Fifth Meeting of SNV External Biogas Network

April 3-4, 2008
Vientiane, Lao PDR

Improvement of Biogas Appliances

September, 2008

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Abbreviations

ABP	:	Asia Biogas Programme
AEPC	:	Alternative Energy Promotion Centre (Nepal)
ASS	:	After-Sale-Services
BC	:	Biogas Company
BCSIR	:	Bangladesh Council for Scientific and Industrial Research
BPD	:	Biogas Project Division (Vietnam)
BPP	:	Biogas Pilot Programme (Lao PDR)
BSP	:	Biogas Support Programme (Nepal)
BSP-N	:	Biogas Sector Partnership (Nepal)
BSTI	:	Bangladesh Standards and Testing Institute
BUET	:	Bangladesh University of Engineering and Technology
CER	:	Certified Emission Reduction
CDM	:	Clean Development Mechanism
CO	:	Carbon Monoxide
DAFO	:	District Agriculture and Fishery Office (Lao PDR)
DAHP	:	Department of Animal Health and Production (Cambodia)
DLF		Department of Livestock and Fisheries (Lao PDR)
DTW	:	Development Technology Workshop (Cambodia)
IDCOL	:	Infrastructure Development Company Ltd. (Bangladesh)
Lao PDR	:	Lao Peoples' Democratic Republic
MAF	:	Ministry of Agriculture and Fisheries (Lao PDR)
MARD	:	Ministry of Agriculture and Rural Development (Vietnam)
NBP	:	National Biodigester Programme (Cambodia)
NDBMP	:	National Domestic Biogas and Manure Programme (Bangladesh)
VER	:	Verified Emission Reduction
SNV	:	Netherlands Development Organisation

1. Introduction

In the framework of the Asia Biogas Programme co-funded by the Government of the Netherlands, SNV Netherlands Development Organisation has instituted a regional network of experts working in the field of domestic biogas technology. With a view to share experience and learn form each other; SNV has been organising bi-annual meetings of the experts since the onset of ABP in 2006. The first, second, third and fourth meetings of the network members were held in Hanoi, Vietnam; Bangkok, Thailand; Dhaka, Bangladesh and Phnom Penh, Cambodia respectively in April 2006, September 2006, March 2007 and November 2007. The fifth meeting of network of experts was organised in Vientiane, Lo PDR, during the period April 3-4, 2008. This meeting of experts followed the internal Biogas/Renewable Energy Team Meeting of SNV Asia Region.

This external network meeting on domestic biogas consisted of a field visit to biogas households in Vientiane Capital, a session on carbon development and a meeting with (potential) Lao biogas stakeholders on 3rd April and a working meeting on improvement of biogas appliances on 4th April 2008. This brief report summarises the purpose, schedule, presentations and outcome of discussions related to the fifth meeting of the SNV external biogas network.

2. Objective of the Meeting

The overall objective of the meeting of the network of experts was to present and discuss possibilities for the improvements of the biogas appliances being used under the frameworks of different biogas programmes. The key question was: what are the major areas of improvement of appliances to improve their efficiencies and what are the possible methods/mechanisms to do so?

3. Key Agenda

The tentative schedule and key agenda of the 5th Meeting was agreed upon during the forth meeting of experts in Phnom Penh in November 2007. Though the meeting was scheduled to be held in Kathmandu, Nepal, it could not be materialised due to the uncertain political situation in the country. Later, the venue was changed to Vientiane, Lao PDR.

As per the decision of the third meeting of network-members in Dhaka, Bangladesh, laboratory tests were carried out in three well established laboratories in the Netherlands, China and India to assess the efficiencies of biogas stoves and lamps. Different designs of biogas stoves and lamps being used in Nepal, India, Bangladesh, Vietnam and Cambodia were included in the laboratory testing. The outcome of these tests indicated that there are lot of rooms for further improvements in the design of biogas stoves and lamps. Given the importance of the biogas appliances in successful functioning of biogas plants and need to discuss the way forward in improving the functional efficiencies of these appliances, the key agenda of the fifth meeting was proposed to be the 'Improvement of Biogas Appliances'.

Mr. Wim van Nes, Biogas Practice Team Coordinator, prepared the detailed schedule of the meeting and circulated it among the potential participants.

4. Schedule

The meeting was conducted for two days. The following tables show the schedule of activities during the meeting.

Meeting Schedule

Thursday, 3 April 2008: Field visit, Carbon Financing Strategy and Meeting with Lao stakeholders

07.30-14.00	Field visit to Vientiane Capital
14.30-16.30	Presentation by Jeroen van Bruggen on carbon strategies for domestic biogas programmes, followed by discussion
17.00-20.30	Meeting and dinner with Lao biogas stakeholders and SNV/Lao PDR

Friday, 4 April 2008: Improvement of biogas appliances, especially stove and lamp

08.00-08.30	Opening, welcome and introduction
08.30-09.30	Presentation by Dr. A.K. Kurchania, Professor and Head of the Department of Renewable Energy Sources, Udaipur, India, on the results and recommendations of the testing of biogas stoves and lamps by three institutes (Netherlands, China and India)
09.30-10.30	Plenary discussion on the results and recommendations of the testing of biogas stoves and lamps by three institutes (Netherlands, China and India)
10.30-11.00	Coffee/tea break
11.00-12.30	Group discussions, presentations and plenary discussion on functioning and possible improvement of biogas stove (including tap) and lamp
12.30-13.30	Lunch
13.30-16.00	Group discussions, presentations and plenary discussion on functioning and possible improvement of mixer device, dome gas pipe, main gas valve, water drain, pressure indicator and pipes & fittings
16.00-16.30	Coffee/tea break
16.30-16.45	Other issues related to the Network
16.45-17.15	Evaluation and closure of the meeting
18.30-20.30	Informal dinner at Mekong Deck (opposite of Lane Xang Hotel)

5. Participants

Participants from India, Nepal, Vietnam, Bangladesh, Cambodia, Laos and the Netherlands took part in the meeting. The following table shows the details of the participants.

