

**Mission Report
on
Selection of Biodigester Design
and
Formulation of Quality Control Framework and
Certification Procedures for Biogas Constructors**



Prepared for
**Indonesia Domestic Biogas Programme
(IDBP)**

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ABBREVIATION

ABP	:	Asia Biogas Programme
BORDA	:	Bremen Overseas Research and Development Association
CBO	:	Community Based Organisation
CAMARTEC	:	Centre for Agricultural Mechanisation and Rural Technology
DGEEU	:	Directorate General for Electricity and Energy Utilisation
DGIS	:	Directorate General for International Cooperation (The Netherlands)
DRE	:	Department of Renewable Energy
GGC	:	Gobar Gas (Biogas) Company (Nepal)
GTZ	:	German Agency for Technical Cooperation
HDPE	:	High Density Poly Ethylene
Hivos	:	Humanistic Institute for Development Cooperation
HRT	:	Hydraulic Retention Time
IDBP	:	Indonesia Domestic Biogas Programme
LPG	:	Liquefied Petroleum Gas
LPTP	:	Institute for Rural technology Development
M&E	:	Monitoring and Evaluation
MFI	:	Micro Finance Institute
MOE	:	Ministry of Energy
NGO	:	Non Governmental Organisation
O&M	:	Operation and Maintenance
QC	:	Quality Control
R&D	:	Research and Development
SNV	:	Netherlands Development Organisation
ToR	:	Terms of Reference
US\$:	United States Dollar

US\$ 1 = 10,000 Indonesian Rupiah (IDR)

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1. Introduction and Background

In 2008, a study was conducted by the SNV – Netherlands Development Organisation to assess the feasibility to set-up and implement a national programme on domestic biogas in Indonesia. This study was commissioned on request of the Directorate General for Electricity and Energy Utilisation (DGEEU) of the Government of Indonesia (GOI) by the Environment and Water Department (DMW) of the Directorate General for International Development (DGIS) of the Netherlands Ministry of Foreign Affairs and the Royal Netherlands Embassy (RNE) in Jakarta. The study report concludes that a national programme on domestic biogas in Indonesia is feasible as:

- Indonesia has already some history in domestic biogas with about 6,000 units constructed throughout the country so far;
- The technical potential for biogas amounts to minimum one million units, while there are no strong limiting social factors;
- The financial analysis indicates that an amount of IDR 2,000,000 as investment subsidy is generally sufficient to attract potential farmers resulting in a satisfactory financial internal rate of return (FIRR) of 19 percent for the farmer if firewood is replaced. The actual FIRR realized by the farmer, however, is largely dependent on the actual financial price for biomass. If kerosene is replaced by biogas, the FIRR amounts to 31%;
- Indonesia is endowed with a large number and variety of institutes, organisations and companies with a large potential to participate in the implementation of a national programme, and;
- There is a will and interest among (potential) stakeholders to be engaged in a national programme.

Based on the study findings, Hivos prepared a proposal for an Indonesia Domestic Biogas Programme (IDBP). This proposal was submitted early 2009 to RNE in Jakarta for co-financing. Under the framework of IDBP, overall programme and fund management as well as technical assistance will be carried out by Hivos, while SNV will provide knowledge transfer and back-up of technical assistance. The programme will be implemented by biogas programme offices in each province, selected in consultation with relevant stakeholders. Starting from four provinces in Java, it will gradually expand to other provinces outside Java as well. Criteria for the districts to be chosen within the selected provinces are high livestock population stabled, at least through the night and the presence of potential actors at the supply side, notably constructors and financiers. One of the activities to be conducted immediately is the selection of the most appropriate technology for dissemination under the framework of Indonesia Domestic Biogas Programme.

A Terms of Reference (TOR) was developed by IDBP with the objectives: (i) to select the best suitable standard model of biogas plant for Indonesian context, (ii) to formulate the general quality control framework, and (iii) to devise the certification process for private sector participation. Based upon this TOR, a technical mission was organised during the period June 06 to 26, 2009. This brief report summarises the activities and outcomes of the mission.

2. Objectives of the proposed biogas programme

The overall development objective of the Indonesia Domestic Biogas Programme is to disseminate domestic biodigesters as a local, sustainable energy source through the development of a commercial, market oriented sector in selected Indonesian provinces.

The specific objectives and indicators of the programme are as follows:

- To support implementation of provincial biodigester programmes and increase the number of quality domestic biodigesters with 8,000. Indicator: number of digesters built by – year 1: 900, year 2: 3,300, year 3: 3,800.
- To ensure the continued operation of all biodigesters installed under the programme. Indicator: 90% of all digesters built in the previous years are in operation.

- To maximise the benefits of the operated biodigesters, in particular the optimal use of digester slurry (agriculture and horticulture, ducks and fish rearing). Indicator: a minimum of 50% of digester owners are applying bioslurry to agriculture and horticulture and/or fish and/or duck rearing in a proper manner.
- To develop the capacity of existing organisations and institutions and to facilitate establishment of organisations and institutions for the continued and sustained development of the biodigester sector in selected Indonesian provinces. Indicator: Sufficient, qualitatively effective local organisations are involved to achieve the various objectives of the programme at national and provincial level.
- To develop financial services to enable poor farmer households to participate in the biogas programmes. Indicator: Poor farmer households have sufficient access to appropriate financial services to be able to purchase a biodigester (minimum 45% of digesters financed by households through loan)
- To effectively exchange knowledge between all relevant actors in the programme and with relevant international actors. Indicator: Linking and learning knowledge exchange events have been organised in and between each province, at national and international levels to inform the relevant actors in the biogas programmes of opportunities and constraints. (Reports of these meetings and follow-up activities will be produced; appreciation of the participants will be measured).

3. Rationale of the Mission

It is well understood that the success of a national biogas programme depends heavily upon the workable and effective implementation modality that is based upon the grassroots realities. These include, among others, information on physical status and functioning of existing biogas plants, users' perception on the technology, impact of biogas plants on the users, and capacity of the grassroots communities to adopt and internalise the technology. Information on these issues would help in deciding best suitable implementation modality for the program. This technical mission has been considered to be instrumental in collecting first hand primary data and information on these issues from the users' level so that the findings are reflected in the implementation plan.

Experiences have proved that non-functioning and poorly functioning biogas plants cause not only capital waste but also do a lot of harm to the reputation of biogas technology and eventually to the desired future expansion biogas program. Experiences from various biogas programmes have shown that satisfied biogas users are the main and effective extension medium for the promotion of the technology and vice-versa. Hence, to safeguard the interest of the users, it is important that the biogas plants function to the desired level; which is only possible when the plants are constructed and operated as per the set quality standards. To ensure the quality of biogas plants, it is important that effective quality control mechanisms are formulated and enforced. Quality management, therefore, should be a vital component of the programme.

The private sector, especially the constructors of biogas plants and manufacturers of biogas appliances, are means to develop a more productive biogas sector and to increase the economic participation of the population in the sector. Participation of the private sector helps creating checks and balances between countervailing powers, and minimises the role of the government sector from the need to intervene. Keeping this in mind, the biogas programme is anticipated to aim at letting the biogas sector develop by using the internal forces of demand and supply and by reducing external driving forces such as centrally planned production targets and subsidization in the long run, though the immediate or short term driving force would be external, like subsidy. Effective mobilization of the private sector, therefore, is very important for the sustainability of the proposed biogas programme. The programme, therefore, should address the issue of private sector mobilisation in an effective and efficient manner.

4. Objective of the Mission

The main objective of the mission was to assist Indonesia Domestic Biogas Programme in:

- a. Selecting best suitable design/model of biogas plants for wide-scale dissemination of the technology in the country under the framework Indonesia Domestic Biogas Programme

- b. Formulating basic framework for quality management mechanism in general and quality control in particular, within the Biogas Programme
- c. Preparing general accreditation/certification modality for the participation of private sector constructors/manufacturers in Biogas Programme

5. Activities

The following activities were carried out during the mission:

- o Study the feasibility report and other relevant documents to collect and analyse secondary data and information,
- o Consult with Hivos, DGEEU and other relevant organisations to collect data and information;
- o Formulate the criteria for selection of the most appropriate technologies (performance factors);
- o Prepare checklists for field investigation
- o Conduct a quick field survey to get acquainted with the practice on the ground, to identify the strengths and weaknesses of the existing design, to assess availability and prices of needed materials, and to know the level of users' satisfaction
- o Match different potential biogas plant designs (all 6 or 8 m³) with the performance factors as preparation for the stakeholders' workshop.
- o Prepare an overview of the findings and present this to a workshop which brings together identified biogas constructors both of the public, private or development institutions.
- o Produce a score card, scoring the different models to the selected criteria
- o Facilitate the workshop to select the most appropriate design and sizes with related investment costs based on agreed criteria/performance factors; to propose a certification process for constructors; and to propose quality control mechanisms to ensure quality construction and after sales service.
- o Prepare report on outcome of the mission and workshop



6. Field Investigation

6.1 Methodology

The field investigation works consisted of the following activities (detailed itinerary is in Annex-1):

- Review of existing data and information available in Indonesia and elsewhere
- Preparation of semi-structured questionnaires for data collection (Annex-4)
- Consultation with experts and professionals involved in the sector
- Observations of biogas plants of different models/designs installed in different parts of Java and Bali to assess physical status and functioning as well as quality of workmanship
- Consultations with the users to know the effects/impacts of biogas plants on them
- Consult with the entrepreneurs involved in the sector



The main instrument of the study was the semi-structured questionnaires and open-ended unstructured interviews with the respective plant user. Additional investigation tools included observations, especially of different components of biogas plants, cattle-sheds, household kitchen and slurry pits in the sampled households and informal discussions with people in the survey clusters. The semi-structured questionnaires were discussed with experts from various organizations involved in biogas promotion and extension in

Indonesia. During the field survey process, the study team adopted an interactive approach rather than a 'question and answer session' with the respondents to enhance the quality of data and information collected.



