Private Sector Development Study
for the
National Biodigester Program
Cambodia

final report

For: *National Biodigester Program- Cambodia*
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April / May 2007

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Abbreviations and Acronyms

BoQ	Bill of Quantity
CEDAC	Centre d'Etude et de Development Agricole Cambodgien
ILO	International Labor Organization
KCM	Kompong Cham province
KD	Kandal province
'Kossamak'	Preah Kossamak Polytechnic Institute, Teuk Thla, Phnom Penh
MAFF	Ministry of Agriculture, Forestry and Fisheries
MSME	Management of Micro Small and Medium Enterprises
NBP	National Biodigester Program
NCDD	National Committee for Management of Decentralization and Deconcentration
NBPO	National Biodigester Program Office
PBPO	Provincial Biodigester Program Office
PLG	Partnership for Local Governance (presently re-named PSDD + NCDD)
PNH	Phnom Penh
PSD	Private Sector Development
PSDD	Provincial Support for Decentralization and Deconcentration (formerly PLG/Seila)
PVC	Poly Vinyl Chloride
Seila	Acronym for the predecessor decentralization program now called NCDD
SFKC	Social Fund for the Kingdom of Cambodia
SNV	Acronym for the Netherlands Development Organization
TK	Takeo Province
TSO	Technical Support Office
WFP	World Food Program

Executive summary of the Private Sector Development Study for NBP

The target of the National Biodigester Program in Cambodia is to have 17.500 biodigesters constructed by end of its phase-1: December 2009. Presently the program has passed through its set-up phase: Offices have been created, staff was employed or assigned, staff was trained, links were made in the sector and with stakeholders, basic materials for program implementation have been prepared, processes and procedures have been developed and introduced. This was followed by the promotion of the NBP biodigesters, clients have been identified and targeted with marketing in the start-up provinces. Construction has started and per March 2007 a total of 479 digesters were in operation. This construction process is monitored and quality control is executed. Findings are entered in a database.

Presently the program is in the phase where the familiarization is completed and where various components can be reviewed. Review can lead to adjustments if they are deemed necessary. The reviewed program will then be ready for expansion by covering a larger market, more provinces.

So far the program uses the private sector in the implementation component through tri-partite Contracts between a Client, a Mason, and the respective Provincial Biodigester Program Office. The program arranged for an NBP Mason Training module which is centralized provided to groups of Masons during 10 days, followed by an on-the-job training period in the provinces. Up to April, 147 masons have concluded these trainings. The centralized trainings were deemed to be good but this study concludes that the content should be reviewed for improvements. The selection process of the trainees was not always strict enough adhered to. The training as arranged by NBP is one of the very few vocational training options for masons in Cambodia.

Critical mass development through promotion, marketing and the 'visibility' of constructed biodigesters and Happy Users has not yet reached the level in which large numbers of potential clients request for a digester. Also the existing private sector of small and medium sized construction companies do not yet show much interest to build NBP biodigesters. Still, already the NBP-Masons recognize the dormant market size and an other project introduces its own target groups to the benefits of the digesters. The consultant agrees with the intention of NBP to start now further private sector development by going to aim at companies to become the next service providers for the program. Companies which will build the NBP biodigesters and market them to potential clients. A transition period is to start in which present tripartite contracts with individual NBP-certified masons are going to be replaced with 'normal' contracts of only accepted construction companies direct with the clients. To achieve this, existing small and medium contractors in the target provinces need to be addressed with marketing about the biodigesters and on the program processes. The Seila/PSDD program is implemented in all Cambodian provinces and can provide access to their large pool of listed contractors. These contractors are already used to working within a system of standardized structures and get various type of technical support that is intended to ensure a minimum appropriate level of work quality. The construction sector in Cambodia lacks a proper environment in which quality standards are known. Standards are not enforced, they are not checked and there is no supervision. Technical capacity is on average low and better qualified and experienced persons are scarce. This all means that NBP, similar to Seila/PSDD, is required to develop their own register in which suitable contracting companies can be listed which comply with basic criteria. These criteria are to be formulated by NBP. Parts of this report provide the basis for a desired company profile.

NBP can build on Seila/PSDD experiences with managing a register of construction companies. NBP already has a quality assurance mechanism. This will have to be adapted to link with the company register.

NBP should re-format the cost estimates for the biodigesters. Some items need to be added. Some items need to be split and separate shown. This for reasons of improved transparency and for making sure that the estimated cost per digester is reflecting reality. This will require some research especially on labor inputs and on ongoing labor rates. The contractors and present trained masons can not by themselves calculate construction cost. Transparent costing of the digesters can show these contractors how it should be done and it will reduce risk on them thinking they are not rewarded enough for their construction work. It may be that present costs of the digesters require to be adjusted. If this appears necessary, it is better to do this as soon as possible, before the contractors and masons slowly learn that they do not make a reasonable profit from work for NBP. Overhead cost, write-offs and a management fee/profit should be mentioned. This improvement will ensure sustainable cooperation between the private sector and NBP.

As one of the profile criteria of the biodigesters construction company it is mentioned that they need at least 1 person who has been trained as an NBP-Mason. This will provide the required basic knowledge per company, plus it will allow part of present trained NBP-Mason experts to get employment with such companies. It is expected that others of the trained and now experienced NBP-Masons will want to set up their own company and register with NBP. As most of these masons and small contractors have usually limited financial basis, NBP should consider selective support through a financing mechanism. It is estimated that the set up of a decent but minimum equipped small construction company requires an investment of 600USD. NBP should also consider arranging a Contractor Training Module in which issues such as book keeping, cost calculation and marketing are covered. The marketing part is to be applied marketing for the biodigesters. This training can either be held centralized or decentralized but the schedule in close coordination with the NBP program development. This kind of training in non-existing in Cambodia, although there are some business skills trainings. Several years back ILO trained about 40 medium scale contractors on road construction.
NBP should continue its appreciated NBP-Mason trainings.

The duration of the transition period for the above switch to an operational pool of Biodigester Construction Companies with sufficient members is not exact to predict. This depends on how long the advised reviews will take and how long adjustments and set up of new support and process mechanisms will take. It is expected that pre-transition period would take minimum 5 months, and the transition itself 9 months.