List of Participants

SN	Name	Organisation	Address	E-mail
1	Mr. Le Anh Duc	Biogas Engineer-R&D, MARD/BPD, Vietnam	298 Kim Ma, Ba Dinh, Ha Noi, Vietnam	ducla@biogas.org.vn
2	Mr. Le Van Tan	Sr. Officer, MARD/Department of Science & Technology		levantanhn@yahoo.com

3	Mr. Bastiaan Teune	Biogas/RE Advisor, MARD/BPD, SNV/Vietnam	298 Kim Ma, Ba Dinh, Ha Noi, Vietnam	bteune@snvworld.org
4	Mr. Andrew Williamson	Biogas/RE Advisor, BPP, SNV/Lao PDR	Nongbone Road, Vientiane, Lao PDR	awilliamsongeorge@snvworld.org
5	Mr. Bounthavy Sengtakoun	Biogas Advisor, BPP, SNV/Lao PDR	Nongbone Road, Vientiane, Lao PDR	bsengtakoun@snvworld.org
6	Mr. Thongchanh Santhasith	Project Manager, BPP, Laos	Vientiane, Lao PDR	thongchanh@biogaslao.org
7	Mr. Nivath Phanaphet	Director, BPP, Laos	Vientiane, Lao PDR	nivath_phanaphet@yahoo.com
8	Mr. Jeroen van Bruggen	Asia Carbon Financing Advisor, SNV Lao PDR	Nongbone Road, Vientiane, Lao PDR	jvanbruggen@snvworld.org
9	Mr. Jan Lam	Biogas Advisor, NBP, SNV/Cambodia	P.O. Box 2590, Phnom Penh, Cambodia	jlam@snvworld.org
10	Mr. Prakash C. Ghimire	Advisor, Asia Biogas Programme, SNV/Cambodia	P.O. Box 2590, Phnom Penh, Cambodia	pghimire@snvworld.org
11	Mrs. Lam Saoleng	Project Manager, NBP, Cambodia	DAHP, # 74 Monivong Blvd., Phnom Penh, Cambodia	saoleng@nbp.org.kh
12	Mr. Richard Pullen	Director, DTW, Cambodia	Phnom Penh, Cambodia	gm@dtw.org.kh
13	Mr. Nazmul Haque (Faisal)	Manager, NDBMP, Bangladesh	G.P.O. Box 619, Dhaka-1215, Bangladesh	faisal@idcol.org
14	Mr. Sundar Bajgain	Biogas Advisor, NDBMP, SNV/Bangladesh	G.P.O. Box 619, Dhaka-1215, Bangladesh	sbajgain@snvworld.org
15	Dr. Fokrul Islam	Bio-slurry Advisor, NDBMP, SNV/Bangladesh	G.P.O. Box 619, Dhaka-1215, Bangladesh	mislam@snvworld.org
16	Mr. Uttam Prasad Jha	OSID Advisor, SNV/Nepal	Bakhundole, Lalitpur, Kathmandu, Nepal	ujhaprasad@snvworld.org
17	Mr. Ramesh Kumar Gautam	Micro Finance Advisor, SNV/Nepal	Bakhundole, Lalitpur, Kathmandu, Nepal	rgautam@snvworld.org
18	Mr. Khagendra Khanal	Assistant Director, BSP-Nepal	Bakhundole, Lalitpur, Kathmandu, Nepal	knkhanal@bspnepal.wlink.com.np
19	Mr. Samir Thapa	RESS Coordinator, AEPC, Nepal	Lalitpur, Nepal	samir.thapa@aepc.gov.np
20	Mr. Rajendra Shakya	Regional Administrator, SNV/Nepal	Bakhundole, Lalitpur, Kathmandu, Nepal	rshakya@snvworld.org
21	Dr. Anil K. Kurchania	Professor Maharana Pratap University of Agriculture & Tech.	Udaipur, Rajasthan, India	kurchania@rediffmail.com
22	Mr. Hans Heijdra	Country Director, SNV Nepal	Bakhundole, Lalitpur, Kathmandu, Nepal	hheijdra@snvworld.org
23	Mr. Willem van Nes	Biogas Practice Team Leader, SNV/HQ, The Hague	Bezuidenhoutseweg 161, The Hague, NL	wvannes@snvworld.org

6. Events and Outcome of Day-1

6.1 Field Visit

The 5th meeting of the network of experts commenced with a field visit to biogas households in Keangkhay Village in Xaythany District in Vientiane Municipality, coordinated by Biogas Pilot Programme (BPP), a joint programme of DLF/MAF of Laotian Government and SNV. It is reported that some 65 biogas plants have been installed in this district within one year of the programme implementation.

An introductory meeting was organised in the premises of Mr. Korra Khan, one of the biogas users and a local political leader. The BPP officials; Mr. Nivath Phanaphet, BPP Director and Mr. Thongchanh Santhasith, BPP Manager; were present in the venue to welcome the participants. Welcoming the visitors, Mr. Bouakeua Khounphavong, Deputy Head of Xaythany District Office, highlighted the benefits of biogas plant and expressed the commitments of the district administration in supporting biogas initiatives in the district. He shared his experience with the newly installed biogas plant in his own house and expressed hope that the electricity bills will significantly be reduced because of the use of biogas. Mr. Bouakeua told that there are many people in the district who are eagerly waiting to install biogas plant. According to him, biogas plants are most suitable for use in rural areas where people keep animals, particularly in areas without connection to electricity grid. Mr. Andrew Williamson, BPP/SNV Advisor, highlighted on the current activities and progress accomplished under the framework of the programme.

Upon the completion of the formal introductory meeting, the participants observed the IEC materials and biogas appliances displayed in the premises. The participants were than divided into three groups to visit three biogas households. The staff members of NBP and respective DAFO staff members facilitated the visit to the selected biogas households. The participants observed the physical status and functioning of operational biogas plants and collected related information from the owners.

The participants were happy to see the use of biogas for cooking, lighting and water heating. The participants enthusiastically observed the use of biogas to operate rice cooker and water-heater.


Following the visits to biogas households, participants attended lunch in a river-cruise. The informal interaction during the lunch was beneficial for the participants in sharing their views on the field findings and clarifying their queries.

The field visit, in general, has been instrumental in enhancing the knowledge of the participants on various aspects of biogas technology dissemination being practiced under the framework of BPP, Lao PDR. Observations of the operational biogas plants, as well as discussions with the owners of the biogas plants and BPP officials; have been beneficial for the participants in getting acquainted with the activities of BPP in Lao PDR.

6.2 Presentation on Carbon Financing and Lao Stakeholders' Meeting

The afternoon session of the first day commenced with the presentation of Mr. Jeroen van Bruggen, Carbon Financing Advisor of SNV Asia, on Carbon Financing. His presentation covered the following topics:

- Climate change
- Carbon financing mechanisms
- Opportunities of carbon trading for biogas programmes
- Potential opportunity for SNV in carbon trading

In his presentation Jeroen highlighted the opportunity and risks as well as future potential role of SNV in carbon trading as summarized below:

<u>Opportunities</u>:

- Increasing number of carbon-reduction methodologies are applicable for domestic biogas programme
- Carbon expertise in biogas projects is growing
- There is good demand/market for CERs and VERs
- Carbon revenue potentially can improve financial, technical and programmatic sustainability of large scale biogas programmes

Risks:

- Carbon projects require effort (expertise, financially, organisationally)
- Methodologies can be complicated and harbour uncertainties and risks
- Markets are still uncertain, e.g. because Kyoto Protocol ends 2012, no new agreement yet

SNV's Role:

- Explore possibilities to extend *Hivos Climate Fund* to biogas programmes in Laos, Rwanda, Ethiopia, Senegal (Bangladesh, Pakistan?)
- Develop more robust *Gold Standards biodigester methodology* for Nepal, Vietnam (Bangladesh, Pakistan?)