The field investigation works were carried out from 8th to 20th of June 2009 covering the West, Central and East Java and Yogyakarta provinces as well as Bali. 40 biogas plants of different designs were surveyed in and around Bandung in West Java (Lembang, Sumedang), Yogyakarta (Sleman), Central Java (Solo, Boyolali, Salatiga, Klaten), East Java (Malang, Pasuruan) and Bali areas.

6.2 Major Outcomes

The following types of biogas plants were surveyed during the study:

- Floating dome digester – 1 plant
- Fixed dome digester : LPTP/BORDA Models of different types (majority of them were similar to African CAMARTEC Model); oval concrete dome model and tubular concrete dome model – 30 plants
- Tubular Digester/Plastic Balloon type – 7 plants
- Stainless steel biogas plant – 1 plant
- HDPE Plant – 1 plant

The following pictures show the types of biogas plants visited during the field investigation.



The outcome of the field investigation revealed the following facts:

Functional Status and Users' Satisfaction

- Majority of the biogas plants were functioning, except for a few plastic, floating drum and steel plants.
- Some of the fixed dome biogas plants were functioning for about 20 years.
- The pressure ratings ranging from few cm of water column (plastic plants) to 120 cm of water column were observed. Plastic digester had very low gas-pressure.
- Efficiency of biogas plants based upon actual feeding was satisfactory; however, the overall efficiency based upon the plant-size was low.



- The size of domestic biogas plants ranges from 9 m³ to 50 m³. Most of these plants are too big when compared to the cooking needs of a family.
- Production of biogas is far more than the consumption leading in escaping of biogas in the atmosphere – not good from environmental point of view.
- Majority of the users were satisfied with the performance of their biogas plants in case of fixed dome designs. In the case of plastic bag digesters, quite a lot of complains were heard from users.



Construction and Workmanship

- Without much capacity building efforts, the local masons were involved in constructing biogas plants, which indicates their skill and ability to read the drawings.
- Installation of plants have been done with minimal supervision from technicians which indicates that the masons are capable of building plants independently; though there was a lot of room for improvements.
- Quality of construction and workmanship in general was satisfactory. However, quite a number of shortcomings as given below were observed:
 - The relative positions of inlet, inlet pipe and the outlet was not maintained leading to shortening of HRT.
 - The effective volume of gas holder was reduced because of the lowering of the zero level.
 - The piping system including placing of water drain, installation of main gas valve was defective in most of the plants. In majority of the plants, water drains were not installed.
 - Compost pits, which are an integral part of biodigester system, were not constructed in majority of the plants.
 - The cooking stoves were not properly modified to suit the use of biogas.
- Selection of the size of biogas plants have been done without considering cooking needs and other technical parameters resulting in over-sized and costly plants.
- Biogas Plants were built without set quality standards. There were no in-built procedures for supervision during construction.
- Time taken to install biogas (20 days to a month) was relatively long.
- Users' contribution was reported to be minimal during installation.

Operation and Maintenance

- Water dung ratio was found to be high in most of the plants which were directly fed from stable floor.
- Plant feeding was not done regularly and appropriately.
- The slurry had escaped without fully being digested in majority of the plants indicating overfeeding.
- There were leakages from neck (top manhole) in the biogas plants; however, the users were not bothered to repair such leakages.
- There were not structured after-sale-service provisions and O&M training to users, though the users were reported to be provided with basic O&M instructions.
- There were lack of users' manuals on operation and maintenance, guarantee and after-sales-provisions as well as follow-up supports.
- Because of substandard quality of feeding, scum formation was a common problem in most of the plants.
- Area around the biogas plants was not managed properly in most of the cases.

- The jets in the stoves were often clogged indicating the lack of routine maintenance works on behalf of the users.
- Users lack the knowledge on operating primary air intake. In most of the stoves, the primary air intakes were clogged or closed.

Gas and Bioslurry Use

- Biogas was used for cooking, lighting, running dual fuel engines, drying ceramic pots and boilers.



- In general the stove burning hours for cooking ranged from 3 to 6 hours per day per family.
- The peak hours of gas use for cooking were reported to be between 5 to 7 in the morning, 10 to 12 during late morning/mid day and 4 to 6 in the evening.
- Handling of slurry was not done properly. In majority of the biogas plants, slurry was not collected in pits to compost. However, there were some users who were using slurry in their farms. Users were found to be well aware of the importance of bioslurry in enhancing agricultural production.

Cost of Installation and Savings

- Plants in East Java were cheaper than that in West and Central Java and Bali. The cost mentioned by the users were:
 - East Java – US\$ 450 for 6 m³ plant
 - Central Java – US\$ 800 for 6 m³ and US\$1,200 for 9 m³ plant
 - Bali – US\$ 1,500 for 9 m³ plant
- The plants in general were costly. It was noticed that the cost of digester floor was unnecessarily high because of more expensive construction techniques.
- The direct saving from the avoidance of conventional cooking fuel, kerosene in majority of the cases, ranged from US\$ 25 to 50 (1 to 2 litres of kerosene/day) per plant per month. The users seem to realize these savings.
- Though low initial investment cost (about US\$150 to 300, depending upon size and locations), plastic digesters were not durable/sustainable.

Technical Problems

- Users reported blowing-up of manhole cover due to high gas pressure. Counterweights on the top of the manhole cover were placed to avoid this problem.
- Plastic gas storage were reported to have leakage problems.
- Other main problems reported were improper gas stoves, gas leakages especially from neck (the top manhole) of the plant and appliances, and non-functioning/absent water drains.
- The biogas stoves in use were meant for LPG or natural gas. Though the installers have tried to modify the nozzle in some of the stoves it was not done properly. Absence of primary air intake in most of the stoves had resulted in a weak and inefficient flame.





Conclusions

- Installation of biogas plants have been done without considering cooking needs and other technical parameters resulting in over-sized and costly plants on the one hand and wastage of the produced biogas on the other.
- Users' contribution has been minimum during installation. Most of the biogas plants were installed with financial and technical supports from local governments. Users therefore do not care to provide timely operation and maintenance activities. For example, the steel biogas digester installed in Tukur sub-district in Pasuruan district with the investment cost of US\$3000 was not even commissioned. Same was the fate of floating gas holder plant in Yogyakarta.
- Though the initial investment cost is relatively low, plastic digesters were reported to be less durable/sustainable. Lots of complaints were heard from users. To make it safe, users have to invest in constructing concreted trenches and fencing which costs money and makes it less attractive because of the added cost.
- Fixed dome plants can operate for more than 20 years without any major technical problems. Users preferred fixed dome plant because of its durability and user-friendliness.
- No dome plant has failed because of technical reasons. Technical problems are mainly related with improper operation and maintenance.
- There is high need to diversify gas use.
- There is need to optimize the efficiency of appliances, especially that of gas stoves.
- As the plant cost is relatively high, there is need to assess cost reduction methodologies without compromising the quality.
- To maximise the benefit from biogas plants it is important that the bioslurry coming out of the biogas plant is collected, composted and handled properly. To ensure optimal use of bioslurry, slurry pits have to be constructed.

7. Stakeholders' Workshop

The field investigation exercise was followed by a 2-day workshop of potential stakeholders in Indonesia to: (i) select standard appropriate design and size(s) to be disseminated under the framework of IDBP, based on agreed criteria and performance factors; and (ii) formulate quality control mechanisms and certification process for private sector constructors. The workshop was attended by participants from private and public constructors as well as experts in the sector. The workshop schedule and the details of participants have been given in Annex-2 and 3. The main issues presented and discussed in the workshop were:

- Lessons from SNV supported biogas programmes in Asia and Africa
- Outcomes of the field investigation
- Technical assessment of different biogas designs and selection of models for further discussions
- Criteria to select most suitable biogas plant model
- Ranking exercises
- Quality management under the framework of biogas programme
- Role of private sector in biogas programme
- Criteria for private sector accreditation

The following sections highlight the activities and outcome of this workshop.