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1 Introduction / Background

The National Biodigester Program in Cambodia (NBP) officially started March 13th 2006. The first phase covers a period of almost 4 years till December 2009 and is intended to start activities in at least 6 Cambodian provinces. Among other activities, by early 2007 the central management, support and monitoring office in Phnom Penh has been set up as well as Provincial Biodigester Program Offices (PBPOs) in 5 provinces. The aim for phase-1 is to build 17,500 biodigesters.

For permanency, efficiency, and sustainability of this program it is expected that private parties have to play important roles. Presently masons are trained for one of the private sector tasks involving marketing, construction and after-sales service. The training for the NBP is done by Preah Kossamak Polytechnic Institute. By March 2007 a total of 147 masons attended the trainings and a total of 479 biodigesters were completed. It has become time to reflect on this part of private sector development strategy.

At its program formulation stage, NBP has chosen for the strategy of selecting and training masons to get a private sector capacity for construction of quality biodigesters. This study aims to provide insight in the present status of these NBP-Masons: their preparation, received support, role and functioning. It aims also to define what the NBP expects from this cooperation with private sector at the end of its phase-1. This insight on present cooperation and the aimed target at end of phase-1 is compared with Cambodian reality in the small to medium scale construction contracting sector. This study was not intended to evaluate the chosen strategy, but to look ay how it can further develop and strengthen the private sector of small to medium contractors so that in future they will be able and willing to construct quality biodigesters in a sustainable way.

To execute and report this study, the consultant has been contracted for a short period in March-April 2007. He worked close together with senior NBP staff and one resource person from CEDAC in a kind of operational field team.

This study frequently uses the word ‘NBP-Mason’ as this is presently used in the program terminology. This term is used for the masons who have completed the whole NBP-masons training program with success. This term applies to the actors who are up to now used by the NBP in the start up period of phase-1.

2 Objective of the study

Based on the background, the specific objective of this study is to determine the ideal but realistic profile of biodigester construction companies who will be active in future in the Cambodian biodigester sector and what actions need to be undertaken and/or support to be provided to establish such companies in the coming three year time period.

3 Methodology

Based on the ToR as attached in appendix-F, a study methodology was formulated which resulted in the following activities:

	PSD study : Executed activities	2007
a	Signing of contract	29/3
b	Desk study of NBP documents	29/3 -13/4
c	Study Team formation with the NBP Engineer and CEDAC reference staff member. Followed by intermittent consultation	30/3 30/3 -13/4
d	Explanatory sessions (1) with NBP key staff	30/3 -2/4
e	Field visits and meetings preparation	30/3 -2/4
f	Field visits to biodigesters under construction and completed.	3/4 + 6/4
g	Three meetings with NBP masons in three different provinces	4/4 - 6/4
h	Meetings and discussion with possible other actors	30/3 – 13/4
i	Secondary opinions and feedback check	7/4 – 16/4
j	Additional explanatory sessions (2) and feed back checks with NBP key staff	10/4 – 13/4
k	Data analysis from the various meeting and data reporting	7/4 – 16/4
l	Pre-Draft report formulation, submission, and discussion with NBP	14/4 – 25/4
m	Draft report formulation and submission	26/4-5/5
n	Commenting and feed back provision on the draft report by NBP and related parties	6/5-31/5
o	Finalizing final version PSD study report with incorporation comments and suggestions from NBP	1/6-15/7

The NBP Engineer, Mr.Vorng Phirun, plus CEDAC staff member Mr.Huong Piseth, in-charge of the cooperation with NBP, were assigned to complement the consultant in a study team which worked intermittent together during the study period. The consultant was responsible for the study implementation, analysis and reporting.
The consultant was provided by NBP with available documents, accompanied with verbal information and explanations. Based on this information a field visit schedule was prepared and a questionnaire developed to use in qualitative participatory meetings with groups of NBP-Masons in 3 provinces each. Field visits, prepared and facilitated by the respective PBPOs, were executed to Takeo, Kandal and Kompong Cham province and majority of the information gathered was compiled in tables which are attached in appendix-B. To keep the meetings manageable and the feedback valuable, the PBPOs were asked to invite for each meeting a limited number of about 10 active NBP-Masons. This target number of participants was easily achieved.
Throughout the study period, NPBO and PBPO staff contributed with feed back. Additional explanations and documents were provided when requested and possible. Data analysis was combined with secondary data and feedback from secondary sources.

3.1 Data value

Appendix-B (Table-6-7-8-10-11-12-13-14) contains summary data of the participatory meetings with NBP-Masons in three provinces. The participants in the meetings were supposed to enable the study team to derive a good impression on the situation in regard to the NBP-Masons. To achieve this, the respective PBPOs were asked to focus on the more active NBP-Masons and to invite a manageable number of 8 to 12 people. Still, during the first two meetings the participants did not show much readiness to provide useful feedback and suggestions, and there was not much of a pro-active attitude among the 21 attending masons. Therefore the third meeting was held with a different approach. This meeting was still participatory and followed similar discussions as in the first 2 meetings, but at the start, the masons with too little or no interest in private sector development were identified and removed from the meeting. The

remainder of the meeting became in this way much more satisfying. The results from this Kompong Cham meeting are therefore to be considered as key-data.

The fact of low interaction[1] in parts of the first two meetings tends to confirm a vital observation made by NBP management earlier on: Lack in enthusiasm and pro-active participation by part of the NBP-Masons could be deemed to be weakening the planned basis in the development strategy in phase-1. As such this became a major reason for the ToR of this PSD Study, which was then commissioned by NBP.

However, it needs to be taken into consideration that the first batches of masons were only trained 12 months earlier (including Kandal and Kompong Cham), and that the masons from Takeo were only trained five months earlier.

4 Factors related to NBP and private sector development

4.1 The Client

The NBP has as its target group the individual farming households with cattle and/or pigs that can produce enough dung, minimum 20kg/day, for an acceptable daily output of bio-gas. Cambodia has a large market for the Farmer's Friend type biodigesters which are promoted by the NBP. NBP estimates that 25% of rural families in present intervention area have this technical potential. However, there are limitations from the side of the market, and there are limitations due to the choice of NBP's implementation strategy.
The NBP piloting phase only covers a limited number of provinces and, next to the minimum dung requirement, lack of space to construct a digester may be a limitation too[2].

