% of the Nepalese live with US$ 1 per day (11). The government of Nepal currently provides subsidy through the BSP and the Alternative Energy Promotion Centre (AEPC). This clearly indicates that the poor, who do not have the cash to pay for systems upfront, cannot benefit from biogas and access these government subsidies.

Micro Finance Institutions (MFIs) could provide loans to those wishing to purchase biogas plants who cannot pay the upfront cost. MFIs are strategically located in the rural areas and have enabled easy access through their simple procedures. The total membership of MFIs in Nepal comprises more than 500 000 rural customers (12% of the total households in Nepal), receiving financial as well as non-financial services. Table 2 shows the outreach of MFIs in Nepal.

Additionally, it is estimated that there are around 330 000 dairy farmer households (Winrock 2004) who are potentially significant users of biogas. Winrock estimates that more than 800 000 farmer households in Nepal are potential customers of micro-credit for the installation of biogas plants. It may not be technically or economically feasible for all dairy cooperative members to install biogas plants, but with a large proportion of dairy cooperative member households without biogas plants, there is a potentially huge market.

Winrock International Nepal, in collaboration with AEPC/BSP, is mobilising MFIs in order to achieve the set target of 200 000 additional installations by 2009, with plans for further scaling up beyond that date. Winrock International has developed manuals and has already trained more than 80 micro-finance institutions MFIs to finance biogas.

II. Health benefit aspects

Biogas can have significant health benefits. According to the Integrated Environmental Impact Analysis carried out by BSP for 600 biogas users (Figure 2) and 600 non-users, four percent more non-biogas users have respiratory diseases than those who own biogas plants (3). Qualitative information from various household surveys carried out by BSP has revealed that problems like respiratory illness, eye infection, asthma and lung problems have decreased after installing a biogas plantn (Tables 3 & 4).

According to the Biogas Users' Survey conducted in 2000 with 100 households, biogas can have positive impacts on the health of its users. Out of 42 respondents who had respiratory problems in the past, it was reported that the problem has improved for 34 of them. Similarly, those who had problems like asthma, eye infections and lung problems found that their problems had decreased after displacing dirtier fuels with biogas.

Table 2 Total membership of MFIs in Nepal (as of December 2003)

SN	Type of MFIs	Number of institutions	Number of members
1	Development Banks	9	253166
2	Savings and Credit Cooperatives	1786	258195
3	Financial Intermediary NGOs	30	18391
Total		1825	529752

Source: Directory of MFIs, Center for Micro-finance

Figure 2 Nepali woman cooking with biogasSource: BSP/Nepal

Table 3: Health benefits of biogas

Disease	Problems in the past (HHs)*		Present status of HHs	
	Yes	No	Improved	Remained same
Eye infection	72	18	69	3
Cases of burning	29	71	28	1
Lung problem	38	62	33	5
Respiratory problems	42	58	34	8
Asthma	11	89	9	2
Dizziness/headache	27	93	16	11
Intestinal;/diarrhea	58	42	14	44

*HHs = households
Source: Biogas Users' Survey 2000, BSP

Table 4 Health benefits of biogas (2)

	Decrease	Increase	No disease
Disease	20	–	80
Cough	53	–	47
Headache	33	3	67
Nausea	5	–	95
Chest pain	15	1	85
Lethargy	11	–	89
Respiratory disease	41	–	59
Malaria	8	2	92
Typhoid	10	4	90
Total (%)	22	1	77

Source: Biogas Users' Survey, 1999, BSP

Unfortunately, these health benefits are included under 'other benefits' in the reports and the health community seems not to have recognised the importance of such impacts.

During the preparation of the 'Status Report for Nepal on Household Energy, Indoor Air Pollution and Health Impacts' conducted by Winrock International Nepal in 2003–2004, no quantitative information available was found on the indoor air quality impacts of biogas plants in Nepal. However, a comparative study carried out in India by Kirk Smith et al in 2000 (4) shows that in terms of net concentration of total suspended particles (flue gas level concentration minus background concentration), biogas has values comparable to those of LPG, with the lowest values compared to other common cooking fuels. This has positive impacts on reducing indoor air pollution level and the corresponding health impacts (Table 5).

Thus, it would benefit the BSP programme (and/or other parties) to measure indoor air pollution improvements following biogas installation, and promote the health benefits. This will both encourage biogas installation and attract the attention of health programmes, motivating them to include biogas in their own programmes. The health benefits of biogas should be delivered by advocated by communities and departments.

Conclusion and recommendation

Specific and target-oriented approaches like subsidy, quality control, private sector involvement etc. adopted by the Biogas Support Program have lead higher additional targets of 200 000 being set. To date, environmental benefits have been the driving factor of biogas promotion, while important health benefits are underemphasized. Existing successful approaches, including quality control, subsidies and information dissemination, should be continued.

Since many of the accessible and more affluent, potential biogas areas are already supplied, it is anticipated that a much higher percentage of future plants will be sold to the poorer and more remote communities. Since His Majesty's Government of Nepal has a strategy to phase out the subsidy gradually, an appropriate credit mechanism for poor farmers is vital if BSP is to successfully meet its target of 200 000 plants. In addition to increasing access to credit, the health benefits biogas offers should be communicated to users, and to health and energy communities.

Table 5 Net total suspended particles' concentrations in flue gas of some cooking fuels

Fuel	Total suspended particle (mg per m3)
Biogas	0.25
LPG	0.32
Kerosene	0.48
Crop residue	5.74

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