7.1 Activities and Outcomes

7.1.1 Welcome and Opening

The workshop formally started with the welcome of participants from Mr. Fabby, moderator of the workshop. He highlighted the three major objectives of the workshop as follows:

- a. To select best suitable model of biodigester for wide-scale dissemination of biogas technology in Indonesia under the framework of Domestic Biogas Programme
- b. To formulate the basic framework for Quality Management within the Indonesia Domestic Biogas Programme
- c. To prepare general accreditation modality for the participation of private sector actors in the Indonesia Domestic Biogas Programme

The introduction of workshop was followed by opening remarks from Mr. Ben Witjes, Director, Hivos Regional Office Southeast Asia. Welcoming the participants in the workshop he highlighted the benefits of biogas technology; experiences on dissemination of biogas programmes from other countries; introduction, objectives, and expected results of Indonesia Domestic Biogas Programme (IDBP); and major functions required under the framework of IDBP. He also shed lights on the implementation arrangements as well as the works carried out till date. Concluding his remarks Mr. Ben requested all the participants to contribute their time and efforts to make this workshop a success. The participants then introduced themselves and expressed their expectations and interests to participate constructively in the workshop.



Formally opening the workshop, Mrs. Ratna Ariati, Director, DGEEU; described the role of her department in promotion and extension of renewable technology in general and biogas in particular. She emphasised the need for the large scale dissemination of biogas technology in Indonesia and urged the participants to come up with the consensus on the best model of biogas plant to be promoted in the country. Expressing best wishes for the success of the workshop, and urging the participants for their valuable contributions, she expressed her belief that active participation of the participants in the whole process of the workshop would be instrumental in achieving the workshop objectives which ultimately would ensure effective dissemination of biogas technology in the country and minimise negative consequences of the conventional fuel sources.



7.1.2 Presentation on SNV supported Biogas Programmes

The informal opening ceremony was followed by the presentations from the facilitator, Mr Prakash C. Ghimire, Senior Advisor, Asia Biogas Programme of SNV; plenary discussions, group works and group presentations on different models of biogas plants being used under the frameworks of biogas programmes in Asia and Africa including their general characteristics, associated strengths, weaknesses and suitability in the Indonesian context. The facilitator stated his presentation with highlights on successful biogas programmes supported by SNV in different countries in Asia and Africa. According to him, following are general approaches of domestic biogas programmes:

- Focus on building capacities of existing, local actors rather than self-implementation
- Setting realistic production targets aiming to develop the whole sector (project → national programme → sector)
- Creating and strengthening a multi-stakeholder platform on the basis of public-private partnership for programme implementation

- Continuous long-term focus on customers' satisfaction, commercialisation and sustainability – users' at the centre
- Capacitating regional networks to create synergies between the national initiatives.

He then described the lessons learnt from various biogas programmes. According to him, the following are essential issues for the success of any domestic biogas programme:

- Understanding the end-user/market and designing a product that meets the needs and addresses the concerns.
- Identifying the most appropriate and cost-effective design for the product before launching a wide-scale dissemination program.
- Establishing and enforcing solid design, quality and service criteria that will ensure the reliable and cost-effective operation of installed plants.
- Identifying the key institutional players and assisting in strengthening the capacity of these players to effectively carry out their respective roles.
- Creating a multi-stakeholder platform on the basis of public-private partnership for programme implementation.
- Securing the commitment and support of financial institutions to work in close partnership for the dissemination and financing of the product.
- Identifying the financial incentives needed to stimulate the market and attract qualified buyers.
- Designing and applying financial incentives in a uniform, transparent and easy-to-administer manner.
- Ensuring that financial incentives reach the target groups and are not diverted to manufacturers.
- Providing technical and management support to all key players.
- Instituting co-ordinating committees to ensure the co-operation and partnership of stakeholders.
- Maximizing the use of program resources for product support and market development.

According to him, with nearly two decades of involvement in domestic biogas SNV,

- has demonstrated with its approach that dissemination of biogas is not a technology driven affair.
- learned that more “abstract” development objectives (capacity building, governance, integrated development) can be served in a tangible way through product dissemination;
- learned that involvement in activities with tangible results is crucial, both for internal as well as external justification, and;
- learned that establishing commercially viable biogas sectors in developing countries is not a “short-term” activity but rather has a time horizon of 10 years or more.

Before concluding his presentation, the facilitator also highlighted some important issues that are still of major concerns for these programmes, i.e.:

- accelerating market demand to finally reach the anticipated target
- strengthening institutional capabilities of the stakeholders
- strengthening the financial and managerial viability of the private sector biogas producers to ensure a sufficiently robust supply base
- maintaining biogas system standards for quality, performance and maintenance services in an expanding market
- reducing the amount and eventually phasing out the need for financial subsidies.

In closing he stressed the need to select a robust model of biogas plant that is suitable for the local context. He also described the need to adopt a single-model approach.

Questions were asked by the participants on the performance of different biogas models, status of biogas programmes in different countries, issues of carbon financing in biogas programmes and lessons learnt from other countries.

7.1.3 Presentation on Field Findings

Following the presentation on SNV's experience and achievements in biogas technology dissemination, Mr. Ifnu Setyadi, member of the field study team, presented the summary of the outcomes of field investigation. According to him, 40 digesters of various designs such as floating drum, tubular, fixed dome under various trademarks of LPTP-BORDA of different capacities ranging from 5m³ to 50 m³ were visited in Java and Bali. He then described major findings and conclusions of the field visit as described in Chapter 6.

7.1.4 Presentation on Selection of Biogas Plant Model

Mr. Prakash C. Ghimire then facilitated the session on selection of biogas plant model. He described different models of biogas plants being disseminated in various parts of the world and highlighted major criteria for the selection of biogas plants for a particular context.

He emphasised the need and importance of best suitable model/design of biogas plant to successfully achieve anticipated objectives of any biogas programme. He told that varieties of models/designs of biogas plants are being used in different countries in the world with successful track records. He also talked about different models being installed in Indonesia – the fixed dome models, floating gas holder type, plastic tunnel model etc. He emphasised, that 'based upon the performance of the existing biogas plants and experiences from other biogas countries, an effort should be made to select the best model for the wide-scale dissemination of the biogas technology in the country.'

According to him, a biogas plant should be:

- Strong
- Reliable/robust
- Water tight
- Gas-tight
- Built of local materials
- Cheap to build
- Easy to build
- Cost effective to supervise the construction
- User-friendly (easy to operate and maintain)
- Easy to insulate (in cold areas).

To ensure that a biogas plant fulfils the above mentioned parameters, the following factors need to be considered to evaluate its suitability assuming that the adaptability of any biogas plant in a given context depends mainly upon these factors.

- a. Climatic and geo-physical parameters
 - Ambient temperature
 - Geo-physical conditions of the soil
 - Condition of groundwater table
 - Geological stability; problems of landslides, flooding, earthquake etc.
- b. Technological Parameters
 - Structural strength against different load conditions (structural durability)
 - Methods of construction/supervision
 - Time and effort in quality control
 - Methods of operation and maintenance
 - Applicability/adoptability of the design in different geographical context for mass dissemination
 - Prospects for sharing of technical information and know-how
- c. Affordability of potential farmers to install biogas plant
 - Availability of construction materials

- Availability of human resources (skilled and unskilled) at the local level
 - Cost of installation, operation and maintenance
 - Transportation facilities
- d. Purpose of the use of the products from biogas plant
- Use of gas for cooking, lighting and/or operating a dual-fuel engine
 - Use of slurry as organic fertiliser
 - Gas use pattern/cooking habits of people (type of food, time for cooking, cooking style etc.)
- e. Performance of existing models, if any, in the local and/or regional conditions
- Existing physical status and functioning
 - User's level of satisfaction
- f. Quality and quantity of available feeding materials
- Type of feeding materials (cattle dung, pig manure, human excreta etc.)
 - Availability of water for mixing
 - No. of cattle/pigs per household

The participants were then facilitated to consider the following factors to select the types of biogas design for detailed analysis:

- Models presently in use at the local level
- Models not in use at the local level but are being widely used in other countries with similar socio-economic and climatic conditions
- Models with proven track records of successful operation

The plenary discussion resulted in the selection of the following three different types of biogas designs for further analysis.

- The Cambodian Farmer's Friend Model
- The Modified GGC Model from Nepal being used in Laos and Pakistan in Asia,
- The modified CAMARTEC Model being used in Tanzania which is the mother design of LPTP plants.

The existing LPTP/BORDA design being installed in Indonesia was not selected for further discussion because the mother of this model, the CAMARTEC design from Tanzania, has already been modified under the framework of SNV/Hivos supported biogas programme in Tanzania. The participants agreed that the modified CAMARTEC model was representative of the BORDA Model for discussion. The facilitator then described the strengths and weaknesses of these three designs as well as illustrated the construction methods to assist the participants in selecting one best suitable model from among these three selected models. The drawings of these models have been given in Annex-7.

7.1.5 Ranking Exercise

Ranking of different models as per the criteria given above was done in two stages. At first the participants were divided into four different groups to carry out in-depth discussions to analyse the suitability of the three models. The participants evaluated these models based upon the following score card.