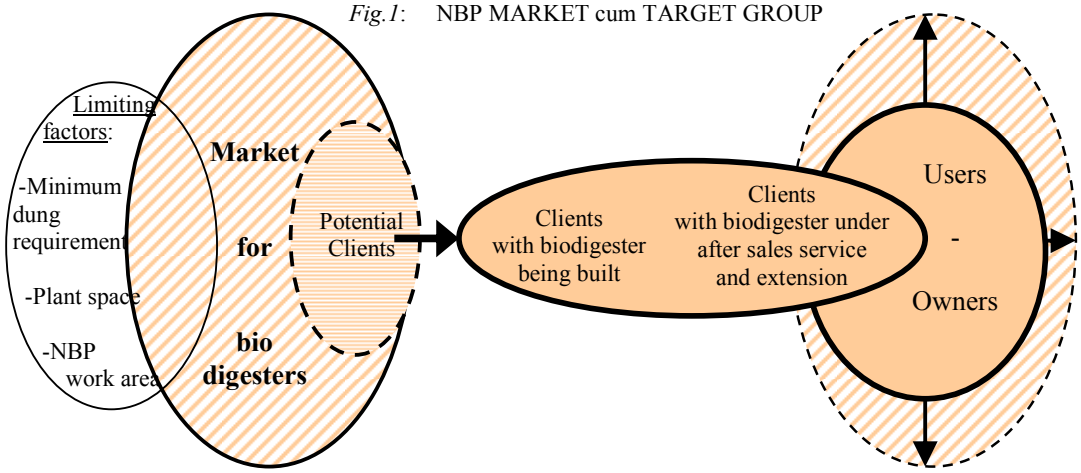
Limiting the standard models to 4, 6, 8, and 10m^3, together with the flat rate subsidy of 100USD per household, independent of the size of digester, is a strategic choice in line with the program's objective to target the poorer households[3].
The real investment cost for the standard models may seem to be rather high and thus could be seen as a limitation. But also here there are several strategic choices that allow and actually require that true good quality cost are required to be the basis of digester construction:

- The digesters have a quick return of investment and only a temporary or limited support is required for the poorer section of potential clients to enable them too to take advantage of the opportunity the NBP offers.
- The digesters are required to be built using good quality materials and with good workmanship to ensure that they can serve their purpose for a long time. Only long-time operating digesters will instill confidence and demand under the population for this type of environment and cost saving interventions.
- Reflecting the real cost and providing the 100USD subsidy afterward can facilitate an increased commercial involvement by private sector and other actors in the NBP's efforts.

[1] It is expected that the PBPOs in the respective provinces indeed followed the selection procedure for invitees as mentioned.
[2] It has not yet been researched if there are potential clients for biodigesters, and who have this space-constraint as a major limitation.
[3] The demand for larger or more plants by one household, which for different reasons may have a larger dung availability, is discussed in the NBP and per 25th April 2007 resulted in a clear directive that such cases can get NBP support if certain conditions are met. This includes a larger NBP designed model for instance of 15m^3. These conditions are related as to not interfere with present poverty alleviation objective and with the need for certain parameters so that NBP quality and after sale service can be guaranteed.

Figure-1 here below shows the market which has potential clients. The potential clients can become contracted clients and upon completion of the biodigester these clients become owner and user of the biodigesters.

Fig.1: NBP MARKET cum TARGET GROUP



A potential client household, who passes the minimum requirement as covered in a feasibility check visit, is offered a tripartite Contract with the NBP-Mason/contractor and with the concerned PBPO to get a biodigester constructed at their farm. (A copy of such a Contract is attached in appendix-H)

Going into a contract provides the following outputs to the client-farmer:

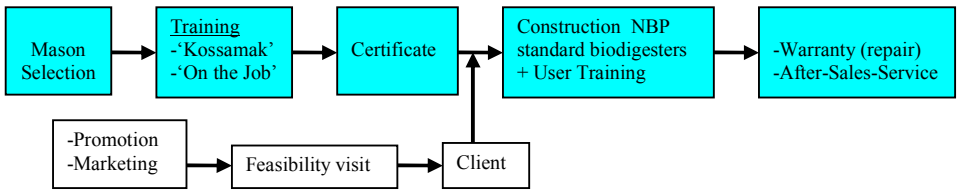
- Client gets a completed high quality biodigester on their farm which is constructed by a certified NBP-Mason. Construction is expected to be completed in 20 calendar days. (This construction time includes the digging, but it is negotiated who does the digging and as such also how this cost estimate items is covered). Digester model is for long-term use and with low maintenance.
- Client gets training on the use of the biodigester including aspects of daily operation, required maintenance, and on troubleshooting issues.
- The biodigester is of an assured quality and there is an after-sales-service including 2 year warranty period for constructive defects on the whole plant.
- PBPO supervisors provide information, assistance, and training before, during, and after construction. The same supervisors execute quality assurance tasks.
- The client gets 100USD subsidy amount cash in return upon official completion of the unit. (which presently roughly equals 20-30% of the investment depending on the size of the plant)
- The client becomes 100% owner of the biodigester and can use the gas and slurry produced as per own wishes.
- PBPOs arrange/facilitate extension activities on the use of bio-slurry for which the Clients are invited to participate.