The presentation on Carbon Financing was followed by the meeting of biogas stakeholders, existing as well as potential, in Lao PDR in which participants from government, SNV, Biogas Network in Asia, donor organisations and private sector agencies took part. The meeting was initiated with the presentation form Mr. Andrew Williamson, BPP Advisor, on 'Establishing Biogas Sector in Lao PDR' followed by that of Mr. Wim van Nes, SNV Biogas Practice Area Team Leader, on 'SNV supported biogas programmes in Asia and Africa'. Mr. Williamson also presented brief summary of the recent Biogas Users' Survey conducted by Mr. Prakash Ghimire and Mr. Thong Xaysombath. Mr. Ghimire responded to various queries of the participants on the findings of the BUS.

The representatives from various stakeholders expressed their willingness to work with BPP in promotion and extension of biogas technology in the country.

7. Events and Outcome of Day-2: Workshop on Improvements of Biogas Appliances

7.1. Opening and Introduction

The meeting of the second day, the workshop of improvements of biogas appliances, started with the welcome of participants, opening remarks and agenda introduction from Mr. Wim van Nes. He recalled the tests that were carried out in three well established laboratories: Gastec Certification B.V. in the Netherlands, Chengdu Energy-Environment International Cooperation in China and Department of Renewable Energy Sources, College of Technology and Engineering in Udaipur, India to assess various parameters related to functioning and efficiencies of biogas stoves and lamps. According to him, these laboratories used their own approach and methodology of testing which were different from one another and this has resulted in differences in outcome of the tests too. However, scientists form the three countries met together to discuss the test results and minimise the differences. Pointing out the outcome of the laboratory testing, he emphasised the need of improvements in existing biogas stoves and lamps, especially in reducing carbon mono-oxide emissions. Relating to the test results, Wim highlighted the need and importance of improvements in existing biogas appliances including stoves and lamps.

He then called upon Dr. Anil K. Kurchania, Professor and Head of Department of Renewable Energy Sources, College of Technology and Engineering, Udaipur, India to present the outcome of the test results. Dr. Kurchania was one of the scientists involved in the testing of biogas stoves and lamps in the laboratory in India.

7.2. Presentation of Outcome of the Laboratory Tests of Stoves

Presenting the test results, Dr. Kurchania told that the principal objectives of the SNV supported laboratory analysis was to have a comparative evaluation on the performance, durability, safety and handling of commonly used biogas stoves and lamps under various biogas dissemination programmes. According to him, sample stoves from Nepal, Bangladesh, Vietnam, Cambodia and India; and lamps from Nepal, Cambodia and India were tested. He highlighted the test and evaluation criteria (the standards) used by the three laboratories which could be grouped in the following main categories:

For Stoves:

- Materials used for different components
- Fabrication/construction techniques
- Operation and maintenance
- Rigidity, stability and durability
- Gas consumption
- Noise control
- Emissions (Combustion, Formation of shoot -unburned carbon)
- Flashback and flame stability
- Surface temperature
- Thermal efficiency

For Lamps:

- Materials used for different components
- Fabrication/construction techniques
- Operation and maintenance
- Durability
- Illumination power (Lux/Light intensity)
- Luminance dropping rate
- Time of ignition
- Shining efficiency
- Emissions

The following were recommendations for further improvements of biogas stoves as suggested by the laboratories based upon outcome of the tests:

Table: Recommendations for the Improvements of Biogas Stoves

Samples	Gastec Certification B.V., The Netherlands	College of Technology & Engineering Udaipur, India	Energy-Environment International Cooperation, Chengdu, China
Nepal Biogas Stove 	• High CO concentrations in all test conditions- For improvement – Smaller injector will result in a smaller heat input, shorter flames and thus less CO. An injector size of 1.8 mm seems more logical. – Making the burner outlet ports more horizontal facing will results in better CO/CO2 values. Chance of boiled milk inside the burner is also reduced by this solution. – Distance between pan and burner can be extended to reduce CO values, even though this will give also a lower efficiency value. • Burner is very close to the ground, which results in high floor temperatures. Extend the legs of the stove. • Making the burner pipe longer, keeping the primary aeration holes on the same place, will result in a bigger adjustable primary aeration area, which gives the use more flexibility for setting the correct primary aeration.	• Venturi should be provided for proper mixing of gas with air and for proper combustion. • The distance between floor and burner should be increased to prevent the heating up of the floor. • Optimum air to fuel ratio is 5.5:1. Knowing this figure the injector orifice and throat area can be altered to contort the ratio. • The distance between flame port and cooking pan should be kept such that it does not interfere with flame ignition, allow the supply of secondary air to outer flame area and support the pan firmly. This distance should be minimum 35 mm to minimize the CO emission. • Proper marking on a metallic plate incorporating the information such as manufacture's name, trade mark, total gas consumption, rating etc should be given. • There should be a national standard for biogas stoves and biogas lamps.	• All the biogas stoves have the similar problems of lack of burning area. It is suggested to increase burning area to ensure that biogas could be fully combusted. • For all the sample stoves, the position of one-time air intake normally located at the throat pipe, and the air intake door is too small, which can not bring sufficient air amount. It is recommended to put the one-time air intake at the front. • For the jet designed by all the stove makers is too small and the burning area can not match the one-time air intake. It is advised that redesign and calculate this part. • It is suggested to add the gas switch. • The design of the one-time air intake and the pan support of the stove from Nepal is not reasonable. They should be properly designed. • The surface area of the biogas
Bangladesh Biogas Stove	• Making the burner outlet ports more horizontal facing will results in better CO/CO2 values and the stove can be used for bigger	• Air shutter should be provided to regulate the primary air flow. • Construction of burner was not good. Its	

	pans. Furthermore the chance of boiled milk inside the burner is reduced. It is possible the efficiency will drop by this solution. • It seems that the injector is too big, since the stove is giving a higher efficiency at lower pressure. When the injector will be smaller the stove can be used for a wider range of pressures • Inner pipe work is not leak tight. It would be better to weld all the pipe work, so the chance of release of unburned gas out of the pipe work is reduced to an acceptable minimum. • Making the straight pan holders more sloping will result in a stove which can be used also for round bottomed pans. A correct distance between round and flat bottomed pans must be taken in account	casting should be improved and ports of uniform size should be made. • Venturi should be provided for proper mixing of gas with air and for proper combustion • Optimum air to fuel ratio is 5.5:1. Knowing this figure the injector orifice and throat area can be altered to contort the ratio. • The distance between flame port and cooking pan should be kept such that it does not interfere with flame ignition, allow the supply of secondary air to outer flame area and support the pan firmly. This distance should be minimum 35 mm to minimize the CO emission. • Proper marking on a metallic plate incorporating the information such as manufacture's name, trade mark, total gas consumption, rating etc should be given. • There should be a national standard for biogas stoves and biogas lamps.	stove from Vietnam is too small and the gas can not be combusted fully, which cause high heat flow, low efficiency and CO content not matched.
Vietnam Biogas Stove 	• Making the burner outlet ports more horizontal facing will results in better CO/CO2 values and the stove can be used for bigger pans. The chance of boiled milk inside the burner is reduced. • It seems that the injector is too big. When the injector will be smaller the stove can be used for a wider range of pressures. An injector size of 2.2 mm seems more logical. Even though this must be verified in practice.	• Distance between the ground and the base should be increased so that the heating of ground can be reduced. • The system of the primary aeration through one port should be modified. If two ports of 8 mm diameter each are provided on both sides of the pipe, opposite to each other, the primary aeration will be better. • The ring given for primary air circulation	