Biogas Plant Model Score Sheet

SN	Evaluation Criteria	Model 1	Model 2	Model 3
1	Climatic and Geological Conditions			
1.1	Ambient Temperature			
1.2	Type of Soil			
1.3	Condition of Ground Water Table			
1.4	Geological stability against land slide, earthquake			
2	Technological Parameters			
2.1	<i>Structural Durability and functioning</i>			
2.1.1	Inlet Chamber and Inlet Pipe			
2.1.2	Digester			
2.1.3	Gas Holder			
2.1.4	Outlet Tank/hydraulic chamber			
2.2	<i>Methods of Construction/ supervision</i>			
2.2.1	Requirement of area for construction			
2.2.2	Digging of Pit			
2.2.3	Construction of Base (foundation)			
2.2.4	Construction of Digester			
2.2.5	Construction of Gas Holder			
2.2.6	Inlet and Outlet Tanks			
2.2.7	Time and Efforts in Quality Control			
2.3	<i>Operation and Maintenance</i>			
2.3.1	Operational Activities			
2.3.2	Maintenance Activities			
2.3.3	Top-filling and protection of plant			
2.4	<i>Applicability/Adoptability in different context (including suitability with locally available construction materials)</i>			
2.5	<i>Prospects for sharing Technical Information & Know-how</i>			
3	Affordability of Farmers to install biogas plants			
3.1	Availability and accessibility of construction materials at the local level			
3.2	Availability of human resources			
3.3	Cost of Installation			
3.4	Operation and maintenance cost			
3.5	Transportation facilities			
4	Purpose of the use of Products from biogas			
4.1	Use of Gas			
4.2	Use of Bio-slurry			
4.3	Gas use pattern/Cooking habits			
5	Performance of Existing biogas plants in local/regional context			
5.1	Existing physical status and functioning			
5.2	Level of Satisfaction of Users			
6	Quality and Quantity of available feeding materials			
6.1	Number of cattle/grazing pattern			
6.2	Type of feeding materials (cattle dung, pig manure, human excreta etc.)			
6.3	Availability of water for mixing			
7.	Other Criteria, if any			
7.1				
7.2				
	Total Marks obtained			
	Ranking			
	Final Decision			

Secondly, the outcomes of the group discussion were presented and discussed in the plenary. The following table shows the scores allocated for each model by the four groups:

Model	Group-4	Group-3	Group-2	Group-1	Total
Cambodia Model	133	156	159	133	581
Laos/Modified Nepal Model	132	153	159	140	584
Modified Borda/Tanzania Model	117	159	155	132	563

As shown in the table above, the score allocated for these plants by the participants did not differ much. Further discussions were made in the plenary on the strengths and weaknesses of these plants. Participants asked various questions related to the structural as well as functional aspects of these models.

After a series of discussions, the participants reached a consensus to follow a technology that incorporates recent technological achievements in other countries for mass dissemination of biogas digesters in Indonesia. The participants preferred to have a model with concrete gas holder like that of Laos (Modified Nepalese GGC) model and also concrete floor like that of Cambodian model, keeping in view the soil conditions as well as the geological stability in the region. According to them, Indonesia needs a model that is strong enough to withstand the complexities because of recurrent earthquake and volcanic activities. The facilitator then proposed slight modifications on the Laos (modified Nepalese GGC) design to fulfil the participant's aspirations. The new Indonesian design will be the modified version of Laos (Nepalese GGC) design that will have the characteristics as described below.

7.1.6 Characteristics of the New Model for Indonesia

The design will have combined strengths of Cambodian as well as Laos (Modified Nepalese GGC) model with the following specifications:

- It will have a flat concrete floor of 3" (7.5 cm) thickness to withstand the frequent ground tremors that is common in Indonesia.
- HTR of 50 days will be considered while preparing the modified design.
- 5 different sizes (4, 6, 8, 10 and 12 cum) of biogas plant will be designed.
- The minimum pressure to be considered while designing will be 70 cm of water column.
- The design will incorporate options for direct feeding of dung from the cattle shed as well as separate mixing tank depending upon the site condition and user's demand/need.
- The other design parameters will be as per the standard norms and practices.

The participants unanimously approved the modification provisions. Mr Prakash C. Ghimire on behalf of Indonesia Domestic Biogas Programme was given the responsibility to prepare the new design. The final design as well as costs and quantity estimation of the new design have been given in Annex-5 and 6.

7.1.7 Presentation and Discussion on Quality Control Framework

As per the agenda for the second day, the facilitator started with the session on the importance of quality management under the framework of a biogas programme. He emphasised the fact that non-functioning and poorly functioning biogas plants cause not only capital wastes but also harm the reputation of biogas technology and eventually the desired establishment of sustainable biogas sector. Therefore, 'quality' should be the prime concern of any biogas programme. He described the following consequences if the issue of 'quality' is not given due care.

- At user's level
 - unsatisfied clients
 - gossip/ negative image resulting negative impacts on promotion
 - loss of investment, land and initiative
 - added expenses for repair and maintenance

- At installer/mason's level
 - Bad reputation,
 - loss of market/jobs,
 - more efforts on repair and maintenance

- At programme level
 - waste of resources
 - loss of momentum/slow down of distribution
 - set back of the programme –damage to the reputation of biodigester technology and eventually to the desired future expansion of biodigester programme.
 - drop out of donors
 - programme failure
 - management complexities

The facilitator then highlighted that quality should basically relate to the following aspects of biogas programme implementation:

- **Quality of the design of biogas plant:** The biogas plant should be cost-effective; users' friendly; easy to construct, operate and maintain.

- **Quality of training and capacity building activities:** Correct training need assessment; proper selection of training participants, proper selection of facilitators, suitable training content, session plans and scheduling; appropriate training methods; effective practical sessions; effective evaluation of training; timely follow-up of the evaluation findings.

- **Quality of promotion and extension works:** Potential customers should fully be aware and understand all the benefits and costs. They should be provided with factual data and information and should be aware of their roles and responsibilities for quality control.

- **Quality of the construction** (including selection of construction materials and appliances): Strict adherence of set quality standards on site selection, selection of construction materials and appliances and construction.

- **Quality of the operation and maintenance** by the users and technical backstopping from the installer: Effective training to users', timely follow-up visits by the installer.

- **Quality of after-sale-services** on behalf of the installers: Strict adherence of terms and condition of after-sale-service provisions including timely actions to the complaints from users, routine visits and problem-solving.

- **Quality of financial and administrative procedures and practices:** Proper utilisation of fund, timely disbursement of subsidy amount, proper book-keeping, shorter procedures, fast, friendly and useful customer services.

The facilitator underlined that 'a biogas plant performing what is anticipated by the programme personnel and what the user wants it to do; that is, a plant meeting the anticipated requirements, is a quality plant.' Hence, quality is the performance excellence of a biogas plant as viewed by all stakeholders.

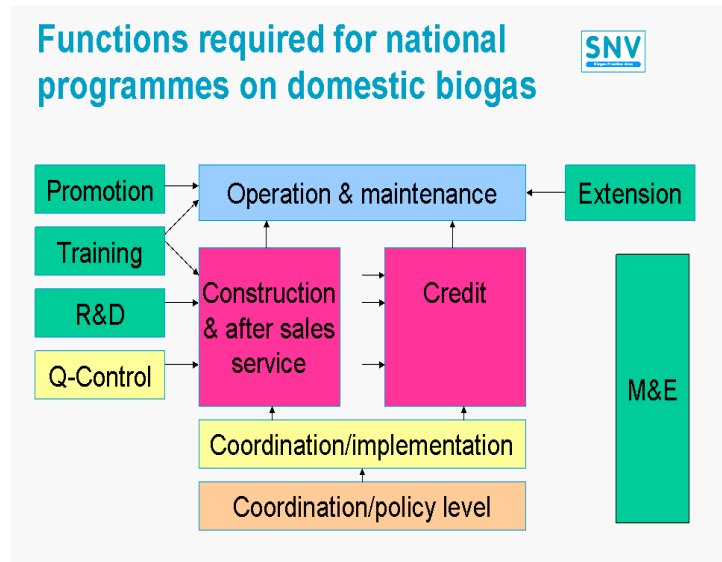
Thus, if the installed biogas plant:

- has the right dimensions, configuration and features,
- does what it's supposed to do,

- is reliable and durable,
- is delivered on-time, and
- is well-supported;

then, it is quality biogas plant.

Describing various functions under a biogas programme as shown in the figure, the facilitator stressed the need to integrate quality aspect in all these functions. According to the facilitator, the basic objective of quality control in any biogas programme is to ensure that the installed biogas plants meet the set quality standards and they function optimally without any major problems for the anticipated duration of time. Effective quality control not only helps in ensuring the compliance of quality standards but also provides learning opportunity for the programme personnel.



