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Country Paper for Bangladesh

BY

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Executive Summary

In Bangladesh, only 3% of the population enjoys the facility of natural gas coming to their homes through pipelines. The lucky few mostly live in the city areas. Majority of the remaining 97% still depend on biomass fuels for cooking and more than 40 million tons of biomass fuels are being used every year in this regard.

Biogas technology can be used to implement a sustainable energy and waste management program, which can provide the necessary energy requirements for cooking and lighting. Apart from the energy, the treated slurry produced as a bi-product from biogas digesters is a very good organic fertilizer.

The first biogas plant in Bangladesh was constructed in 1972 at the premises of Bangladesh Agriculture University. In the 80s, efforts were undertaken by EPCD, BCSIR, DANIDA, LGED, DLS and Grameen Bank. A wider dissemination of biogas took place while BCSIR implemented the "Biogas Pilot Plant Project" during 1995-2004. During this period, 21,858 fixed dome plants were constructed throughout the country. During 1998-2003, LGED also implemented a parallel biogas project constructing 1,120 domestic plants.

van Nes, Wim J., et. al. their report on '*Feasibility of national programme on domestic biogas in Bangladesh'* came out with about 950,000 households as potential to construct biogas plants. Moreover, there exist about 116,000 poultry farms all over the country of which at least 80,000 farms have 200 – 1,000 birds where construction of biogas plants is technically feasible.

At present, there are three ongoing biogas programs in Bangladesh. National Domestic Biogas and Manure Programme (NDBMP) is currently the largest biogas programme of the country implemented by IDCOL with support from Netherlands Development Organization (SNV). Under this programme, a total of 36,450 domestic sized biogas plants are planned to be constructed during 2006-2009. German Technical Cooperation (GTZ) supports installation and financing of large biogas plants (above 4.8 m^3). Moreover, Ministry of Youth and Sports has undertaken a biogas program under which 100 biogas plants are planned to be constructed per month in 10 selected areas till June 2009.

Till 1994, biogas plants were financed primarily through subsidy. The 'Biogas Pilot Plant Project' by BCSIR introduced the concept of owners' equity and subsidy was limited to Taka 7,500 per plant. Moreover, an agency system was introduced where BCSIR provided an incentive of Taka 5,000 per plant to private agencies as service charge. The biogas project of LGED provided an investment subsidy of Taka 5,000 and had to foreclose with limited success given the contemporary higher subsidy offered by BCSIR program. No credit was made available to the plant owners and an upfront equity investment of about Taka 7,500 – 10,000 was required (average cost of a 2.4 m^3 biogas plant was Taka 15,000).

The IDCOL-SNV biogas program introduced the concept of soft credit in financing biogas plants in Bangladesh. In a typical IDCOL financed biogas plant, subsidy is Taka 7,000 (USD 100), household's contribution is 15% of the plant cost and the remaining is a micro-credit loan from MFIs. at 10% - 14% flat interest rate and for a period of maximum two years. Since MFIs have limited source of fund, IDCOL refinances 80% of the MFI loan at 6% diminishing interest rate and for a period of seven-year with one-year grace period.

In a GTZ financed social biogas plant, subsidy is Taka 20,000, owner's equity is minimum 15% of the plant cost and the remaining is a micro-credit loan at 10% - 14% flat interest rate for maximum two years. GTZ, in addition to subsidy, provides a zero-cost revolving fund to the MFIs for on lending to the plant owners. In commercial plants, no subsidy is provided.

Under Ministry of Youth and Sports (MYS), GoB provides Taka 5,000 as subsidy per plant. Equity investment is not mandatory and GoB provides the remaining portion (with a ceiling of Taka 20,000 per plant) of the plant cost as credit for three years at 10% flat interest rate.

An efficient financing mechanism is crucial for sustainable and mass dissemination of biogas technology. The previous BCSIR and LGED models had higher subsidy component and required higher equity investment. No credit facility was attached and private agencies lost motivation as soon as subsidy channel dried up. This resulted into poor after sales service, resulting non-performance of many plants and loss of confidence on biogas technology. The ongoing IDCOL-SNV program has the credit component attached to it, which was needed for making biogas technology affordable to mass people as well as to ensure after sales service, as owners typically don't pay instalments unless plants are operational. However, subsidy has been reduced significantly, plant cost has almost doubled since 2004, no direct subsidy available for MFIs and credit terms are less attractive compare to other similar programs. Since MFIs have limited resources, this has resulted larger MFIs to concentrate on other higher return programs. Smaller MFIs simply lack resources to disseminate the program on a mass scale.

The financial rate of return (FIRR) of a 2.4m^3 domestic biogas plant has been calculated from the perspective of plant owner. The base analysis considering saved biomass indicates a financial internal rate of return (FIRR) of 13.52%. The FIRR is much lower that 17% based on which the grant amount of Taka 7,000 per plant was fixed in the NDBMP implementation plan. To keep the FIRR same as before, minimum amount of subsidy to the plant owners should be Taka 9,549.