	• Placing the burner on legs, will result in better floor temperature results • If the primary aeration will totally surround the burner pipe, instead of giving one hole, primary aeration will be better.	should be made strong so that it can control the flow properly. • Diameter of the injector jet is quite big. It should be reduced up to 1.5 to 2 mm to make it applicable for higher pressures. • There should be a national standard for biogas stoves and biogas lamps.	

Cambodia Biogas Stove
 
	• Stove is very toxic in all the test conditions. High CO concentrations are very dangerous for people. To get rid of high CO concentrations Smaller injector will result in a smaller heat input, shorter flames and thus in less CO
	  • Making the burner outlet ports more horizontal facing will results in better CO/CO2 values. Chance of boiled milk inside the burner is also reduced by this solution. It is possible the efficiency will drop by this solution.
	  • The distance between the pan and burner can be extended to reduce CO values, even though this will give also a lower efficiency value.
	• The burner is very close to the ground, which results in high floor temperatures. This can be easily solved by extending the legs of the stove.
	• Making the burner pipe longer, keeping the primary aeration holes on the same place, will result in a bigger adjustable primary aeration area, which gives the use more flexibility for setting the correct primary
		• Primary air opening should be made fully open and there should not be any restriction for air.
		• Smaller injector jet diameter (from 1.5 to 2 mm), may give better result during higher pressures.
		• Optimum air to fuel ratio is 5.5:1. Knowing this figure the injector orifice and throat area can be altered to contort the ratio.
		• The distance between flame port and cooking pan should be kept such that it does not interfere with flame ignition, allow the supply of secondary air to outer flame area and support the pan firmly. This distance should be minimum 35 mm to minimize the CO emission.
		• Proper marking on a metallic plate incorporating the information such as manufacture's name, trade mark, total gas consumption, rating etc should be given.
		• There should be a national standard for biogas stoves and biogas lamps.	

	aeration. •		
India Biogas Stove 	• Reducing the injector will have a good effect on the efficiency and CO/CO2 emissions. The correct size is off course depending of the usual inlet pressure. An injector size of 1.8 mm seems more logical. Even though this must be verified in practice. • The metal cover is looking fine, but not strong. Consolidate the construction in the corners with steel bars seems to be a good improvement. • The burners are connected through one screw to the cover. The other side is hanging on the gas tap. The construction must be improved to make sure the burners stay in the correct position. This can be easily made through a brace square to the burner pipe connected to the cover.	• Proper air regulator which can be adjusted easily should be provided to control the primary air flow. • Diameter of the injector jet should be reduced up to 1.5 mm and venturi should be used for better result. • Optimum air to fuel ratio is 5.5:1. Knowing this figure the injector orifice and throat area can be altered to contort the ratio. • Proper marking on a metallic plate incorporating the information such as manufacture's name, trade mark, total gas consumption, rating etc should be given. • There should be a national standard for biogas stoves and biogas lamps.	

7.3. Discussions and Clarifications on Tests Results

Taking part in the discussion, Mr. Richard Pullen, Director of DTW put forward the following issues.

- There is total lack of standardisation of biogas appliances.
- There seems lack of applied R&D activities and innovations in all the countries. The main question is who should initiate/carry out the R&D works - the manufacturers or the biogas programmes or the government agencies?
- Establishment of regional facility for R&D, testing and certification could be one solution, though this is not the only solution.
- Though innovating a 'silver bullet' is not possible, however, there is need to have some regional standardisations.
- When it comes to biogas appliances, especially the stove, its appearance is not that important, however, performance plays the main role.
- It is better to carry out field testing without involving 'rocket scientists'.
- There is need to have standardisation not only on design but also on product performance, handling and filed testing of appliances.

Questions were raised by the participants on the consistencies of the test results form three laboratories as well as the validity and reliability of the testing procedures. As there were no representatives from the other two test centres than that from India, it was agreed that the participants will prepare the list of their queries and send them to Mr. Wim van Nes for conveyance.

7.4. Group Discussion and Presentation on Improvement Options

Following the presentation and discussions on test results of biogas stoves, a group exercise was proposed. Mr. Jan Lam initiated the session with the highlights of objective of the group discussions. The purpose of group discussion, according to him, was to build on the outcome of the laboratory tests and propose the improvement options, modality for carrying out such improvements as well as future plan of actions of each country programme to improve the performance of biogas stoves. He asked the participants to come up with key points that are important and relevant for ensuring the basic minimum improvements that are needed. For carrying out R&D and standardisation three possible options were suggested:

1. Centralised R&D and decentralised (in-country) manufacturing
2. Decentralised (in-country) R&D and decentralised manufacturing
3. Regional (Joint Venture of two or more adjoining countries) R&D and manufacturing

Mr. Lam asked the participants to consider the following issues while recommending for future plan of action to implement the proposed improvement options.

- Clear understanding of the existing shortfalls of stoves and improvement options (A clear TOR formulation)
- Presence of capable R&D institutions in the country to carry out the anticipated improvements

- Capacity of the country biogas programmes to implement, follow-up/monitor the R&D works
- Capacity for testing of efficiency (field testing in particular) and CO emissions
- Availability of budget for R&D and follow-up activities

The participants were then divided into five country groups for discussion. The outcome of the discussion was presented by one of the participants from each country groups as summarised below:

a. Nepal Country Group

Mr. Samir Thapa presented the outcome of the discussions of this group. His presentation was focussed on national approach for stove development. He summarised the following plan of action for the future:

- Review test results thoroughly
- Clarify unclear issues
- Share the findings and recommendations with stakeholders especially the manufacturing workshops
- Identify/prioritise issues for further improvements
- Develop national standards on survey, lab-testing and field testing (supports may be needed from outside)
- Share the standards with stakeholders
- Incorporate the standards in National Programme
- Modify the designs based upon the standards

Mr. Thapa clarified that the second option of decentralized (in-country) research and decentralized manufacturing would be favourable option for Nepal given the national context.

b. Cambodia Country Group

Mr. Jan Lam presented the outcome of discussion on the future action plan of Cambodia. He highlighted the existing situation and positioning of NBP-Cambodia as:

- NBP Cambodia fully realises that there are lots of rooms for further improvements of biogas stoves presently being used.
- There is no capable R&D institution in Cambodia at this moment.
- The capacity of the technical unit of NBP Cambodia is very limited for follow up and monitoring activities related to R&D. Moreover, the unit is already overloaded and there is no time available to carry out additional works of R&D.
- There is high need of centralised manufacturing within the country.
- There is need for field testing protocols/standards to be formulated.
- There is need for testing (both laboratory and field) involving an well-equipped institution.
- NBP is willing to make available the needed resources for R&D. There is budget available.