4.2 The NBP-Mason

Private operating, NBP-certified masons are at present key players in the NBP implementation. Simplified their involvement is shown in figure- 2.
PBPOs source for experienced and interested masons who are interviewed and selected. The selected masons receive a 10 day centralized theoretical and practical training related to the construction of biodigesters, followed by a decentralized on-the-job training. The centralized training is presently conducted at Preah Kossamak Polytechnic Institute. During the on-the-job training the trainees are to construct 3 biodigesters under supervision of an experienced NBP biodigester construction mason. After those two training components the successful masons[4] get the NBP-Mason Certificate[5]. The certificate confirms not only that the mason has successful completed the biodigester construction training, but it is also intended to certify that this NBP-Mason is allowed to work within the scope of the NBP program. A certified NBP-Mason can, and is expected to, execute the following tasks:

- Promote the NBP biodigesters to potential clients ('marketing', refer to para-5.5)
- Execute feasibility visits at potential client's farms.
- Cooperate with the potential client to get an NBP-Contract for the construction of a standard biodigester.
- Construct the biodigester for the client.
- Provide user training to the client (while executing the construction works).
- Ensure quality of workmanship by taking responsibility of the 2 year warranty on the plant against constructive defects.
- After construction and handover, the NBP-Mason will for 2 years, at least twice a year visit the Client. During these visits the NBP-Mason will:
  - Provide after-sales-service to the client through support/fine-tuning/advice.
  - Check the plant for technical problems, and if required take action.

Fig.2: INVOLVEMENT OF NBP-MASONS: SIMPLIFIED VERSION

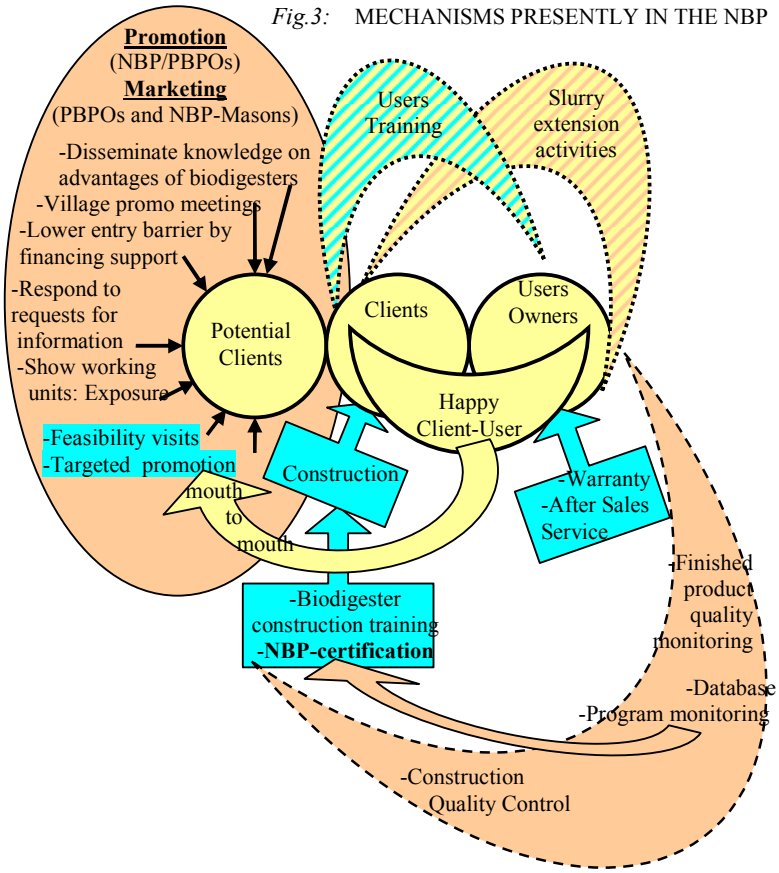


[4] Up to April 2007 there were no trainees who failed during the 10-day training period, but there are trainees who did not complete the required on-the-job training part..
[5] In appendix-H a sample of the NBP-Mason certificate is shown which was finalized in correct format by time this study was conducted. The so-far successful trained NBP-Masons did not get their certificate earlier due to wrong printing of the first batch of certificates. In addition NBP is now also to distribute NBP-Mason identification cards.

4.3 Mechanisms in the National Biodigester Program

Figure-3 shows mechanisms that are included in the NBP. It does not show all mechanisms but focuses on those related to the role of the masons in the program.

Fig.3: MECHANISMS PRESENTLY IN THE NBP



- Core focus is on the potential clients becoming contracted clients, who turn into users/owners. The program wants to get happy owner/users who are satisfied with the plant: satisfied on reduced spending of money on cooking fuel and possibly lighting; satisfied by the production of fertilizer; happy about the quality and reliability of the plant; happy and satisfied with other effects from the biodigester; happy about the NBP-Mason; and happy about the support and extension activities the program provides. If that is the case, then the happy owner/user will be a positive pawn in the marketing component of the program.
- The market is approached in various ways to reach potential clients split over either promotion or marketing based activities.
- Interested clients, who during the feasibility visit confirm to be viable, get contracted and under quality control by PBPO supervisors the NBP certified masons construct for these clients the Farmer's Friend Biodigester.
- During construction and upon completion, the NBP-Masons provide the client with advice and instruction on topics listed in the User Manual.
- Completed construction is checked together with the PBPO supervisor and if all is correct, the client is provided with the Biodigester Construction Completion Report, the Warranty Certificate and the User Manual. At this point the plant is officially handed over to the user.
- As after-sales service, for 2 years the finished and operational plant will be visited at least

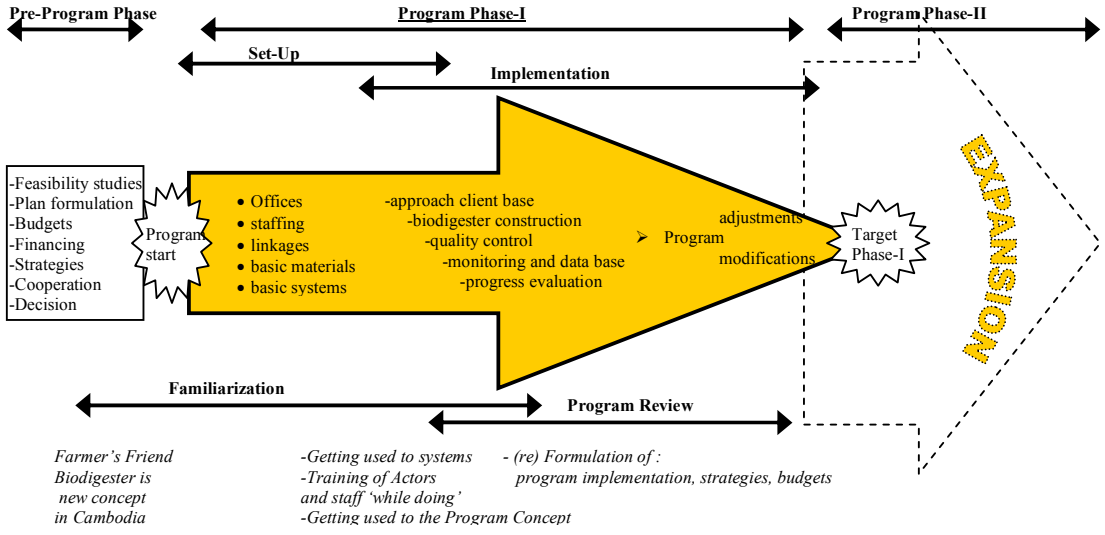
twice per year by the mason who constructed the plant, and PBPO supervisors will also pay visits. During these planned visits or upon notification or requests by the owners, problems will be solved and advice on improved use and maintenance is disseminated.