Some modifications in the financial structure based on learning from other successful programs as well as new financial instruments have been explored for expediting the program further. The report recommended linking subsidy to plant owners with the plant construction cost revised at periodic intervals, providing a phased-out direct subsidy to MFIs, making credit terms to owners and refinancing terms to MFIs similar with other ongoing successful programs, offering working capital finance to smaller MFIs and creating a revolving 'Sustainable Energy Fund' using carbon credit.

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Abbreviations

BARI	Bangladesh Agriculture Research Institute
BAU	Bangladesh Agricultural University
BARD	Bangladesh Academy for Rural Development
BBS	Bangladesh Bureau of Statistics
BCSIR	Bangladesh Council of Scientific Industrial Research
BDT	Bangladesh Taka /Taka
BRAC	Bangladesh Rural Advancement Committee
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CO_2	Carbon dioxide
DANIDA	Danish International Development Agency
DLS	Department of Livestock
DNA	Designated National Authority
DoE	Department of Environment
EIRR	Economic Internal Rate of Return
EPCD	Environment Pollution Control Department
FI	Financial Institute
FIRR	Financial Internal Rate of Return
GOB	Government of Bangladesh
GTZ	German Technical Cooperation
HH	Household
IDCOL	Infrastructure Development Company Ltd
IFRD	Institute of Fuel Research and Development
KfW	Kreditanstalt fur Wiederaufbau (German Development Bank)
KVIC	Khadi and.Village Industries Commission
LGED	Local Government Engineering Department
MFI	Micro Finance Institute
MoYS	Ministry of Youth and Sports
NGO	Non Governmental Organization
NDBMP	National Domestic Biogas & Manure Programme
PO	Partner Organization
SHS	Solar Home System
SNV	Netherlands Development Organization
SWOT	Strengths, Weaknesses, Opportunities and Threats
VER	Verified Emission Reduction
USD	United States Dollar

In Bangladesh, only 3% of the population enjoy the facility of natural gas coming to their homes through pipelines. The lucky few mostly live in the city areas. Majority of the remaining 97% still depend on biomass fuels for cooking and more than 40 million tons of biomass fuels like fire-wood, agricultural residues, dry leaves, cattle dung, straws, rice husk etc. are being used every year in this regard.

Biogas technology can be used to implement a sustainable energy and waste management program and Bangladesh has got a great potential for that. The cattle population including buffaloes is about 24.19 million (1996), which yield about 242 million kg of cattle wastes per day. These wastes have a potential for production of 8.8 million cu m of gas. If even 50% of the cattle wastes could be used for biogas production, about 1.73 million biogas digesters with gas production capacity of 2.4 m^3 could be set up. A 2.4 m^3 biogas digester requires about 65-70 kg cow dung per day, which can be obtained from 6-7 cattle or 4-5 buffaloes. Such a biogas digester can provide the necessary energy requirements for cooking and lighting for a family of 6-8 members. Apart from the energy, the treated slurry produced as a bi-product from biogas digesters is a very good organic fertilizer.

History of Biogas

The first biogas plant in Bangladesh was constructed in 1972 at the premises of Bangladesh Agriculture University (BAU) following Indian KVIC floating-drum model. During 1972 - 1980, a total of 72 such plants were constructed with technical assistance from IFRD.

In the 80s, efforts were undertaken by EPCD (150 floating-drum and 110 Chinese fixed-dome plant), BCSIR, DANIDA (few trench and bag type digesters), LGED (over 200 plants), DLS (about 70 plants) and Grameen Bank (17 plastic bag digesters). In 1992, IFRD and Dhaka City Corporation jointly built an 85 m3 bio-digester at Dholpur using city wastes. Several other pilot schemes were undertaken by LGED during 1992 -1994 using city wastes, human excreta, water hyacinth and poultry dropping.

A wider dissemination of biogas took place while BCSIR implemented the “Biogas Pilot Plant Project” during 1995-2000 (1st phase) and 2000-2004 (2nd phase). During this period, 21,858 fixed dome plants were constructed throughout the country. During 1998-2003, LGED also implemented a parallel biogas project constructing 1,120 domestic plants.

Recently, Infrastructure Development Company Limited (IDCOL), a government owned energy and infrastructure financing company, with the support from Netherlands Development Organization (SNV) started ‘National Domestic Biogas and Manure Programme’ under which 36,450 domestic size biogas plants with capacity ranging 1.2 – 4.8 m3 gas production are planned to be constructed by end of 2009. Moreover, GTZ has created a facility to support construction and financing of biogas digesters with capacity of above 4.8 m3, installed mostly in commercial dairy, poultry and slaughterhouse. In addition, Ministry of Youth and Sports has an ongoing biogas program in ten selected areas of Bangladesh.

Biogas plants installed so far by different organizations are listed in Annex 1.