Based upon the above mentioned situation, Mr. Lam told that NBP Cambodia is in favour of the first option - centralised R&D as well as standardisation and decentralised manufacturing. He also expressed

the willingness of NBP to cooperate on R&D with other biogas programmes that are using similar stoves. According to him, NBP is ready to co-finance the R&D activities with Nepal and/or Bangladesh.

c. Bangladesh Country Group

Presenting the outcome of the group discussion of Bangladesh country group, Mr. Nazmul Haque (Faisal) from NDBMP, Bangladesh emphasised the preference on the second option, decentralized (in-country) research and decentralized manufacturing. He highlighted the following issues:

- There is need for NDBMP to follow the national standards and therefore, the R&D on stove should be done with in country itself.
- NDBMP may need technical advices on R&D and specialized support for field testing services from national and international experts.
- There are capable institutions in Bangladesh with proven track records to carry out applied research such as BUET and BSTI. Based upon findings of test results the design of stove could be improved in consultation with these institutes.

d. Vietnam Country Group

Mr. Le Anh Duc presented the outcome of the country group from Vietnam. He reported that there are many workshops in Vietnam that are producing biogas stoves, but only few are registered. He summarized the proposed action plan of BPD as follows:

- Carry out further laboratory testing of few more samples of biogas stoves being used in the country referring to Chinese and/or Indian standards.
- Analyse the test results and make recommendations for further improvements.
- Formulate national standards for biogas stoves.
- Manufacture sample stoves based upon national standards and test them in laboratory.
- Pilot the stoves at the filed and carry out users' surveys.
- Based upon the outcome of the pilot study, finalise national standards and apply them.

e. Lao PDR Country Group

Mr. Andrew Williamson presented the outcome of the discussion of the Lao country team as follows:
Lao Biogas programme is relatively new and has very little experience in the field – there are no real data and information collected from the field yet.

- BPP Laos is using the LPG stoves manufactured in Thailand with some modifications to suit the use of biogas. These stoves are not perfect however, are serving the purpose satisfactorily.
- The following are the major requirements for BPP Lao PDR:
    - Proper optimization of existing LPG stoves to make it suitable for biogas.
    - Manufacturing of simple valve (biogas tap).
    - Local manufacturing workshop identified and capacitated to produce appliances.
    - The Thai stoves are relatively expensive (USD 20 when tax is paid) and hence low cost stoves are needed. Further, these stoves encounter corrosion within a short time span of

their use. Therefore, corrosion resistant, fancy looking, relatively light in weight, stoves are needed.

- The stoves should be optimised to accommodate the pot used to cook sticky rice (popular food in Lao PDR).

According to Mr. Williamson, the following will be the plan of action for Lao PDR:

- Formulate national standards for biogas stove.
- Test the existing Thai stove in use.
- Explore possibility of importing quality stoves from Cambodia, China and Vietnam.
- Take decision on whether to use existing design or prepare new Lao model.
- Capacitate local manufacturing workshop and start in-country production.

7.5 Questions and Clarifications on Group Presentations

Mr. Jan Lam wanted to know from Nepal Country group who will take initiatives and responsibilities for the modifications. Mechanical Department of the Kathmandu University and Energy Faculty of Tribhuvan University were reported to be the potential partners to carry out these tasks. Mr. Prakash C. Ghimire expressed his concerns that the development of standards may consume longer time. His question was, can we wait for such a long time without doing anything to correct the pitfalls of Nepalese stove as indicated in the test report? Discussions were held on whether to opt for single burner or double burner stoves. Participants agreed that the type of stove should suit the food habits and cooking pattern of the users.

Mr. Richard Pullen expressed concerns that the type of research and designs should comply with the interests of the manufacturers. Mr Wim van Nes was of the view that design and manufacturing are two different things and should be viewed separately. He emphasised the importance and need of effective quality control mechanism to produce quality stoves. He commented that the action plans of Nepal and Vietnam are time consuming which will not serve the immediate purpose of rectification of existing problems in stoves. He also expressed doubt if the existing expertise in the countries are capable enough to carry out the anticipated tasks.

Mr. Le Van Tan told that there are different types of biogas stoves being manufactured in Vietnam and there are no reliable data and information on the performance of these stoves. The users do not know which one is the best to purchase. Pointing out the need of large number of stoves in the country given the higher rate of installation of biogas plants, he asked if SNV could support in testing all the designs of stoves that are being manufactured in Vietnam and recommend the best. He also pointed out the need to build awareness of users on selecting the quality stoves.

Mr. Nazmul Haque (Faisal) suggested SNV to concentrate on local capacity building at the national level rather than opting for a centralised R&D. Wim clarified that the idea is not to centralise the whole process of R&D and manufacturing, however, to seek for collaboration and cooperation as much as possible.

7.6. Summary of Group Discussion and Presentations

The participants from Nepal, Bangladesh and Vietnam favoured to go for the second option, decentralised (in-country) R&D and decentralised manufacturing, while Laos and Cambodia favoured

either the first (centralised R&D and decentralised manufacturing) or the third options (Regional -Joint Venture of two or more adjoining countries R&D and manufacturing). All the participants fully realised that there is high need for the improvements in biogas stoves being used under the frameworks of various biogas programme.