- During same period, possible defects are checked for. Those which are found and are due to bad workmanship are repaired under the Warranty Period arrangement.
- The program runs extension activities on the use of the bio-slurry which, next to the combustible gas, is the other product coming from the biodigesters. During a timeframe after completion, the NBP clients are invited to participate in these activities to make sure they know how to get best benefit from this product.
- NBP selects masons who fit in the program and it trains these to the required level to ensure good craftsmanship in building the Farmer's Friend digester models.
- The mason's work is checked at construction time, its completion, and the resulting plants remain then monitored by regular inspection visits. The data from these visits are entered and maintained in a database. If there is proof that an NBP-Mason is not adhering to the warranty responsibility (and after sales service), or that his craftsmanship is not good enough, then this is considered and he may loose his NBP certification as a result.

4.4 The NBP and its Farmer's Friend biodigesters: A new concept in Cambodia

The NBP is set up from scratch and needs time in which its program staff and the cooperating actors get familiar with the working environment. At the same time the Cambodian public will have to get familiar with the NBP. This implies that a process with much learning will have to be covered. This path through this process is guided by studies initiated by the NBP, like this PSD study. Evaluation of learning and these reviews can lead to adjustments and modifications in the remainder of Phase-I. It will also allow the formulation of an improved version of a possible Phase-II which may expand beyond the initial target of 6 provinces.
This concept is visualized in figure-4 here below.

Fig.4: STRUCTURAL + SUSTAINABLE BIODIGESTER PROGRAM DEVELOPMENT



4.5 Program familiarization and integration: promotion and marketing

NBP takes marketing/promotion serious and has awarded these aspects an important role in program implementation.
The used marketing channels reach a wide audience while the clients who are targeted are a segment of the population with only medium characteristic difference.
The messages and methods used in promotion and marketing are focused on the same principles used to justify the need for this specific program, with elaborated emphasis on a personalized approach, stressing sustainability and guaranteeing and providing an extended period of service after construction.

NBP regards Promotion and Marketing as two different activities. Promotion being considered information dissemination aimed at groups, while marketing aims at further in-depth discussion and liaison directly with potential clients. Both are recognized as required for the NBP to become a successful and sustainable program. NBP also builds on spin-off effects of aspects of their Program.

Promotion activities are such as:

- General dissemination of information about the NBP such as:
  - The advantages of Farmer's Friend biodigesters.
  - The support the Program can provide.
  - The quality the Program assures.
- Offer 20 model plants for each province.
- Production and distribution of a wide range of materials for dissemination of information.
- Targeted support to actors who do program marketing.
- Provide for a window where potential clients can get information
- Establish a reliable system which assures the workmanship and quality of digesters and extension activities for a long time.
- (Exposure trips with potential clients to functioning digester owner-households)[6].

Marketing activities are such as:

- Organize promotion meetings in target villages.
- Provide leaflets and verbal information and explanations: answer to questions.
- Execute feasibility visits at interested farmer households.
- During the construction period of a biodigester provide more information to the Client on its advantages, on the best way of operating it, and on the use of its 2 products; gas for cooking and lighting, and bio-slurry for fertilizer. At the same time, promote the digester to others such as potentially interested neighbours.
- (Exposure trips with potential clients to functioning digester owner-households.)[7]

A spin-off mechanism for marketing and promotion will be triggered when the Program has achieved enough "critical mass":

- When there are sufficient biodigesters built in a large enough area.
- When the built digesters are indeed successful and remain successful in making the NBP client-users happy.
- When enough information about the advantages of the program is disseminated.

[6] It seems that this type of promotion is not yet applied by the program, but others, like the MSME project are visiting the NBP clients in this way.
[7] For present NBP-Masons as service providers, this is still in most cases too costly.

- When the Program shows that it can maintain standards and support.
- When the Program succeeds in establishing sufficient cooperation with qualified actors to fulfill demand.

Fig.5 CRITICAL MASS DEVELOPMENT WITH SPIN-OFF CHARACTERISTIC

4.6 The (small) construction contractors sector in Cambodia

First of all it must be realized that in Cambodia there are neither standards in place for construction materials nor for quality of construction work. Like many things lacking in Cambodia, there is not yet[8] a working infrastructure and regulated work environment in the construction sector in general. Any standards or registration requirements that are at present in practice are the result from donor driven projects which somehow try to create for their own interests some kind of insurance against complete disaster and waste of money.

Market study[9] showed that there are considerable numbers of qualified masons and small type of contractors available in Cambodia, but due to the fact that they are usually not required to work as per standards and regulations, they can also not always be blamed if practices are of a low quality. Many of them can indeed make good quality work if they get the right instructions on how to do it and why. This should be combined with realistic payment procedures and a realistic financial reward[10] for the services, materials, and investment which the small contractor mobilizes to do the job. Especially payments should be quick upon delivery without unnecessary delays.