The facilitator then explained the importance of structured QC system as follows:

- To maximize performance, reliability and lifetime of every biogas plant
- To maximize the value for money for biogas customers, biogas programme, donors and the Government of Indonesia
- To maximize the potential livelihood benefits to customers and communities
- To minimize the risk of accidents or damage to users or property
- To maintain the reputation, credibility and value of the Biogas Program in Indonesia

The facilitator described that the term 'quality control' refers to the operational techniques and the activities used to fulfil and verify requirements of quality and it is a planned process of identifying established technical specifications for the programme and exercising influence through the collection of specific (usually highly technical and standardized) data. Therefore, quality standards related to various aspects of biogas programme implementation need to be formulated.

In a biogas programme, quality control is involved in developing systems to ensure biogas plants are designed and constructed to meet or exceed users' requirements. As with cost control, the most important decisions regarding the quality of a biogas plant are made during the design and planning stages rather than during construction. It is during these preliminary stages that component configurations, material specifications and functional performance are decided. Quality control during construction consists largely of insuring conformity to this original design and to planning decisions.

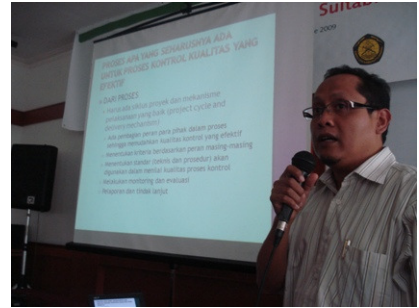
After the presentation, the participants were divided in four different groups to work out the best model of quality control system to be practiced during construction and installation of biogas plants. The participants were requested to focus their discussions on the following three key questions:

- What should be the general process of Quality Control under the framework of domestic biogas programme in Indonesia?
- What are the potential roles and responsibilities of different stakeholders in quality control?
- What quality standards are necessary?

Outcome of Discussion on Quality Control

The group leaders presented the outcome of discussions. Summarising the presentation from the four working groups, the facilitator presented the following major points as the outcome of the discussion:

- The concept of quality control will be embedded in all the functions under the framework of the biogas programme including promotion and extension, training, R&D, construction and after-sale-services, credit and subsidy administration, and other programme management issues.
- DGEEU in consultation with Hivos/SNV and other stakeholders will formulate the quality standards on the following aspects based upon the agreed design of biogas plant to be disseminated:
 - Biogas programme management including subsidy and credit administration
 - household selection
 - plant size and site selection
 - construction materials & appliances
 - workmanship of construction (plant) and installation (pipeline & appliances)
 - user instruction (verbally & provision of user manual)
 - after-sales service



Quality Control Process

- Detailed quality control mechanisms will be formulated by the programme once the programme management/ implementation modality is finalized.
- DGEEU will coordinate the activities related to quality control. A National Biogas Programme unit will be established under the jurisdiction of this agency.
- IDBP as the implementing agency will be responsible to implement the quality control activities. It will establish a quality management unit to manage activities related to quality control.
- The task of quality control could be outsourced to a specialized organisation/agency based upon their organizational capacities/competencies and willingness to participate in the programme. However, organisations that are contracted for QC assignments will not be eligible for taking the responsibility of installation of biogas plants.
- The biogas constructors will be responsible for carrying out the internal quality control of the activities. The biogas programme will ensure the required capacity building of the accredited companies to effectively carry out the quality management activities. Biogas construction companies will be responsible for:
 - On site quality control (e.g. distance from house etc.)
 - Give feedback on quality control standards.
 - Ensure that contractors comply the quality standards.
 - Support the other contractors to build necessary capacity to confirm and adhere to the standards.
- Biogas users will be provided with pre-construction training in which their roles on quality control will be discussed. They will also be involved in quality control.
- The biogas programme, in consultation with biogas companies and other stakeholders, will finalise the sampling methods and process of external quality control mechanisms including the number of visits



- The IDBP shall formulate in consultation with stakeholders the methods and procedures to be used for the quality control process. The methods and procedures should incorporate the following issues:
 - How and when the installer submits the details on the digesters under construction.
 - Random sampling method to select digesters.
 - Expected time of field visit after commencement of work.
 - Formats for site verifications.
 - Time for site verification.
 - Standard forms to be signed by all parties concerned e.g. contractor, user, financier and quality controller from the program.
 - Creation of a computer database for information management.
 - Feedback mechanism to the contractor.
 - Follow up mechanism to ensure that the contractor implements recommended measures in the next installation.

7.1.8 Presentation and Discussion on Certification Process for Private Sector

Upon the completion of the discussions on QC, the facilitator initiated the session on certification process for private sector constructors and manufacturers to participate in the IDBP. He underlined the importance of private sector involvement in an effective and efficient manner for speedy promotion and extension of biogas technology and to ensure sustainability of the sector. Central in the concept of any biogas programme should be the inclusion of the private sector constructors and manufacturers in the primary process which ultimately leads to sector growth.

Prior to entering into the core subject, roles of the private sector and accreditation criteria, the facilitator presented the potential roles of different organisations under the framework of domestic biogas programmes as follows:

- The existing/potential users
 - Invest in the biogas installation,
 - Carry out operation and minor maintenance activities according to agreed standards
 - Share their views to other potential users to motivate them for installation of biodigester. A satisfied user can be a very good promoter of the technology.
- Implementing Partner at the centre, provinces and districts
 - Policy formulation
 - Coordinate the activities
 - Integrate biodigester related activities in their routine activities
- Domestic Biogas Program Support Office
 - Technical, financial backstopping services/advices to provincial offices
 - Monitoring and evaluation of the activities
 - Research and development
 - Subsidy administration
 - Networking and lobbying
 - Capacity building and strengthening
 - Managing central database
- Provincial Biogas Program Offices
 - Implement the activities as stipulated in the implementation document and provincial guidelines
 - Capacity building and strengthening
 - Quality control of construction and after-sales services
 - Registration of completed plant (updating of database)

- Registration of guarantee
- Research and development
- Program management at provincial and district levels
- Program monitoring and evaluation.
- Promotion and extension

- Educational institutions/schools
 - Include the topic of biodigester technology in curriculum
 - Make the student aware of the technology and develop students as information disseminator
 - Organise and conduct training and research activities

- INGOs/ NGOs/ CBOs/ Functional groups/ clubs working at the grassroots level in the fields of agriculture, forestry, rural development, women development, health & sanitation and environmental management
 - Promotion and extension of the technology
 - Organise community level workshops/seminars
 - Organise and conduct users training
 - Facilitate operation and maintenance activities
 - Distribute promotional posters, leaflets etc.
 - Capacity building of the local users to operate biodigesters optimally
 - Integrate biodigester program with their routine programmes
 - Be instrumental in penetrating rural needy communities

- Local government bodies at the provinces, districts and villages
 - Dissemination of information,
 - Motivating the potential users
 - Bridging the users and provincial/district biogas office

- Financing institutes including commercial and development banks, cooperatives and micro-associations, community level saving-credit groups
 - Improve access to the credit if the users need it
 - Promotion and motivation
 - Create subsidy settlement mechanism?

- Media (radio stations, FM transmitting stations, newspapers, TV stations)
 - Transmit success stories, interviews with satisfied farmers
 - Stimulate public control and corrective action in case of omissions?
 - Help in popularising the technology by disseminating information on subsidy and other incentives being provided by the government.

- Civil society groups and village key-informant-persons
 - Motivate the farmers by disseminating factual information related to the benefits of biodigester technology.

The presentation from the facilitator included the following important roles that the private sectors (private companies/mason's group/local artisans and craftsmen) can play effectively based upon past experience in previous biogas programmes:

- Promotion and marketing of the technology
- Marketing of the product/Demand collection
- Construction and quality control
- After-sales-services

- Users training
- Manufacturing of appliances
- Marketing of appliances
- Ensuring availability of spare parts
- Research and development (user's satisfaction surveys)
- Subsidy channelling
- Internal quality control

The presentation also highlighted the following basic pre-requisites for the private sector to participate in biogas programme:

- Commitment to comply with the approved standard design and sizes of biogas plants;
- Commitment to employ trained, certified and registered masons for the construction of biogas plants;
- Commitment to construct biogas plants on the basis of detailed quality standards;
- Commitment to participate in production and marketing of quality biogas appliances (pipes, valve, stove, water trap, lamp) approved by the programme
- Commitment to provide proper user training and provision of a user instruction manual;
- Commitment to provide at least one year guarantee on appliances and two years guarantee on the civil structure of the biogas plant, including an annual maintenance visit during guarantee period;
- Commitment to ensure timely visit of a technician to the biogas household in case of a complaint from the user;
- Proper financial and administrative management systems in place

Following the presentation on importance and roles of private sector, the participants were divided in four groups for discussion on the following three key questions:

- What is the definition of private sector in the framework of domestic biogas programme?
- What are the potential roles of private sectors in the biogas programme?
- What should be the certification/accreditation criteria for the involvement of private sector in biogas programme?

7.1.9 Outcome of Discussion on Private Sector Involvement

Based upon the presentations from the four working groups, the following outcomes were summarised and agreed upon by the participants.

Definition of Private Sector

- Non governmental, social or business oriented organisations.
- An entity not affiliated to government in its operation and not relying only on subsidy provided by the programme.
- Organisation that fulfils the quality criteria and is willingness to participate in the programme with business motive.