7.7 Presentation and Discussions on Improvements of Appliances

The session after lunch started with the country presentations on status of different appliances being used. The summary of the presentations have been given below:

a. Cambodia

Ms. Lam Saoleng presented brief overview of different appliances being used under the framework of NBP-Cambodia. She reported that main gas pipe (dome pipe), biogas stoves, gas taps and water drains are manufactured locally in DTW. Biogas lamps and pressure meters are being imported from China. According to her, NBP Cambodia would like to initiate the following as early as possible:

- Redesign of stove to ensure lower CO emissions
- Foolproof primary air regulating mechanism without need for adjustment in stoves
- Introducing of venturi techniques in stoves for higher efficiency due to better gas-primary air mixing
- Better shock resistant thicker mantle cover (glass) for biogas stoves
- Better shock resistant mantles for biogas stoves
- Better corrosion resistance upper shell for biogas lamps, and
- Better corrosion resistance thicker reflector for biogas lamps

Mr. Duc Anh expressed that the thicker glass cover will decrease the illumination (lux) and wanted to know why thicker covers (upper metal reflector) are proposed. Mr. Lam clarified that the higher temperature causes reflector to become very hot and prone to accident which necessitates mechanism to minimize the effect of higher temperature. Dr. A.K. Kurchania wanted to know why bigger sizes of biogas plants (4, 6, 8 and 10 cum) are proposed within a framework of domestic biogas programme in Cambodia. Mr. Ghimire made it cleat that the common practice to call the sizes of biogas plants in Cambodia, Nepal, Vietnam and Laos are based upon the total volume of digester and gas holder; which is different from the practice in India and Bangladesh, where the size of biogas plant denotes the capacity of biogas plant to produce specific quantity of gas per day. For example, biogas plant of 2 cum in India corresponds to that of 6 cum in Cambodia. Mr. Thapa expressed is view that the costs of biogas plants in Cambodia are relatively higher. Mr. Bajgain wanted to know whether NBP Cambodia has been facing the problem of wear and tear of washer (commonly called as 'O' rings) in the gas taps as in Bangladesh and Nepal. Mr. Lam told that the washers till date are functioning satisfactorily. Mr. Pullen told that the washers are purchased in the local market; however, the quality is relatively better.

b. Nepal

Mr. Khagendra Khanal presented the proposed changes envisaged by BSP Nepal to reduce the cost of appliances without compromising the quality. According to him the following are some of the problems which call for some changes as described below:

- Size of dome gas pipe 1.5"Φ seems slightly bigger which can be reduced to 1"Φ. The length of this pipe could be reduced to 60 cm from the existing 75 cm.

- It is difficult to clean the dome gas pipe if it is clogged with slurry or scum entering into it. Introduction of 'T' in this pipe will enable easy cleaning of the pipe when clogged.
- The handle of water trap is too small. There is need to have bigger handle for water trap. Likewise, there is prospect of cost reduction by the reduction of the length of water trap to half the present size. BSP is also exploring the possibility of introducing automatic draining devices.
- There is need to change the handle of gas tap to ensure durability. Due to higher carbon accumulation the washer gets damaged; however, no alternative is yet decided.
- The users have complains that the main gas valves being used, which are imported from Thailand, need frequent greasing. If a mechanism to inject grease automatically could be introduced, the robustness of the device will be enhanced.
- Attempts are being paid to start manufacturing of main gas valves in Nepal.
- The handle of the mixing device encounters corrosion within a short duration of use. There is need to galvanise this part too. Also the height of pivot needs some adjustments.

Mr. Lam expressed his concern that galvanising the handle of the mixing device may add the cost unnecessarily. Mr. Teune wanted to know if biogas is used to generate electricity in Nepal. Mr. Lam told that there were biogas plants of bigger sizes used to generate electricity; however, all these plants later became dysfunctional due to various reasons.

c. Bangladesh

Mr. Sundar Bajgain highlighted the issues from NDBMP Bangladesh as:

- The water drains need to be made as short as possible so that the drain pit could be constructed at a higher elevation to avoid ground water problems.
- The washer in the gas tap, similar to that used in Nepal, is reported to be problematic by the users. Hence simple ball valves are being used in Bangladesh; however, the suitability of such local ball valves is highly questionable.
- Galvanising of mixing device has been one of the problems in Bangladesh and enamel paints are widely used. However, this is not the right solution. Farmers are very happy with the installation of mixing devices.
- The dome gas pipe of 1.5" Φ is being used and it seems all right. However, if the cost of pipe goes up, the programme will think of using the pipe of 1" Φ.
- Lamps are not in priority for the users. However, if needs arise, the existing BCSIR model could be used.
- Gas pressure meters are not mandatory at present. Piloting is being done in some of the households. Decisions will be taken based upon the outcome of the piloting.
- Biogas stove needs modifications as pointed out in the test report. One of the workshops in Bangladesh has already produced double-burner biogas stoves with better fancy look. These stoves are being tested.

Dr. A.K. Kurchania asked whether it is mandatory to install gas pressure meter. Mr. Bajgain replied that till now it is not mandatory. He told that pressure meters are being installed in some of the households.

As these pressure meters are not available in the local market and importing them from China is a real hassle in Bangladesh, the programme is cautious in making this provision mandatory, according to him.

d. Lao PDR

Reminding the fact that biogas programme in Lao PDR is relatively new and there are not many issues to share, Mr. Bounthavy Sengtakoun highlighted the following issues.

- The gas pressure meters are being imported from China. The quality is not up to the required standards. Farmers have complains on the functioning of these devices.
- Biogas lamps are also reported to be problematic by the users. The glass covers are not durable and mantles are highly vulnerable to damage.
- The main gas pipe (dome pipe) being used is of 1"Φ.

Mr. Sengtakoun asked the participants for their comments and suggestions on the use of 1"Φ main gas pipe. Mr. Lam emphasised the need to prevent entry of slurry in and clogging of the pipeline. According to him, bigger size is better if there are cases of slurry in the pipeline.

e. Vietnam

Mr. Le Anh Duc presented the cases from Vietnam. He started with the historical background of the research and development of biogas appliances in Vietnam. He highlighted the following facts:

- Before 1976, only the LPG stoves were used especially in the southern provinces.
- During 1976-81, R&D was initiated under the framework of National Programme on New Energy on fire-brick stoves.
- The Ho Chi Minh University of Technologies conducted research on iron-framed cook stoves with spherical burners during the period 1982-90. Later Hanoi University of Technologies and Vietnam Institute of Energy also carried out research on biogas stoves, lamps and small generators.
- At present there are different types of biogas stoves available in the market. However, the lamps are still being imported from China.
- Water heaters and small generators are increasingly operated using biogas.
- Pressure meters and desulphurisation units are also installed.
- Pipes and fittings are produced widely in the country.

According to Mr. Anh Duc, investment in research and development of biogas appliances in Vietnam is very negligible. He also pointed out the fact that there are not yet effective quality standards and compliance mechanisms in place on the production of biogas appliances. He concluded that the substandard quality of appliances has resulted in gas leakages.

Commenting on the issues of gas leakage from appliances, Jan pointed out the need to avoid such leakages not to have negative effects on carbon trading.