In this environment there are considerable masons and small contractors available who can do simple construction work such as building culverts, schools, ring wells, and, once having the experience for this specific type of construction, who can also build the Farmer's Friend Biodigester plant.
One of the nation wide operating projects in Cambodia which worked with a large number of medium sized contractors was the SFKC which had 200 contractors on their pre-qualification list by 1999. However this project stopped around 2001 and it was not recommended to use the majority of the contractors on their list.
By 2000 the Seila program worked in 10 provinces and had about 225 small to medium sized

[8] Min.of Urban Planning, Land Development and Construction (MUPLM&C) Has started setting up regulatory frameworks an standards, but so far only in few cases these are required to be adhered to in practice.
[9] Small Contractor Survey CMB/01/R72/RILG- UNOPS/UNDP, 2001
[10] Most contractors can not estimate construction cost. They often sign up for a contract at a too low value and find out at a later stage that they will loose money. In this phase in Cambodia the Client should also calculate the true construction value and allow the contactor to make a profit if the work is done satisfactory and on time. Contracts at a value below real cost lead to either bad quality and/or un-finished products.

contractors on their pre-qualification list. Presently Seila covers whole of Cambodia. They have done regular improvements on their system for pre-qualification and on their requirements for contractor registration regarding those contractors who want to bid for their yearly round of Commune level small construction contracts. The local infrastructure contracting component of the Seila program has now the following parameters:

- Approximately 1200 Communes
- Budget available per Commune per year: 5000USD
- Average number of contracts per Commune: 1.25
- Minimum number of small contracts per year: 1650
- 3 bids minimum per contract; Out of which there is likely a 40% overlap under the contractors bidding for more contracts.

This means that there are now at least 3000 small to medium sized contractors who are bidding yearly for the Commune and Sangkat Funds projects. The work being executed is in the villages all over the country. It is likely that on the pre-qualification list of Seila/NCDD there are more small to medium sized contractors as not every one of the pre-qualified contractors enters the bidding every year.

Seila in past 6 years started to target experienced masons and craftsmen to act as a local contractor for their small infrastructure projects. This is because their expansion to nation-wide coverage required a large base of potential small contractors to bid on the large quantity of yearly contracts. Regulations, designs and drawings were adjusted to suit this low level and/or starter level of contractors. Per province the Seila/PLG/NCDD infrastructure advisor maintains the provincial contractor pre-qualification list. This advisor and the TSO staff should be able to provide information on where the small contractors are located, which ones are indeed small, which ones are the more energetic ones, and which are the contractors who defaulted on their obligations.

The main drawback on the existing contractor sector is that due to the lack of an existing work environment with quality standards and a mechanism which provides training, supervision, monitoring and checking, then the quality of work is most of the time below what it should be. For time being in Cambodia, if a client or a program does not take care of a mechanism which provides the contractors with the required support, control, checking and taking action, then the pool of suitable contractors to provide quality work is limited, and those who can do good quality work are tempted not to do so.

and checking and supervision , control

4.7 Cambodian requirements for company registration

The situation regarding registration of companies in Cambodia, and specificly, the registration of construction companies, has in recent years in reality not much changed nor developed. In appendix-D a summary of registration requirements is attached as surveyed in 2001. The original version has been updated with some minor changes and additions. Most of these listed processes are in practice not relevant for the level of contractor and construction works as is foreseen in the next 3 years under the NBP.
Targeting qualified and experienced masons/plumbers and small contractors who work mainly within a district/province provides the following basic requirements countrywide:

- When operating only at provincial/local level it is not required to register at central level. In such cases the ongoing practices in the specific province of work becomes the rule to

abide to.

- Normal maximum level of registration at provincial level is through the payment of the yearly tax-fee for a small company. That payment is a flat fee of usually 100.000riel[11]. The receipt from this payment is called 'patong'. (Some provinces however charge additonal a monthly fee for registration)
- Depending on the requirements from the program or the client who wants to contract the contractor, there may be no registration required at all.

Seila/NCDD has since 1999 countrywide experience with supporting the development of small contractors and with working at provincial, district, and commune level on small contracts contracting and contractor registration.
Recently they have out of experience eased their registration requirements for the contractors who want to get on the pre-qualification list. Before, one of the rules was that they needed to be registered provincially, which meant they had to show proof that they had paid the tax fee so they could show the valid patong. This practice appeared a drawback for those small contractors who did not win any contracts but who each year had to pay the 100.000riel fee. Therefore at present for pre-qualification the proof of tax fee payment is no longer required. Now only when a contractor is the lowest bidder, before he gets the contract, he has to go and register, pay the tax fee, and show the patong prior to signing the contract. This practice appears to be working and is accepted at the provinces for Seila/NCDD contracting of Commune and Sangkat Funds projects

4.8 Present status of private sector development within the NBP

The compiled table here below has several headings related to components of the NBP program and the private sector development strategy in regard of the NBP-Masons.

PRESENT STATUS OF PRIVATE SECTOR DEVELOPMENT WITHIN THE NBP	*Table-1*
-0- Choice of biodigesters: The Farmer's Friend model	
	▪ A study was done to select from available designs a biodigesters model, which would be suitable for the Cambodian environment, possible to build with available construction materials, and within the capacities of skills and competence of Cambodian masons.
-1- The training of masons versus the desired private actors to construct and market the biodigester program	
	▪ The program started with training experienced masons/plumbers into masons who can construct a biodigester at a desired level of workmanship, and who know enough additional aspects so that they can instruct the user/owners on the operation and maintenance of their units. The masons are also taught about the advantages of the digesters so that they can use this knowledge in promoting the digesters. ▪ The program actually needs a group of entrepreneurial small to medium sized contractors who are willing to work with the NBP and perform roles and responsibilities as a pro-active partner in marketing of the program. The trainee selection for present training is not geared to these additional skills and abilities. The selection is not looking for contractors. The Mason Training does not have modules on entrepreneurial skill development and marketing. ▪ The program realizes that this training set-up up does not directly deliver the desired long term actors. And it realizes that only a distinguished few of the trained will have the desired abilities. It realizes that a second selection needs to be made to identify from the trained masons, those with desire and ability to develop as entrepreneurial biodigester contractors, and that those will need additional support. ▪ The program expressed that it does not want to upgrade present NBP Mason Training to one which would in majority deliver the desired level of actors. If the training would be upgraded as such then its name would have to change to something like NBP Contractor Training (at least if the training content would warrant such a name) ▪ The program expressed the desire to have an additional inflow of actors who better fit the desired mould as biodigester contractor, and to identify what additional support is required to upgrade the suitable ones who

[11] Since end of 1997 the exchange rate is approximate 4000riel per1USD; 100.000 riel = 25USD

PRESENT STATUS OF PRIVATE SECTOR DEVELOPMENT WITHIN THE NBP	*Table-1*

have passed through the NBP Mason Training.