The following organisations could be termed as private sector in the context of IDBP:

- Informal sector – women's group, cooperatives
- Chamber of Commerce and similar organisations
- Contractors/construction companies
- Appliance Manufacturers/suppliers
- Consulting firms/individuals
- Construction materials suppliers
- Financing Institutes (commercial banks, MFIs)

- Training Institutes (universities, polytechnics)

The following are the potential roles of Private Sector in biogas programmes:

- Research and Development
- Training and capacity building
- Manufacturing and marketing of appliances
- Supply of materials
- Channelling of funds/subsidy
- Insurance of product
- Dissemination of technology including marketing and product development
- Quality improvements and control
- Construction (site selection/plan)
- After-sales services and guarantee
- Financing and credit management

The following should be the accreditation criteria to engage private sector under the framework of biogas programme:

- Commitment to comply with the standard design and sizes of biogas plants;
- Commitment to employ trained, certified and registered masons for the construction of biogas plants;
- Commitment to construct biogas plants on the basis of detailed quality standards;
- Commitment to participate in production and marketing of quality biogas appliances (pipes, valve, stove, water trap, lamp) approved by the programme
- Commitment to provide proper user training and a user instruction manual;
- Commitment to provide guarantee on appliances and on the civil structures of the biogas plant, including an annual maintenance visit during guarantee period;
- Commitment to ensure timely visit of a technician to the biogas household in case of a complaint from the user;
- Proper financial and administrative management system in place
- Legal Business Unit/Registered
- Qualified staffing/technicians
- Physical office/Premises to work (well established office)
- Adhere to ethical standards/compliances
- Field experience/reputation in the sector
- Sound background (proven track records)
- Having no outstanding loans/liability that undermines their reputation
- Should have orientation to make profit for sustainability

7.2 Informal Closing of Workshop

The 2-day workshop came to an end with the closing remarks from Mr. Robert de Groot, Biogas Programme Manager, Hivos and some selected participants. They expressed their deep satisfactions on the outcome of the workshop and thanked all the participants and the facilitator for their active participation, constructive suggestions and effective facilitation. An informal evaluation of the workshop by the participants indicated that the process has been effective and outcomes have been beneficial for the future of planned biogas programme.



8. Conclusion

Indonesia has a high potential for biogas technology given the favourable social climatic as well as technological conditions. However, there are some visible challenges for Indonesia Domestic Biogas Programme such as:

- Competing with fully subsidised biogas plants that are being supported by local governments
- Changing the mindset of the potential installers and masons who have been working without a structured system of quality control and quality standards
- Selection of best partners in the provinces as implementing partners
- Capacity building of the installers/masons to construct quality plants of the selected design

There is need to ensure a quality product which is different from the existing products in the market to motivate the potential users. Experiences in other countries in Asia with similar biogas programmes have revealed that the users will be ready to pay for a quality product that has added value such as structured after-sales-services and guarantee provisions.

Annex-1: Itinerary

Dates	Agenda
June 7, 2009	Prakash arrived in Jakarta
June 8, 2009	Meeting in HIVOS Office with Mr. Ben, Mr. Robert and Mr. Panca Meeting in DGEEU with Mr. Dadan, Ms. Fitria, Mr. Effendi and Mr. Agus Travel to Bandung by car with Mr. Robert (HIVOS) Meeting with Mr. Ifnu. (Mr. Ifnu joined the team)
June 9, 2009	Field visits in Lembang – Meeting with Plastic Bag Installers (Biogas BCL) - With Mr. Bambang Boedi Cahyono and Wawa Wahyudi and visits to biogas households with plastic bag digesters (Mr. Asep and Mrs. Anang) Meeting in provincial energy office with Mr. Sumarwan, Mr. Bagus, Ms. Aan and Mr. Tubagus
June 10, 2009	Field investigation in Sumedang Meeting with village head Mr. Adang, Mr. Komar and users Mr. Rob left for Jakarta Travel to Yogyakarta by night train
June 11, 2009	Meeting in LPTP office (accompanied by Mr. Effendi from DGEEU) with Mr. Suryanto, Mr. Popo Rianto, Mr. Suprpto, Mr. Rian and other officers Visits to biogas households (Mr. Bardiman, Mr. Suyadi) in Turi sub-district with Mr. Suryanto and Mr. Rian.
June 12, 2009	Visits to biogas households with Mr. Suryanto, Mr. Abdullah and Mr. Rusdi : - In Tumang Village, Boyolali District (Mr. Yadi, Mr. Mitro, Mr. Sumitro) - In Tengaran Village, Salatiga District (Mr. Mungguh, Mr. Hariyadi) - In Kalibening Village, Salatiga District (Mr. Ibrahim, HDPE container tank)
June 13, 2009	Visits to biogas households with Mr. Suprpto and Mr. Rusdi : - In Mojosojo – Solo (Tofu industries – Mr. Aco & Mr. Samudra) - In Cangak'an and Tegal Gede, Karanganyar District (Mr. Bagyo and Mr. Mardi)
June 14, 2009	Field visit to Yogyakarta Borobodur area to see floating drum digester in Sleman Travel to Malang
June 15, 2009	Meeting in KPSP Setia Kawan Cooperative with Mr. Haryanto and Mr. Irfan (ILO officer) Visits to biogas households in Tutar sub-district (Mr. Winarso and Mr. Kusnan)
June 16, 2009	Meeting in Malang District Planning office (accompanied by Mr. Agus from DGEEU) with Mr. Nehrudin – Head of District Development Planning Office (BAPEKAB), Mr. Yusron – Energy and Mineral Resources Office, Mr. Endi Kusaeri – Head of Livestock Office, Mr. Abdul Syukur – LPKP, Mr. Indra Setyawan – Secretariat of district officer, Mr. Tomie Herawan – Head of economic section in BAPEKAB, Mrs. Subandiyani – Head of Environment Office, Mr. Renung – Public Works Department and Mr. Irfan Afandi – ILO Meeting with Mr. Khoirul Huda, Mr. Tamar, Mr. Wiranta, Mr. Samsul Bakri and other staff in JABUNG cooperative (KAN Jabung) Visits to biogas households in Jabung and Slamperejo (Mr. Samin, Mr. Sumo, Mr. Erwin)
June 17, 2009	Fly to Bali from Surabaya Meeting in Balifokus office in Denpasar with Mr. Tedy (office manager) and Mr. Gede
June 18, 2009	Mr. Robert from HIVOS joined the team Visits to Biogas households in Bangli with Mr. Yudi and Mr. Gede
June 19, 2009	Visits to biogas households in Denpasar with Mr. Yudi and Mr. Gede Debriefing meeting in Balifokus office
June 20, 2009	Travel back to Jakarta Report preparation
June 21, 2009	Preparation for workshop
June 22, 2009	Preparation for workshop
June 23, 2009	Workshop on Selection of Best Biogas Plant Model
June 24, 2009	Workshop on Quality Control Framework and certification Procedures for Biogas Constructors
June 25, 2009	Travel to Jakarta and Debriefing meeting in HIVOS with Mr. Ben, Mr. Robert, Mr. Panca, Mr. Faby and Mr. Ifnu Travel back to Bangkok
June 26, 2009	Travel back to Phnom Penh

List of Organisations Consulted

1. BIOGAS BCL (Barudak Cicalung, Plastic Bag Installers).

- Office : Jl. Cihampelas 212 B Lt.1 Bandung 40132
Workshop : Kp. Cicalung RT. 5 RW. 8, Desa Wangun Harja
Lembang, Bandung Barat 40391
Email : info@biogasbcl.com
Contact : Bambang Boedi Cahyono, mobile phone : 081394900642
2. West Java Energi and Mineral Resources Office
Jl. Soekarno – Hatta No. 576 Bandung
www.distamben-jabar.go.id
Contact : Tubagus – head of planning section, mobile phone : 08157111507
tubagus@distamben-jabar.go.id
3. LPTP - DEWATS
Jl. Anggajaya I/282 Condong Catur, Yogyakarta
www.lptp.or.id
Contact : Suryanto 0811259298
suryanto@lptp.or.id
4. Badan Perencanaan Pembangunan Kabupaten (Bapekab) Malang
Jl. KH. Agus Salim No. 7 Malang - 65119
Tel. (62) 0341 – 352210
Contact : Dr. Nehruddin (Head of Bapekab) , mobile phone : 08123351482
5. KAN JABUNG, Koperasi Agroniaga – Agri Trade Co-op.
Jl. Suropati 4 – 6, Ds. Kemantren – Jabung, Malang
Tel. (62) – 0341 – 791 227. Fax. (62) – 0341- 793100
Email. agroniagacoop@malang.wasantara.net.id or kanjabung@yahoo.com
Contact : Khoirul Huda (Population & Development Spv) mobile phone : 081334764062
kohumicayez@yahoo.com
6. KPSP (Koperasi Peternakan Sapi Perah) Setia Kawan
Jalan Raya Nongkojajar, Desa Wonosari Kecamatan Tukur - Pasuruan
www.kpsp-setiakawan.com
Contact : Haryanto (secretaris), mobile phone : 08125228446
Winarso (biogas experts) : 08175214483
7. Bali Fokus
Jl. Tukad Tegal Wangi, Gg. Mandala Wangi No. 5 Seseetan – Denpasar 80223
Tel. (62) 0361 – 233520 Fax. (62) 0361-233520
www.balifokus.org
Contact : Mrs. Yuyun , mobile phone : 08123819665
I Made Yudi Arsana, St , mobile phone : 0852 370 07280
yudi@balifokus.or.id