Potential for Biogas and Future Target

van Nes, Wim J., et. al. in their report on 'Feasibility of national programme on domestic biogas in Bangladesh' came out with about 950,000 households as potential to construct biogas plants. These data are based upon the households who have five or more cattle heads. Moreover, there exist about 116,000 poultry farms all over the country of which at least 80,000 farms have 200 – 1,000 birds. Since poultry droppings are an excellent feeding material for biogas generation, 80,000 biogas plants through using poultry droppings alone are technically feasible for domestic sized plants.

At present, there are three ongoing biogas programs in Bangladesh, each having different timeline, target and focus group.

i. National Domestic Biogas and Manure Programme

National Domestic Biogas and Manure Programme (NDBMP) is currently the largest biogas programme of the country implemented by IDCOL with support from Netherlands Development Organization (SNV). Under this programme, a total of 36,450 domestic sized biogas plants are planned to be constructed during 2006-2009. 30 partner organizations (PO), mostly NGOs and private entrepreneurs, have been engaged in this regard and 4,934 biogas plants have been constructed till August 2008.

Given current progress rate, the target seems ambitious. According to IDCOL, resulting underperformance is primarily due to lack of household confidence, higher construction cost, lower subsidy amount, low incentive to POs and unfavorable weather condition during the four-month rainy season. Lack of household confidence has resulted from poor performance of the biogas plants installed under previous biogas programs. A study of 66 biogas plants by Mr. Prakash C. Ghimire in December 2005 found only 31 plants (47%) functioning satisfactorily.

The table below illustrates the initial target, revised target and number of biogas plants already installed under NDBMP.

Year	Initial Target	Revised Target	Installed
2006	2100	2100	205
2007	4200	2200	2116
2008	12150	5400	2613 (Jan – Aug)
2009	18000	7000	-
Total	**36,450**		

ii. GTZ Biogas Programme

German Technical Cooperation (GTZ), under the programme 'Sustainable Energy Development', supports installation and financing of large biogas plants (above 4.8 m3). Like IDCOL, GTZ also implements the programme by engaging partner organizations.

Plants supported by GTZ can be divided into two categories, (i) Social biogas plants, i.e. plants installed in slaughterhouses, educational institutions and (ii) Commercial biogas plants, i.e. plants installed in commercial dairy and poultry firms. According to GTZ, 90 plants under category one and 350 plants under category two have so far been constructed.

GTZ does not seem to have any specific construction target. Plants would rather be supported given availability of funds till program closing date in 2010.

iii. MYS Biogas Programme

Under the 'Youth Development through Employment and Income Generation Programme', Ministry of Youth and Sports has undertaken a biogas program under which 100 biogas plants are planned to be constructed per month in 10 selected areas till June 2009. Minimum size of the plant has been set at 3 m3 and about 1,000 plants have already been constructed.

Objective, Methodology and Limitations

Objective of the assignment

The objective of this assignment is to prepare a report on the evolution of instruments for financing of biogas plants in Bangladesh. The report will address the following areas:

- Brief description of the domestic biogas programme in Bangladesh including an overview of the number of plants installed in the past, with possible targets for future;
- A breakdown of the current costs of domestic biogas plants;
- An overview of the financial instruments applied in the past and today;
- A breakdown of the current financing of domestic biogas plants;
- An evaluation of the strengths, weaknesses, opportunities and threats (SWOT) of the financial instruments applied in Bangladesh so far; and
- Conclusions on the use of financial instruments so far and recommendations on its improved use in future.

Methodology

The report has been prepared in Bangladesh context by collecting secondary information and contacting key informants in IDCOL, GTZ, Grameen Shakti and BCSIR.

Limitations

The study does not present an impressive development of sophisticated instruments in the financial sector, as it is difficult to introduce sophisticated credit derivates in the context of Bangladesh. Moreover, no biogas user has been contacted directly and detailed assessment of loan performance, particularly on repayment aspect has not been done.

Current Costs of Domestic Biogas Plants

In Bangladesh, hardly any user buys a piece of land to set up biogas plant; rather it is assumed that biogas user already has a piece of land for biogas plant construction. Assuming this, cost of a biogas plant varies with changes in the following cost components.

- Model or type of the biogas plant
- Size and dimension of the biogas unit
- Amount and prices of material
- Labor input and wages

At present, there are two major types of biogas plants constructed in Bangladesh. One is based on cow dung and the other on poultry droppings.

Detailed cost breakdown of different size of biogas plants are shown in Annex 2 and 3.

Financing Instruments Used to Finance Biogas

As per Household Income and Expenditure Survey 2002 the average annual income is USD 826 per household with average annual saving of USD 96. Average cost of a biogas plant is USD 400 and it frequently exceeds the affordability of the rural households. Commercial bank loan is not available as rural households are often classified as higher risk clients with limited own proper means as coverage for credit risk. Pricing of commercial bank loans in Bangladesh currently ranges from 14% to 18% per annum.