-2- Recruitment of trainees for present running NBP 'Mason Training' program

- Mason trainee selection is not strict adhering to the present defined NBP selection criteria. 40% of trainees do not comply with the basic criteria of minimum 2 year experience as a skilled mason or plumber.
- There is considerable number of trainees recruited who do not have the required interest and skills to become an NBP mason/contractor. A number of trainees do not complete second part of the training. An additional number of trainees drop out of the program after completion (Present total drop-out rate estimated at 25%). From the interviewed 'more-active' NBP masons 50% stated that they are only interested in simply being a good mason
- The selection criteria check does not have a part which questions the potential trainee about their entrepreneurial interest, and their marketing and communication skills. It does not inform the potential trainees about the full list of roles and responsibilities which they are actually expected to take up.

-3- The 'Mason Training'

- NBP is one of the very few parties in Cambodia who arrange true skills training at a skilled mason level. Theoretically every Province Training Center has a mason-skills training in its curriculum, but due to its format there is usually not enough demand to implement these trainings. (Only the Battambang training center has mason trainings quite regular.)
- There are no complaints from any of the interviewed NBP-Masons about the training content, but a number of trainees did not complete second part of the training and an additional number of trainees drop out of the program after completion (Combined drop-out rate estimated now at 25%)
- There is comment from the more experienced NBP masons that the on-the-job training is not always at the desired quality due to inexperience of some of the assigned on-the-job trainers.
- It seems that parts in the training are providing too much information about program and biodigesters in a way which is not required for the expressed training objective and training level. It should be checked if there are parts which should be removed or exchanged for better topics.
- Background knowledge related to the Farmer's Friend biodigester design is not provided in the modules. (For instance it is not explained why the tank is dome shaped?)
- The training modules are not at an equal approach level toward the trainees. Some assume that there is a lot of experience within the trainees. Other modules start at a very low level. The trainee selection should allow that all the training models can be of a same level.
- The English version of the mason training curriculum is not at mason level. Nor is the attached training feedback evaluation form. This English version seems to be the instructor manual on how to conduct the training.
- The text under 'handouts' is not about handouts.
- The Khmer version of the 'Mason Training' could not be fully studied. It seems to be partly better than the English version. Simultaneous with the review of the English true 'Mason Manual', the Khmer version should be re-developed.
- The training focuses on material (and construction) quality check by only referring to the right type of materials. No examples are provided from the bad materials, not on how they can be recognized, nor on how some bad materials can be treated to improve them to become acceptable.

Cambodian trainees will not learn to distinguish what is good and what is bad by only telling a difference in theory and only showing a good sample. A bad sample needs to be shown also to clearly show the difference in practice.

It is advised that a separate study is done on how present training is perceived by the trainees and compare this with the desires from the program. This separate study is to advice on which improvements are required to get to the desired curriculum standard and to include the suitable approaches and content.

Presently as part of their total training[12], the supervisors of the program also follow the NBP-Mason training at same time as the selected mason trainees. This may cause the training to direct too much attention to issues that are not directly related to the masons. It is questionable if this approach is the right one if this is the only main training the supervisors receive.

-4- Certification of the NBP-Masons

[12] Total initial supervisor training covers: NBP-Mason training + 2 day training at NBP Phnom Penh + on-the-job training in the province which is conducted by NBP-Technicians

PRESENT STATUS OF PRIVATE SECTOR DEVELOPMENT WITHIN THE NBP	*Table-1*
	▪ At time of the study none of the successful trainees had received their certificate due to a mistake at the training centre[13]. As a result, so far the NBP-Masons can not use the certificate to provide proof and confidence at village and district level if they want to promote the biodigesters and try to get clients. At the time of this study this issue has been partly resolved and will be fully resolved once the new developed certificates have been distributed, and when the program has assisted the NBP-Masons in introducing them and their certificate at district and commune levels. ▪ Presently there is no such thing as a signed "Code of Conduct" document between NBP and the certified masons. This kind of agreement can improve the relationship between the trained masons and the program, and can also mention the expected roles and responsibilities to be taken care of by the certified masons cum contractors. (Seila/NCDD program has a basic level code of conduct agreement with their pre-qualified contractors)
-5- Contract and Construction Aspects	
	▪ Soil conditions in some areas are difficult while there is only one rate for excavation in the cost of a biodigester. (refer to last part of appendix-E) ▪ NBP-Masons know the importance of good quality workmanship and that they are responsible for 2 years for constructive defects. It still regularly requires explaining that not all problems are under that warranty, and explanation on which ones are the ones under warranty and which are not. ▪ NBP-Masons know that the digesters need to be built in a quick timeframe. It seems that presently the payments around the construction are going as they should be because the NBP-Masons appreciate that this kind of work gives them their cash payment quick compared with other employment options. ▪ NBP-Masons do not yet understand much about the financial side of the warranty system if something proves to be of bad quality. They are not aware about the interest which is gained on the outstanding warranty amounts. *(At time of this study, none of the constructed plants have reached 2 year maturity yet, There are several aspects of the Warranty System which have not been'tested' yet, such as for the NBP-Masons to claim the retainer money etc.)*
-6- Bill of Quantities and the cost estimation	
	▪ There are items missing in the bills of quantities for the digesters which should be there if one works on the basis of being a contractor. This includes items such as provision for: Formwork/scaffolding/temporary roof and lighting; Small tools; Transport; Management fee, and Profit. ▪ The rate for skilled and un-skilled labor should be reviewed on the basis of a survey in the project provinces. ▪ It is desired that correct data are gathered on how much skilled and unskilled labor really is required for the construction of the various models. This then to be stated clearly and separate from the Profit and Management Fee cost item. ▪ The 'backfilling' item seems to be missing from the cost estimate, though this is an important work to be done properly. (if this work item is included in either the tasks 25 or 26 shown in Appendix-E, table-19, then refer back to previous item.) Anyway, it is advised due to its importance, to specify this work as a separate item. ▪ The cost estimate format can improve so that it can be better used during contract discussion with the client in relation to who is going to take care and be responsible for each item.
-7- Marketing and promotion of the Farmer's Friend Biodigester.	
	▪ It is realized by both the program and the NBP-Masons that the biodigesters have a 'critical mass' effect in which in due time the units will more or less 'sell themselves'. However, that stage is not yet reached. ▪ The program is initiated by SNV and MAFF and it was explained to the consultant that promotion has been awarded a serious role in which a split is made on what is considered to be 'promotion' and what is 'marketing'. Different channels for promotion and marketing are used, probably involving considerable financial resources. As the basis of this strategy, "the Client" is assigned as the focus of attention and the NBP-Masons cum contractors are desired to be "the Service Providers" who are to link with the potential clients. ▪ A business approach of marketing follows an other approach where the client is also the focus, but where the marketing concept is made as efficient as possible independent of the actual product. The approach is geared to what will attract and convince the client. In the case of a product like the biodigester the strongest selling point is likely to be the savings on expenses for fuel, with the other advantages to be playing a minor role for most people. ▪ The program uses concepts in its promotion and marketing, which are likely to be more impressive on