Annex-2
Constructor' Workshop on Selection of Best Model of Biogas Plant; Quality Control Mechanisms and Accreditation of Private Companies

Workshop Schedule

Session No.	Time Schedule	Session Topic	Facilitation
Day-1: June 23, 2009			
1	08:30-09:00	Registration and Opening	Hivos
2	09:00-09:30	Introduction, Objectives, Expected Outputs and Detailed-Schedule	Moderator
3	09:30-10:30	Experiences from other country programmes	Prakash
	10:30-10:45	Tea break	
4	10:45-11:30	Presentation on outcome of field investigation	Ifnu/Prakash
5	11:30-12:00	Criteria for the selection of best suitable model of biogas plant	Prakash
	12:00-13:30	Lunch	
6	13:30-14:30	Presentation and discussions on models of biogas plants under scrutiny	Prakash
7	14:30-15:30	Group discussions to evaluate the biogas models under consideration based upon the selected criteria	Moderator/ Participants
	15:30-15:45	Tea break	
8	15:45-16:45	Presentation of the outcome of the group discussion	Moderator/ Participants
9	16:45-17:15	Presentation and discussions on potential changes, if any, in the selected design for the Indonesian context	All
10	17:15-17:30	Recapitulation and closing of the first day	Moderator
Day-2: June 24, 2009			
11	08:00-08:15	Agenda for the day	Moderator
12	08:15-09:15	Presentation on quality management in biogas programme and quality standards	Prakash
13	09:15-10:30	Group discussion on quality management process, role of different stakeholders on quality management and quality standards	Moderator/ Participants
	10:30-10:45	Tea break	
14	10:45-11:45	Presentation on the outcome of group discussions	Moderator/ Participants
15	11:45-12:15	Finalisation of Quality management framework for Indonesian biogas programme	
	12:15-13:30	Lunch	
16	13:30-14:15	Presentation on the role of different stakeholders including private sector on biogas programme	Prakash
17	14:15-15:15	Discussion and presentation on potential role of private sector on biogas programme and basic minimum criteria to be fulfilled by the private companies for the accreditation	Moderator/ Participants
	15:15-15:30	Tea Break	
18	15:30-16:30	Presentation of the outcome of group discussion	Moderator/ Participants
19	16:30-17:00	Recapitulation of the day, evaluation of the workshop and closing	Moderator

Annex-3: Name of Participants

Annex-4: Field Visit Checklists

Questions with the Biogas Users

1. How did you know about biogas technology?
2. When was your biogas plant installed?
3. Who installed it? Which Company? Who selected the design and size of your plant?
4. Are you satisfied with the services of the construction company that installed your biogas plant? If no, why?
5. What was the cost of the plant? How was it financed? (Your contribution, subsidy, loans, if any?)
6. Are you satisfied with functioning of your plant? If yes why? If no, why?
7. Are there any technical problems in your plant? What is/are the most common problem(s)? How do you solve these problems?
8. How much money you spend each year to repair and maintain your biogas plant? Who does these activities?
9. What is the most difficult part of operation of your biogas plant?
10. Have you received any training on operation and maintenance of your biogas plant? If yes, from whom?
11. How many cattle do you have? How much dung you fed into the digester? Is toilet attached to your biogas plant?
12. Is water easily available in your locality? Do you collect urine to mix it with dung to feed into the biogas plant?
13. For how many hours you use your biogas stove/ lamp in a day? Is the biogas sufficient to meet your requirements? If not which fuel do you use if biogas is not sufficient?
14. Do you cook all the food items in biogas stoves? If no, which food items? And why not cooked with biogas?
15. What is the quantity of conventional energy sources that have been saved after the installation of your biogas plant? Firewood? Charcoal? Kerosene? Dung-cakes? Agriculture residues? LPG? Other?
16. What is the cost of these conventional energy sources in your village?
17. Are you utilizing bioslurry coming out of the biogas plant? What is your impression on the fertilizing value of bioslurry against the farm-yard-manure?
18. Have you seen any other biogas model(s) than yours? If yes, which model do you think is best? Why?
19. Do you think there are rooms for improvements in the design of your plant? If yes, what?
20. What are the 3 main benefit of biogas plant?
21. Any demerits?
22. Do you have any suggestion for the proposed biogas Programme related to the selection of a biogas model?

Questions to the constructors

1. Since when is your organisation/company involved in installing biogas plants? What are the reasons to involve in this sector?
2. How many plants have your organisation/company installed till date? Which model?
3. What is/are the most difficult part(s) while constructing a biogas plant? Any problems in construction? Are construction materials easily available? Where do you get biogas appliances?
4. What are some of the main technical problems with biogas plants that you have installed? What are common complains from the users?

5. Do you provide after-sales-services to the users? Are there any problems in providing effective after-sales-services to the users?
6. How many technical persons does your company have?
7. Do you know other designs of biogas plants than the one your are installing?
8. Do you think the design that you are installing is the best among other in use? If yes, why? If not, why did you select this design?
9. If you have experiences with more than one model of biogas plants, which model do you think is the best suitable one for the mass dissemination in Indonesia under the framework of national biogas Programme? Why?
10. What is the cost of an average size (6 or 8 cum) of biogas plant? How do the farmers pay these costs? How much you charge the farmers as your organisation/company overhead?
11. What is the cost of different construction materials in your working area?
12. What is your target for the next year? How many plants will be installed?
13. Are you involved in other activities than biogas?
14. Will you continue to involve in this sector? What makes you convinced to involve in biogas sector?
15. What do you think are the problems and prospects of biogas program in Indonesia in relation to the involvement of organisation/private companies as yours?
16. What is the most preferred size of biogas plant in Indonesia?
17. Who decides the size of biogas plant? the owners? the installer?

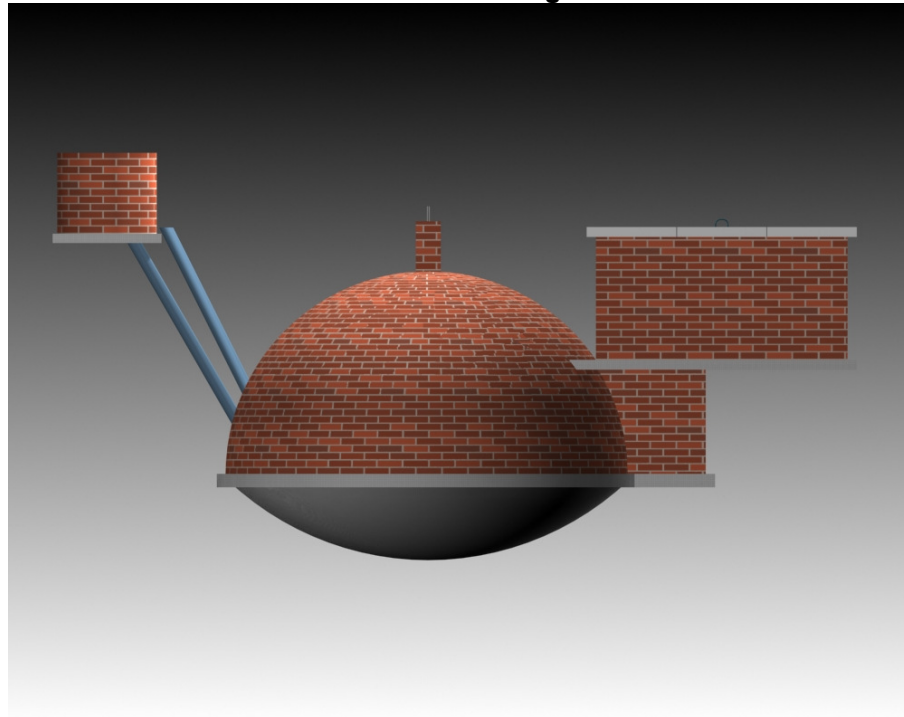
Annex-5
Design of Indonesian Model Biogas Plant (4, 6, 8, 10 & 12 m³ Sizes)