Till 1994, biogas plants were financed primarily through subsidy. The 'Biogas Pilot Plant Project' by BCSIR introduced the concept f owners' equity and subsidy was limited to Taka 5,000 (1st phase) and Taka 7,500 (2nd phase) per plant. Moreover, an agency system was introduced where BCSIR provided an incentive of Taka 5,000 per plant to private agencies as service charge. The biogas project of LGED provided an investment subsidy of Taka 5,000 and had to foreclose with limited success given the contemporary higher subsidy offered by BCSIR 2nd phase program. No credit was made available to the plant owners and an upfront equity investment of about Taka 7,500 – 10,000 was required (average cost of a 2.4 m3 biogas plant was Taka 15,000).

Key information of the previous BCSIR and LGED models are shown below.

	BCSIR Model	**LGED Model**
Project period	1998-2004	1997-2002
Plant size	3 m^3	3 m^3
Equity	50% of the total cost	66% of the total cost
Subsidy	50% of the cost. In addition provision of grant amounting US$ 80.00 to agent.	33% of the cost. In addition provision of grant amounting to US$ 80.00 to agent.
Credit support	Absent	Absent
Service charge	NA	NA

At present, there are three ongoing biogas programs in Bangladesh. Financial instruments used in these programs are discussed below.

i. IDCOL-SNV Biogas Programme

The IDCOL-SNV biogas program introduced the concept of soft credit in financing biogas plants in Bangladesh. In a typical IDCOL financed biogas plant, subsidy is Taka 7,000 (USD 100), household's contribution is 15% of the plant cost and the remaining is a micro-credit loan from MFIs like Grameen Shakti, RSF, Brac Foundation etc. at 10% - 14% flat interest rate and for a period of maximum two years. Interest is paid back to the MFIs in equal monthly installments and average collection efficiency of MFIs is about 89%. Since

MFIs have limited source of fund, IDCOL refinances 80% of the MFI loan (with a ceiling of EUR 147/plant) at 6% diminishing interest rate and for a period of seven-year with one-year grace period.

ii. GTZ Biogas Programme

GTZ supports financing of large biogas plants (above 4.8 m3) only. Two types of biogas plants are financed.

*a. **Social Biogas Plants:***

In a GTZ financed social biogas plant, subsidy is Taka 20,000, owner's equity is minimum 15% of the plant cost and the remaining is a micro-credit loan at 10% - 14% flat interest rate for maximum two years. GTZ, in addition to subsidy, provides a zero-cost revolving fund to the MFIs for on lending to the plant owners. Maximum GTZ credit per plant is Taka 14,000 or 40% of the loan amount whichever is lower.

*b. **Commercial Biogas Plants***

In commercial biogas plants, no subsidy is provided. Owners provide at least 15% of the plant cost as equity and the remaining is a micro-credit loan from MFIs at 10% - 14% flat interest rate. The same revolving fund with similar terms, as discussed above, is used for on lending to plant owners.

iii. MYS Biogas Programme

Under Ministry of Youth and Sports (MYS), GoB provides Taka 5,000 as subsidy per plant. Equity investment is not mandatory and GoB provides the remaining portion (with a ceiling of Taka 20,000 per plant) of the plant cost as credit for three years at 10% flat interest rate. Collection is done through community engagement. Due to poor collection efficiency, credit is currently discouraged.

Lessons Learnt from financing of Domestic Biogas Plants and Other Similar Programs

Each of the financial models used so far for financing domestic biogas plants has its own strengths and weaknesses.

- The BCSIR model had high subsidy component i.e. 50% of the plant cost and also an incentive of Taka 5,000 (about 33% of the plant cost) per plant for private agencies. However, owners' equity contribution was high i.e. remaining 50% of the plant cost due to absence of any credit facility. The program was not sustainable as many private agencies discontinued operation as soon as subsidy channel dried up. This resulted into poor after sales service and nonperformance of many plants.

- The LGED model had lower subsidy compared to the BCSIR model i.e. 33% of the plant cost and an incentive of Taka 5,000 per plant for private agencies. Owners' equity contribution was higher and no credit was made available. Since the LGED and BCSIR models were launched almost at the same time, the former had to foreclose with limited success due to higher subsidy offered by the later one.

- The ongoing IDCOL-SNV model has further lowered subsidy as well as equity portion to 23% and 15% of the plant cost respectively and introduced the concept of soft credit i.e. the remaining 62% of the plant cost from MFIs. No direct subsidy to MFIs is provided; however, MFIs can charge maximum Taka 4,000 as service charge to the households in addition to interest on credit. To make the credit available and affordable to plant owners, IDCOL refinances 80% of MFI-loan to households at soft terms. The credit component has been introduced with a view of making the biogas program sustainable and also to ensure better after sales service.