7.8 Summary of Presentation and Discussions on Improvements of Appliances

Summing up the issues from the country presentations on appliances, Wim stressed the need to initiate immediate actions for improvements. He pointed out the possibilities of working jointly or independently for such improvements:

- Nepal and Bangladesh can work jointly for the improvements of mixing device. The proposed changes can be done in-country. Mr. Lam asked if the proposed changes are documented with justifications and circulated to all the network members.
- No joint or regional initiation is needed for the improvements of main gas pipe (dome pipe). It can be done locally.
- Imported main gas valves are of good quality; however, use of locally available valves is preferable given the low costs and easy accessibility.
- The types of pipe and fitting depend upon the need of stakeholders. Country programmes will take decision in this regards. Mr. Lam wanted to know the performance of HDPE pipes in Nepal which have been widely used in these days to replace the GI pipes because of the restrictions form the security personnel to transport metal pipes in remote areas fearing security reasons. Khagendra told that the performance is not as good as that of GI pipes. He recommended using GI pipes as far as possible.
- Water drain is not a big issue. It can be modified locally.
- BPD Vietnam will keep others informed about the performance and effectiveness of the desulphurisation filter. The value-addedness of such device should be monitored carefully.
- Pressure meters seem to have problems. Mr. Khanal shared the problem of gas leakage as well as indicator not working properly. Mr. Bajgain recommended monitoring the performance before coming into the conclusions.

Mr. Van Nes asked all the participants to formulate future action plan as early as possible and initiate the anticipated improvements. He also asked all to share the progress. He advised Nepal, Bangladesh and Vietnam to prepare an individual action plan; and Laos and Cambodia to formulate a joint action plan. He assured the participants that the budget issues will not be a problem. It was decided that Mr. Ghimire will prepare a questionnaire and send to all the country programmes for information collection in this regards. Mr. Lam emphasised the need of making use of the existing research institutes in Nepal, Vietnam and Bangladesh.

7.9 Presentation of Outcome of the Laboratory Tests of Lamps

Following the discussions on appliances, Dr. Anil Kurchania presented the outcome of the laboratory test of biogas lamps conducted in the three research institutes. The following table summarises the main recommendations as suggested in the test reports:

Table: Recommendations for the improvement of Biogas Lamps

Samples	Gastec Certification B.V., The Netherlands	College of Technology & Engineering Udaipur, India	Energy-Environment International Cooperation, Chengdu, China
Nepal Lamp 	• Placing first the straight pipe and then the gas tap would result lower temperature. • Providing a rubber ring with adapter will stop the leakage. Construction should be made minimum connections to avoid leakage. • Divide combustion air opening equally will divide the flow. Less ceiling temperature. • Strong construction is required. • A metal burner will cover the problem of breaking the burner • Changing the pipe work to a rust free construction will improve the durability.	• Temperature of the air regulator was quite high. Necessary arrangements should be done like proper distance, insulation. • Air regulator handle should be made sturdier.	• Biogas lamps are low in heat load and illumination, which directly affect lighting efficiency. The reason is that the jet, injecting distance, size of mud head (combustion) and yarn mantle are not matched.
Cambodia Lamp 	• Construction of the glass holder should be made stronger to protect the glass. • Metal burner head for long life. • Replacing the gas tap by a stronger variant will ensure more safety and reliability for the user. • A metal ring above the combustion holes will result in a better separation of the hot	• Air regulator should be modified for the better control of the primary air flow. • Construction of upper shell should be made strong. Reflectivity of the reflector should be improved for the better performance. • Protection over the glass should be	• Although the jet is big, heat load is also big, yet the mud head is too small, the one-time air intake can not be adjusted. And the yarn mantle is not matched neither. • Hence during the combustion process there is obvious flame, the lighting efficiency is too low and the

	air. This will ensure better ceiling temperatures.	given for its long life.	temperature at the upper part of the lamp is too high.
Indian Lamp 	• Provision of some holes to allow to escape flue gasses. Construction should be such that ceiling will not attain a higher temperature. • The mica could be used, but maybe a stronger and thicker version. The metal welded bars must be much stronger, so the use can easily handle the lamp. • The tap for small adjustments is reaching a temperature of 120 0C. Placing the tap in a higher position will result in lower temperatures. • It is difficult to reach the gas tap, since it is above the lamp and reaching a high temperature. A small chain on the gas tap could help operating the appliance. • The small adjustment valve is not improving the lamp and gives more maintenance. Remove the tap.	• Temperature of the gas knob, air mixing tube was found high. Necessary arrangements should be done to protect the surrounding from fire. • Air regulator should be provided to control the primary air flow.	• In design, although a head switch and a gas switch are added to the jet (adjusting gas flow), still the mud head is very small and biogas could not be burned normally. • Heat load is near to the normal value and lighting efficiency is still very low. • Structure of biogas lamp is complex and the self-weight is too heavy while the production cost may be high (i.e. All are of rare metals like copper, aluminium and mica.

7.10 Discussions on the results of Laboratory Tests of Lamps

Following the presentation of Dr. Kurchania, Mr. Ghimire raised questions on the results on luminance dropping rate of different biogas lamps. Mr. Williamson wondered why there are no good quality lamps produced till date despite the rapidly growing market. Mr. Pullen clarified the need to trade-off between cost and performance. Mr. Van Nes pointed out the need to prepare an inventory of lamp manufacturing companies as well as the suppliers presently active in Asia. He emphasized the need to work with the existing manufacturers rather than creating a new one. Mr. Pullen revealed that profit will be in the centre of any manufacturing company to invest in any new product or diversify the production. He suggested identifying some potential manufacturers and negotiating with them. Mr. Lam raised the issue of certification. Mr. Van Nes told that the standards are not complied fully by the manufacturers. Mr. Ghimire cited the example of the test result from China – the Chinese Lamp imported in Cambodia was sent to the testing institute. The testing institute followed the national standards of China to evaluate different parameters of the lamp. Interestingly, the test result indicated that majority of the parameters do not comply with the national standards. Mr. Pullen suggested that because of the fact that the bigger the customer, the more the manufacturers listen, it is good to have a collective negotiation with one of the reliable manufacturer.

Mr. Ghimire and Mr. Lam were named to prepare an inventory of the existing manufacturers in Asia, especially in China and India, and recommend future plan of action.

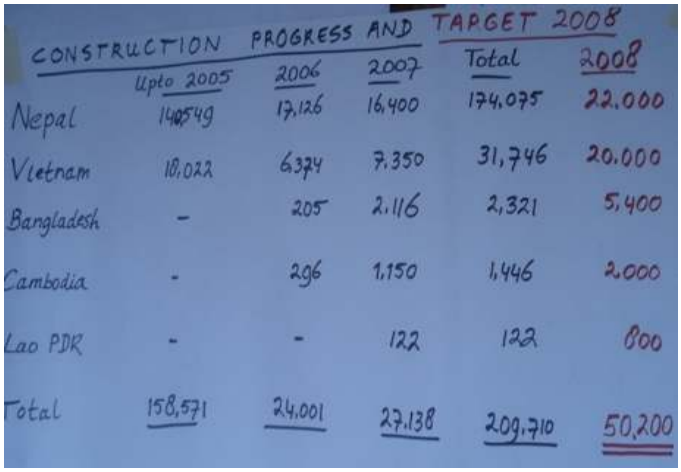
Mr. Van Nes asked if all the issues that were anticipated to be discussed during this meeting have been covered. Mr. Williamson asked if we are going to discuss on other appliances such as rice-cooker, water heater, refrigerator, small duel-fuel engines. Mr. Lam expressed his doubt that there may not be sufficient market for these end-use applications. Mr. Ghimire suggested considering the diversification of end-use applications in case gas production is much more than consumption such as in Lao PDR. His suggestion was, either we have to reduce the average size of biogas plant or opt for diversification of end-uses.