Annex-6 Quantity and Cost Estimation of Indonesian Model Biogas Plant

SN	Item	Unit	4m ³		6m ³		8m ³		10m ³		12 m ³	
			Unit	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity
I Construction Materials												
1	Bricks/Concrete blocks	No.										
2	Stone	m ³										
3	Cement – 50 kg bag	bag										
4	Gravel 1x2	m ³										
5	Coarse sand	m ³										
6	Fine sand	m ³										
7	Inlet pipe 10cm dia, length 2m	piece										
8	Iron bars ø 8 mm	Kg										
9	Binding wire	kg										
10	Water proofing compound	kg										
11	Acrylic emulsion paint	Lit										
Subtotal I												
II Accessories												
12	G.I Gas outlet pipe Ø 0.5", 0.6m long	pcs										
13	GI nipple, Ø 0.5" for connecting main gas pipe and main gas valve	pcs										
14	Main gas valve (Ball valve Ø 0.5")	pcs										
15	Male-female socket Ø 0.5", G.I. with aluminium thread, for connecting main gas valve and gas pipeline (G.I.)	pcs										
16	G.I. 90° elbow	pcs										
17	T-socket Ø0.5" for water trap (aluminium thread inside)	pcs										
18	Water drain	pcs										
19	Gas tap	pcs										
21	Teflon tape	pcs										
22	Gas pipe, G.I. or PVC pipe Ø 0.5"	m										
23	Gas rubber hose pipe Ø 0.5" and 2 clamps	m										
24	Stoves – single burner	pcs										
25	Lamp	pcs										
26	Pressure meter/Manometer	pcs										
27	Miscellaneous											
Subtotal-II												
III Labours												
28	Skilled Labour	No.										
29	Unskilled Labour	No.										
Subtotal III												
Total												
Overhead, Guarantee and After-sales Services (20%)												
Total Cost of Installation												

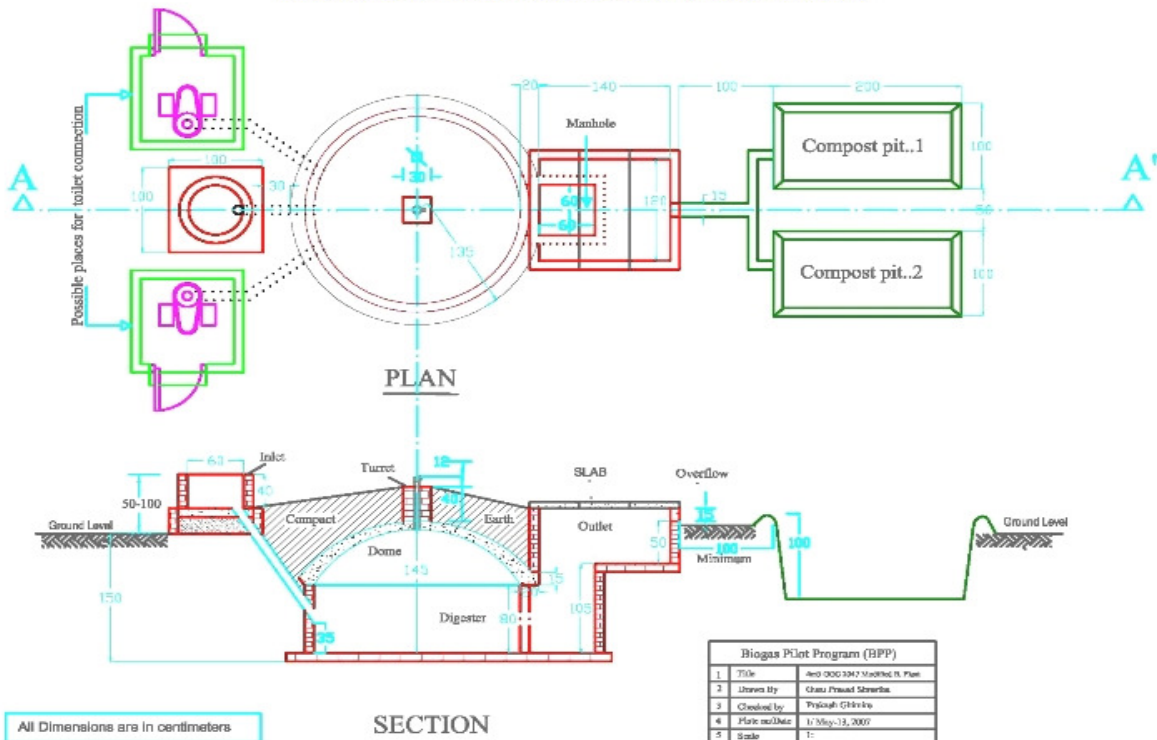
Annex-7: Different Models of Biogas Plants

Cambodian Model Biogas Plant

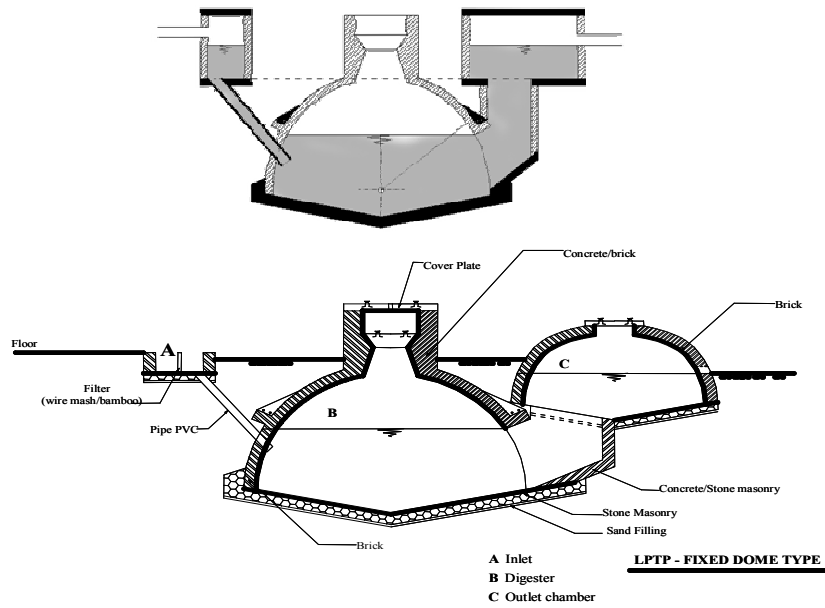
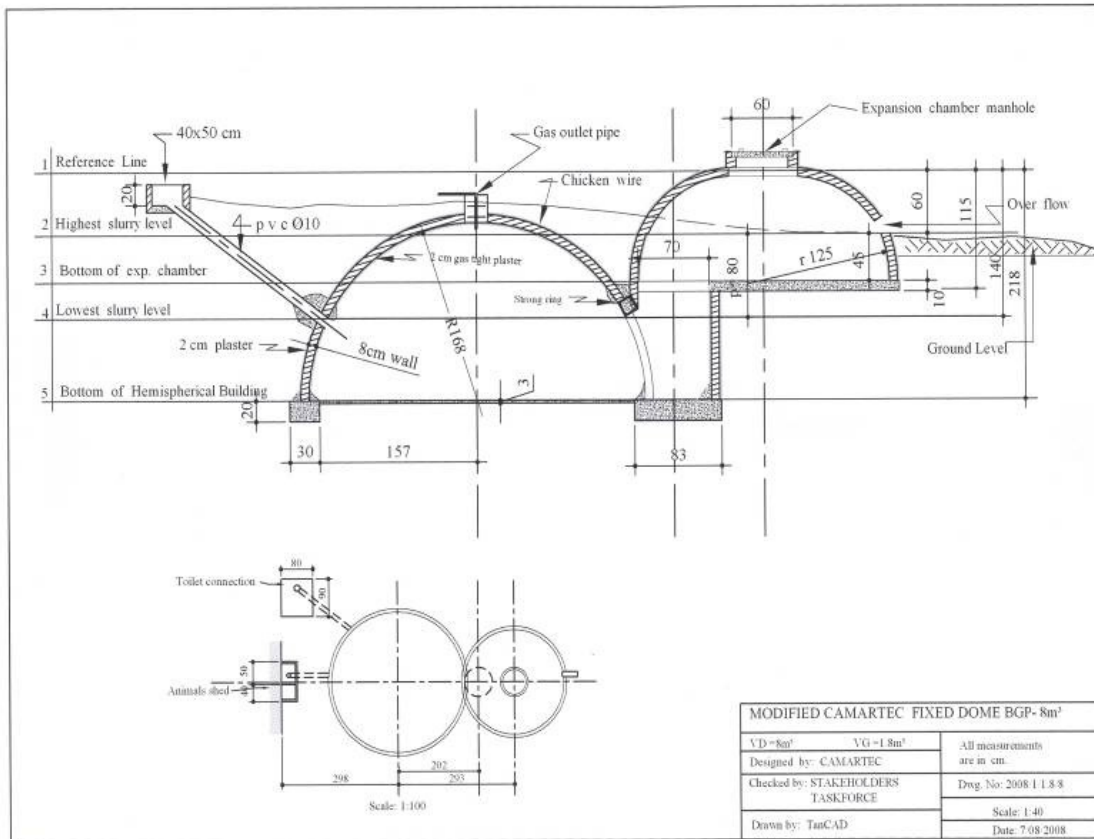


GGC Biogas Plant

GENERAL BIOGAS PLANT DRAWING



Modified CAMARTEC Biogas Plant



LPTP Mdel DIGESTER, modified from CAMARTEC design