Lessons were also drawn from other similar ongoing programs i.e. IDCOL's successful solar home system (SHS) program. A comparative cost-benefit analysis is shown below:

	IDCOL SHS Program	**IDCOL-SNV Biogas Program**
Focus group	All households/enterprises in off-grid areas	Households with at least 4 cattle / 200 poultry birds and 200 square feet land
Subsidy to household	Started at USD 70 and now stands at EUR 30	USD 100
Owners' equity	Minimum 10%	Minimum 15%
Interest rate from MFI to plant/system owner	6% - 10% flat	10%-14% flat
Loan tenure from MFI to plant/system owner	1 – 5 years	1 – 2 years
Service charge	Nil	Taka 4,000
Subsidy to MFIs	Started at USD 20 and now stands at EUR 4	Nil
Maximum IDCOL loan to MFIs	USD 230 per household	EUR 147 per household
Interest rate from IDCOL to MFIs	6% on reducing balance	6% on reducing balance
Loan tenure from IDCOL to MFIs	10 year loan with 2 year grace period	7 year loan with 1 year grace period
Construction / installation time	4 hours	10 days
Maximum number of plants per staff per month	>50	6 -10

Like solar, MFIs in IDCOL-SNV biogas programme do not get a direct subsidy from the programme. Moreover, SHS programme has a wider customer group, softer credit terms and lower operating expenses in terms of installation time, staff involvement and after sales service. SHS program is also less risky as the system installed is a movable one and can be taken back in case of household default. Since many of the large MFIs in IDCOL-SNV biogas programme are also involved with IDCOL SHS programme and risk-return scenario is comparatively better in the later one, more efforts are usually given to the solar programme.

The New Financing Structure for Biogas

Domestic biogas plants are currently being financed using a mixture of equity, subsidy and small loans. Some modifications in the financial structure based on learning from other successful programs as well as new financial instruments need to be explored for expediting the program further. Following limitations under the existing financing structure need to be addressed.

- Cost of a biogas plant has almost doubled since 2004, resulting in higher up front equity contribution from plant owners and lower affordability.
- Micro-credit is available for a maximum of two years compare to a maximum of five years in contemporary IDCOL solar programme.
- No direct subsidy or performance-based incentive for MFIs is available for capacity building.
- Larger MFIs have better investment opportunities in other similar programs in terms of softer credit terms and economy of scale
- Smaller MFIs do not have the necessary fund to invest 20% of the credit from their own resources

i. Subsidy

Subsidy to household has been significantly reduced, from 50% of the plant cost in 2004 to 23% in 2006, with no provision to adjust for price escalation. Given construction cost has now almost doubled since 2004, fewer households can afford a biogas plant. Subsidy as a fixed percentage of the plant cost revised at periodic intervals instead of a fixed subsidy amount may encourage more households to avail the biogas technology.

No direct subsidy or performance-based incentive is currently provided to the MFIs. A phased-out subsidy scheme for the MFIs until the MFIs gain necessary institutional capacity to run the program on a sustainable basis was found helpful in IDCOL solar program.

ii. Credit

In Bangladesh where large-scale infrastructure and energy projects have to face competition for very scarce local finance, traditional institutional financing is quite unfeasible for biogas projects. Moreover, rural people lack collateral, steady employment and a verifiable credit history and therefore cannot meet even the most minimal qualifications to gain access to conventional credit.

Nevertheless, Bangladesh has the largest MFI network in the world with almost all villages having at least one MFI branch. MFIs can provide poor rural households with small, collateral-free loans for the purpose of installing and maintaining biogas plants.

Under the existing credit mechanism in biogas, MFIs require to invest at least 20% of the loan to households from their own resources and the rest they can avail from IDCOL. However, larger MFIs who have the necessary capacity to invest have better incentives under IDCOL solar program in terms of softer refinancing terms. Smaller MFIs who are not able to participate in the solar program lack the necessary fund to make the up front investment. This may be solved my lowering the investment requirement from MFI's, offering working capital loan at soft terms and/or providing similar refinancing terms like IDCOL solar program.

Loan tenure currently offered to the plant owners is maximum two years. Given significant price escalation, high installment amount now needs to be borne by the households. Like IDCOL solar program, flexibility needs to be created for plant owners by providing them with a 1-5 year loan.

iii. Carbon Fund

Being a clean energy, use of biogas replaces this traditional biomass and reduces significant amount of green house gas emission to the atmosphere. The reduced amount of green house gas can be sold to the international carbon market and can generate significant amount of fund that can be utilized for further development of biogas programme. Typically one biogas plant can reduce about 2.5 tones of CO2 per year. Therefore under IDCOL program alone, if 36,450 plants are constructed and 90 percent are in operation about 820,135 tones of CO2 is reduced by which about 500,000 Euro (@Euro 6 per ton) can be easily generated every year.

A bundling agency may work in this regard and the carbon revenue may be shared among the households, MFIs and the bundling agency. Alternatively, a 'Sustainable Energy Fund' may be created using the carbon revenue, which may work as a revolving fund to provide working capital and/or other financial support to MFIs. Carbon fund can be an attractive and sustainable source of funding that will enable to continue the programme even when donor grant and concessional credit resources would dry up.