7.11 Miscellaneous Issues

The group discussion and presentation was followed by the reviewing of action plan agreed in the previous meetings of experts as well as other issues related to programme implementation. Mr. Van Nes moderated the discussions on the following issues:

a. Construction Progress

Mr. Van Nes presented the construction progress and targets, in terms of number of biogas plants, of different country programmes as given in the picture in the right. He stressed that there is lot more to achieve in this year. He strongly urged all the country programmes to use all their means and efforts to fulfil the anticipated targets. He



CONSTRUCTION PROGRESS AND TARGET 2008

	Upto 2005	2006	2007	Total	2008
Nepal	140549	17,126	16,400	174,075	22,000
Vietnam	18,022	6374	7,350	31,746	20,000
Bangladesh	-	205	2,116	2,321	5,400
Cambodia	-	296	1,150	1,446	2,000
Lao PDR	-	-	122	122	800
Total	158,571	24,001	27,138	209,710	50,200

cautioned not to compromise quality while increasing the number of installations.

b. Annual Reports

Mr. Van Nes told that the annual report is being finalised and the final version will be circulated soon. He thanked all concerned for their time and efforts

c. Mid Term Evaluation of Asia Biogas Programme

Mr. Van Nes pointed out the need to carry out mid-term evaluation of Asia Biogas Programme (ABP) comprising of biogas programmes in Vietnam, Laos, Cambodia and Bangladesh this year. He informed that it will not be possible to conduct the study before the monsoon season. He told that DGIS will be preparing TOR and select the consultants for the evaluation.

d. Bioslurry Study Tour in Bangladesh

The bioslurry study tour to Bangladesh, as planned, will be organised in November 2008 as per the suggestions from Dr. Fokhrul Islam.

e. Meeting of Administrators

The meeting of administrators form different biogas programmes will not take place in the first half of 2008. Mr. Rajendra Shakya will conduct preliminary discussions and negotiate with regional office and discuss with Finance Officers to settle this issue.

d. Next meeting

Mr. Van Nes proposed the next meeting to be held in Bangkok, Thailand in the third or early fourth week of October 2008. This meeting will be combined with an International Workshop on Financing of Domestic Biogas Plants. This meeting will comprise of participations from biogas programmes both in Asia and Africa. It will be good opportunity to review the experience from Cambodia where the credit system has been initiated and experiences from Nepal where the system is well matured.

8. Evaluation

A formal evaluation of the two-days meeting of the members of the Network of Experts on Domestic Biogas was carried out at the end. The participants were provided with a semi-structured questionnaire to evaluate the effectiveness of the training. The following table summarises the outcome of the evaluation.

Evaluation Results

Issues	Very poor	Poor	Fair	Good	Very good	Remarks
Hotel Arrangements		5%	25%	45%	25%	- Rooms were very dark and without ventilation. - Internet connectivity was an advantage. - Welcome letter and other documents were delivered after one day of the arrival by the hotel authority. - The hotel was only good for one night stay! Cooperative staff. But the room was without proper ventilation. - Room was like tunnel/bunker! - Hotel was too far from the meeting venue!
Field visit arrangements	-	-	10%	60%	30%	- Provide additional visits to under-construction plants as well. - Short but enough to get an impression. - No plants to show use of bioslurry. - Translator/facilitator could not manage the team. - The participation of the local governor was good. - It was great to see the use of rice-cooker and water heater from biogas. - Lunch on the boat was really fascinating!
Session on Carbon Financing	-	10%	45%	35%	10%	- Explain more about concerning credit equivalent between CH4 and CO2 - Perhaps too basic. - Old slides which have been shown time and again was used. - The presenter lacked some knowledge and information on carbon credit and biogas. - Acknowledge the difference in knowledge of group in the subject. - Presentation should have been more specific and to the point. - No need to talk about climate change or other theory! - Since carbon financing is instrumental in sustaining the programme in the long run, it was good to have knowledge on this aspect.
Lao Biogas Stakeholders' Meeting	-	15%	25%	50%	10%	- Stakeholders should have been given opportunity to speak how they would like to be associated. - May be more a meeting to have among national stakeholders only.

						- It would have been even better if more participation had been from the stakeholders than from SNV.
Presentation of Dr. A.K. Kurchania	-	10%	30%	55%	5%	- Talk louder and emphasis on important issues. - Some questions were not addressed satisfactorily. - Could have been more efficient! - Could start with stove and lap performance factors. - Would have been better if key points were given attention. More brief and to the point! - Since Dr. Kurchania had to present even the test results from China and The Netherlands, some gaps were felt. - It seems that the presenter was not involved in the research by himself. - A good attempt to present such a big stuff!
Group discussions, presentations and plenary discussions	-	-	20%	50%	30%	- It was good to know/learn about appliances and the potential areas for improvements. - It was good to learn from different country groups about the existing problems and areas for further improvements.
Overall rating of the meeting	Useless -	Not useful -	Moderate 10%	Useful 40%	Very useful 50%	- Learning atmosphere. Such meeting should be continued. - Since I am new to the network, if gave me insight into the actual process of biogas programme support by SNV. Appreciated! - It was really useful particularly from carbon financing knowledge and importance of improvements in appliances as it is important to avoid gas leakage increase efficiency!
Comments and suggestions	- Access information from other countries on their biogas programmes. - Appreciation for the excellent organisation by the Lao Team and the chairmanship of Wim. - Good to share experiences and learn from others in the programme. - Programme was great, learned a lot; perhaps a little too compressed/very busy. - Well organised from landing at the airport, the hotel, meetings and sessions. Well done all concerned! - I appreciate the efforts made by the organising team members, especially Wim and Lao Team. Thanks to their great efforts and cooperation. - We have been time and again requesting to organise residence and meeting in the same hotel but it is never heard. Repeating in Bangladesh, Cambodia and now in Lao.					

9. Closing

Speaking in the informal closing session, Mr. Samir Thapa expressed his full satisfaction on the outcome of the meeting. Reminding it to be his first meeting, he appreciated the formation of the team, both the SNV staff members and the representatives form the counterparts. He revealed his deep satisfaction on the outcome which has helped him to learn new things and share information. On behalf of the participants, Mr. Jan Lam extended heartfelt thanks to the Lao Team for organising this great event and applauded the unfailing endeavour of Mr. Wim van Nes to organise and conduct and successfully complete this event. At the end, as a token of appreciation, the organising team from SNV Lao PDR and BPP Lao PDR were commended for their hard work and unfailing support to make this meeting a great success.