FIRR Analysis

The financial rate of return (FIRR) of a 2.4m3 domestic biogas plant has been calculated from the perspective of plant owner. Major assumptions made are:

1. Total cost of a 2.4 m^3 biogas plant is Taka 28,000
2. Plant life is 15 years
3. Average consumption of biomass is 2420 kg a year at a cost of Taka 1.5 /kg
4. Subsidy is Taka 7,000 per plant
5. Household down payment is 15% of the plant cost
6. Interest on loan from MFI is 12% flat per annum for a 2-year loan
7. Annual plant maintenance cost is Taka 350

Calculation has been shown in Annex –4. Major findings are as follows:

1. The base analysis considering saved biomass indicates a financial internal rate of return (FIRR) of 13.52%
2. The FIRR is much lower that 17% based on which the grant amount of Taka 7,000 per plant was fixed in the NDBMP implementation plan.
3. To keep the FIRR same as before, minimum amount of subsidy to the plant owners should be Taka 9,549

SWOT Analysis

The following table lists the strengths; weaknesses, opportunities and threats (SWOT) of instruments for the financing of domestic biogas plants

i. Equity

SWOT	Positive	Negative
Internal	**Strengths:** • Equity ensures household confidence and smooth operation	**Weaknesses:** • Equity finance is scarce and most expensive • Poorer households may not afford high equity amount
External	**Opportunities:** • Equity/ mezzanine finance may be made available for larger plants	**Threats:** • Poor performance of plants will discourage households to make equity investments

ii. Subsidy

SWOT	Positive	Negative
Internal	**Strengths:** • Subsidy to households encourages adoption of new technology • Subsidy makes biogas technology affordable to the poorer segment • Subsidy to POs provides motivation and expedite performance • Quality can be enforced due to provision of subsidy and credit	**Weaknesses:** • Subsidy makes people dependent • Sustainability is difficult to assess and ensure in subsidized projects • Subsidy may not reach to the intended parties
External	**Opportunities:** • A phased-out approach may be beneficial • Subsidy can be linked with no of plants to expedite performance	**Threats:** • Subsidy is not unlimited and sources may dry up making biogas program unfeasible

iii. Credit

SWOT	Positive	Negative
Internal	**Strengths:** • Micro-credit is widely available in Bangladesh • Reduces one time investment of the households • Outstanding credit ensures good after sales service from MFIs as owners typically don't pay instalments if plant is inoperative • More credit and less subsidy is needed for sustainability in the long run	**Weaknesses:** • Due to collateral free nature, micro credit is comparatively risky • Interest rate is quite high compare to commercial bank rate • Larger MFIs have better incentives in other programs • Smaller MFIs have limited capacity to lend
External	**Opportunities:** • Wider and rapid dissemination of biogas program is possible by engaging micro-credit institutions • A credit line or refinancing facility to MFIs will ensure smooth supply of micro-credit to end customer • Demand may increase due to low upfront investment by owners and economy of scale may be achieved by MFIs	**Threats:** • MFIs may become bankrupt if collection efficiency is not healthy

iv. Carbon Finance

SWOT	Positive	Negative
Internal	**Strengths:** • Carbon finance is free money that can be used for ongoing development of biogas program even when subsidy and concessional credit sources become scarce	**Weaknesses:** • Carbon finance documentation is difficult and complex • Carbon finance is time consuming
External	**Opportunities:** • World carbon market is of more than USD 26 billion	**Threats:** • Post Kyoto risk, carbon market may shrink after year 2012

Conclusion and Recommendations

Biogas is a century old technology. It is technically proven, economically viable and socially acceptable. Its technology is simple and locally available. All hazardous waste, that pollute environment, create disease, spread bad smell are the raw materials of a biogas plant. There is need and demand of gas, fertilizer and electricity without polluting environment. Biogas technology can ensure all. Due to anaerobic digestion, all harmful bacteria die. Through the process, the hazardous waste becomes clean gas and pathogen free rich organic fertilizer drastically reducing carbon emission. Demand of gas and fertilizer is unending, raw materials are abandon and cheap.

However, an efficient financing mechanism is crucial for sustainable and mass dissemination of biogas technology. The previous BCSIR and LGED models had higher subsidy component and required higher equity investment. No credit facility was attached and private agencies lost motivation as soon as subsidy channel dried up. This resulted into poor after sales service, resulting nonperformance of many plants and loss of confidence on biogas technology. The ongoing IDCOL-SNV program has the credit component attached to it, which was needed for making biogas technology affordable to mass people as well as to ensure after sales service, as owners typically don't pay installments unless plants are operational. However, subsidy has been reduced significantly, plant cost has almost doubled since 2004, no direct subsidy available for MFIs and credit terms are less attractive compare to other similar programs. Since MFIs have limited resources, this has resulted larger MFIs to concentrate on other higher return programs. Smaller MFIs simply lack resources to disseminate the program on a mass scale.

Given this, the report recommended linking subsidy to plant owners with the plant construction cost revised at periodic intervals, providing a phased-out direct subsidy to MFIs, making credit terms to owners and refinancing terms to MFIs similar with other ongoing successful programs, offering working capital finance to smaller MFIs and creating a revolving 'Sustainable Energy Fund' using carbon credit.

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    — Wim J. van Nes, Willem Boers and Khurseed-Ul-Islam, Netherlands Development Organisation. Biogas Practice Team

Annex - 1

Biogas Plants Installed so far in Bangladesh

SL	Organization	Installation Period	No. of Biogas plants
1	Bangladesh Council of Scientific & Industrial Research (BCSIR)	1973-2005	22,100
2	Local Government Engineering Department (LGED)	1985-2001	1,142
3	Department of Environment	1979-1983	260
4	Bangladesh Rural Advancement Committee (BRAC)	1987-2005	300
5	Department of Livestock	1988-1994	70
6	Bangladesh Small & Cottage Industries Corporation	1983-1988	30
7	Bangladesh Agricultural Development Corporation	1983-1984	20
8	Danish International Development Agency (DANIDA)	1982	4
9	Bangladesh Agricultural University	1971-1973	2
10	Housing & Building Research Institute	1981	2
11	Bangladesh Academy for Rural Development (BARD)	1974	1
12	Bangladesh Commission for Christian Development	1978	1
13	Bangladesh Rice Research Institute	1983	1
14	Infrastructure Development Company Ltd (IDCOL)	Till August 2008	4,934
15	German Technical Cooperation (GTZ)	Till August 2008	450
16	Ministry of Youth and Sports	Till August 2008	1,000
	Total	**1971-2008**	**30,317**

Annex 2

Cow -Dung Based Biogas Plant: (Costs are based on June 2008 data)

Item	Unit Price	Quantity								Price							
		1.2	1.6	2	2.4	3.2	4.8	6	10	1.2	1.6	2	2.4	3.2	4.8	6	10
Materials																	
Bricks (pc)	5	850	935	1130	1250	1470	1890	2430	3645	4,250	4,675	5,650	6,250	7,350	9,450	12,150	18,225
Sands (Cu m)	530	1.6	1.8	2	2.2	2.5	3.3	3.9	5.8	848	954	1,060	1,166	1,325	1,749	2,067	3,074
Aggregates (Cu m)	1500	0.3	0.35	0.45	0.5	0.65	0.9	1.25	1.9	450	525	675	750	975	1,350	1,875	2,850
Cement (50 kg bag)	360	11	13	15	16	20	26	35	50	3,960	4,680	5,400	5,760	7,200	9,360	12,600	18,000
GI Wire (meter)	70	1	1	1	1	1	1.5	2	3	70	70	70	70	70	105	140	210
MS rod (kg)	65	8	10	13	16	22	36	52	78	520	650	845	1,040	1,430	2,340	3,380	5,070
Polythine (yard)	150	1	1	1	1	1	1	1	1	150	150	150	150	150	150	150	150
Appliances																	
Dome Pipe (set)	350	0.6	0.6	0.6	0.6	0.6	0.6	1	1	210	210	210	210	210	210	350	350
Gas Pipe (meter)	80	12	12	12	12	12	12	12	15	960	960	960	960	960	960	960	1,200
Main Valve (pc)	250	1	1	1	1	1	1	1	1	250	250	250	250	250	250	250	250
Water Drain (pc)	150	1	1	1	1	1	1	1	1	150	150	150	150	150	150	150	150
Gas Tap (pc)	150	1	1	2	2	2	3	4	5	150	150	300	300	300	450	600	750
Stove (pc)	600	1	1	2	2	2	3	4	5	600	600	1,200	1,200	1,200	1,800	2,400	3,000
Mixer (set)	600	1	1	1	1	1	1	1	1	600	600	600	600	600	600	600	600
Hose Pipe (meter)	36	1	1	2	2	2	3	4	5	36	36	72	72	72	108	144	180
Inlet Pipe (meter)	140	4	4	4	4.5	5	5	7	9	560	560	560	630	700	700	980	1,260
Emulsion Paint (litre)	190	1	1	1	1	2	2	3	4	190	190	190	190	380	380	570	760
Labor																	
Mason, Labours (day)		6	7	8	9	10	13	20	32	3,300	3,500	3,700	4,000	4,500	5,000	6,000	7,500
Maintenance																	
	350	2	2	2	2	2	2	2	2	700	700	700	700	700	700	700	700
Total										17,954	19,610	22,742	24,448	28,522	35,812	46,066	64,279
Service Charge										4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Grand Total (BDT)										**21,954**	**23,610**	**26,742**	**28,448**	**32,522**	**39,812**	**50,066**	**68,279**
Grand Total (USD)										**$313.63**	**$337.29**	**$382.03**	**$406.40**	**$464.60**	**$568.74**	**$715.23**	**$975.41**

Annex 3

Poultry Droppings Based Biogas Plant: (Costs are based on June 2008 data)

Item	Unit Price	Quantity								Price							
		1.2	1.6	2	2.4	3.2	4.8	6	10	1.2	1.6	2	2.4	3.2	4.8	6	10
Materials																	
Bricks (pc)	5	770	900	1020	1130	1334	1726	2233	3350	3,850	4,500	5,100	5,650	6,670	8,630	11,166	16,749
Sands (Cu m)	530	1.5	1.5	1.8	2	2.3	3	3.91	5.87	795	795	954	1,060	1,219	1,590	2,074	3,111
Aggregates (Cu m)	1500	0.3	0.34	0.42	0.48	0.62	0.88	1.25	1.87	450	510	630	720	930	1,320	1,874	2,810
Cement (50 kg bag)	360	11	13	15	16	19	26	36	54	3,960	4,680	5,400	5,760	6,840	9,360	12,960	19,440
GI Wire (meter)	70	1	1	1.5	1.5	2	2	2	3	70	70	105	105	140	140	140	210
MS rod (kg)	65	8	11	14	17	24	41	70	105	520	715	910	1,105	1,560	2,665	4,553	6,829
Polythine (yard)	150	1	1	1	1	1	1	3	3	150	150	150	150	150	150	450	450
Appliances																	
Dome Pipe (set)	350	0.6	0.6	0.6	0.6	0.6	0.6	1	1	210	210	210	210	210	210	350	350
Gas Pipe (meter)	80	12	12	12	12	12	12	12	15	960	960	960	960	960	960	960	1,200
Main Valve (pc)	250	1	1	1	1	1	1	1	1	250	250	250	250	250	250	250	250
Water Drain (pc)	150	1	1	1	1	1	1	1	1	150	150	150	150	150	150	150	150
Gas Tap (pc)	150	1	1	2	2	2	2	3	4	150	150	300	300	300	300	450	600
Stove (pc)	600	1	1	2	2	2	2	3	4	600	600	1,200	1,200	1,200	1,200	1,800	2,400
Mixer (set)	600	1	1	1	1	1	1	1	1	600	600	600	600	600	600	600	600
Hose Pipe (meter)	36	1	1	1	2	2	2	3	4	36	36	36	72	72	72	108	144
Inlet Pipe (meter)	140	4	4	5	5	6	6	7	9	560	560	700	700	840	840	980	1,260
Emulsion Paint (litre)	190	1	1	1	1	2	2	3	4	190	190	190	190	380	380	570	760
Labor																	
Mason, Labours (day)		6	7	8	9	10	13	20	32	3,000	3,200	3,500	3,800	4,000	4,500	5,000	6,500
Maintenance																	
	350	2	2	2	2	2	2	2	2	700	700	700	700	700	700	700	700
Total										17,201	19,026	22,045	23,682	27,171	34,017	45,134	64,513
Service Charge										4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Grand Total (BDT)										**21,201**	**23,026**	**26,045**	**27,682**	**31,171**	**38,017**	**49,134**	**68,513**
Grand Total (USD)										**$302.87**	**$328.94**	**$372.07**	**$395.46**	**$445.30**	**$543.10**	**$701.92**	**$978.76**

Annex 4

FIRR Analysis for a 2.4 cu m Biogas Plant

Plant Size	2.4	cubic meter
Plant Life	15	years
Household Consumption Biomass	2,420	Kg/year
Biomass Price	1.5	Taka/Kg
Plant Cost	28,000	Taka
Subsidy	7,000	Taka
Downpayment Requirement	15%	plant cost
Downpayment	4,200	Taka
Loan Amount	16,800	Taka
Interest Rate	12%	flat per year
Loan Tenor	2	years
Total yearly Interest Payment	2,016	Taka
Yearly instalment	10,416	Taka
Free Maintenance	3	years
Plant Maintenance Cost	350	Taka per year
1 USD =	68.5	BDT

FIRR from Plant Owner's Perspective

Year	Annual savings from elimination of expenditures on Fuel Wood (US$)	Total Investment		Plant Maintenance Cost (US$)	FIRR Cash Flows (US$)	FIRR
		Downpayment (US$)	Loan (US$)			
0	0	(61)	0	0	(61)	13.52%
1	53	0	(152)	0	(99)	
2	53	0	(152)	0	(99)	
3	53	0	0	0	53	
4	53	0	0	(5)	48	
5	53	0	0	(5)	48	
6	53	0	0	(5)	48	
7	53	0	0	(5)	48	
8	53	0	0	(5)	48	
9	53	0	0	(5)	48	
10	53	0	0	(5)	48	
11	53	0	0	(5)	48	
12	53	0	0	(5)	48	
13	53	0	0	(5)	48	
14	53	0	0	(5)	48	
15	53	0	0	(5)	48	