[13] In appendix-H a sample of the NBP-Mason certificate is shown which was finalized in correct format by time this study was conducted. The so-far successful trained NBP-Masons did not get their certificate earlier due to wrong printing of the first batch of certificates. In addition NBP is now also to distribute NBP-Mason identification cards

PRESENT STATUS OF PRIVATE SECTOR DEVELOPMENT WITHIN THE NBP	*Table-1*

potential donors and aid providers to get them to think positive about this program, then that they are relevant for the perceptions of the average farmers and villagers.

- It seems that in near future, it will be very worthwhile to re-consider the used marketing techniques. Who is targeted?, with which messages?, Are these messages coming across?, Are these the right messages to have efficient and effective marketing? Compare these findings with the expenditures so far made, and then consider if an adjustment is required. *(This comment includes the CD which is made by the program)*
- In addition to the previous advice, it can at the same time be checked if present style of promotion and marketing is the desired approach, or if there should be a split in which one style gears towards donors, aid providers and other stakeholders, while the other style is more business oriented and more geared toward hands-on marketing tools to be used by the NBP-Masons cum contractors. This aspect has not been researched but the feed back provided by the NBP-Masons indicated there is room for improvement. It is also based on the impressions the consultant experienced during his exposure to part of the marketing and promotion, reviewing the CD-movies, and in follow-up feed back discussions with a few reference sources.
- An extra product which the program is required to sell more and more effective is the certified NBP-Mason as a recognized and visible service provider. Presently this "NBP-contractor/service provider" is not made distinguished visible in the developed promotion materials.
- NBP-Masons feel that they are not well promoted as a part of the NBP and to improve this they request caps and/or long sleeved shirts with recognizable logo markings so that they are easier recognized as an official service provider for NBP. (No T-shirts; they are not official enough). *Consider instead of caps to introduce hardhats of a distinct color and with the NBP logo. Such hardhats are not much seen in the provinces. They are comfortable in the heat, they are distinct, and express to a degree an interest in safety. (including when they use them while driving on motorbike).*
- NBP-Masons say that present promotion leaflets are good, but they also want the poster with 6 bad/good pictures on the left and right to be printed in a leaflet format as they recognize that it a useful tool for direct promotion by talking with potential customers.
- NBP-Masons realize that exposure visits by potential clients to a working plant is a good exercise but so far, they lack the initial finances to organize this as well as they lack at this stage the finances to initiate marketing at a larger scale.

One much appreciated aspect of the biodigesters is the average saving on fuel wood which comes to average 10$ per month. The program also mentions at same level of marketing and promotion the advantage of a nicer environment due to less cutting of fuel wood: More trees and shrub remains!. This is a nice aspect while promoting the program to a non-user stakeholder, but it is not relevant for marketing to a farmer. Reality at village level is that the saved wood will be used for something else. If this aspect of wood saving is to be used in marketing to the farmers, then it should actually tell that the farmer can get extra income by selling the saved wood, or by turning it into charcoal. There will be no reduction in tree-cutting soon.

-8- Cooperation PBPO and the NBP-Masons

- NBP-Masons have no complaints about the cooperation with the PBPO supervisors and report that the relation is good.
- There are Village Meetings for promotion of the NBP at village level and ideally several NBP-Masons are invited to attend these meetings. During the meetings with selected groups of NBP-Masons during this study it was reported that only limited times any of them were invited or attend these meetings.
- NBP-Masons would like to get support by introducing them as certified NBP-Masons to the Commune and District Officials.
- PBPOs collect data on the location of potential clients. This information is apparently not much provided to the NBP-Masons in the concerned areas
- The name of PBPO 'supervisors' can in future provide problems. Especially when the NBP-Masons are developing into small contractors that are producing larger numbers of biodigesters, then the role of the supervisors is one which equals in responsibility. These now-called supervisors are then representing a different partner in the NBP, with quality assurance as one of its tasks, but they are not the supervisors over the biodigester companies.

5 The desired private sector participation in the NBP

Since the program started it has selected and trained masons to a desired level so that they can construct the Farmer's Friend biodigester at an acceptable standard. In addition the NBP-Masons have been instructed to provide training and after-sales-service as an added service package to their construction work. Through the standard tri-partite contracts the NBP-Masons are obliged to provide a two year warranty on their workmanship.

5.1 The role expected by NBP for private sector actors in the position of NBP-Masons cum Contractors

The simplified role model on the mason's involvement in the mechanisms as shown in figure-2 needs an adaptation to reality. Their role is more complex. Figure-6 below shows the total package of involvement in a better way. This model is too complex for a simple mason to live up to and the Program also only expects a distinguished few of them to become the desired entrepreneur.

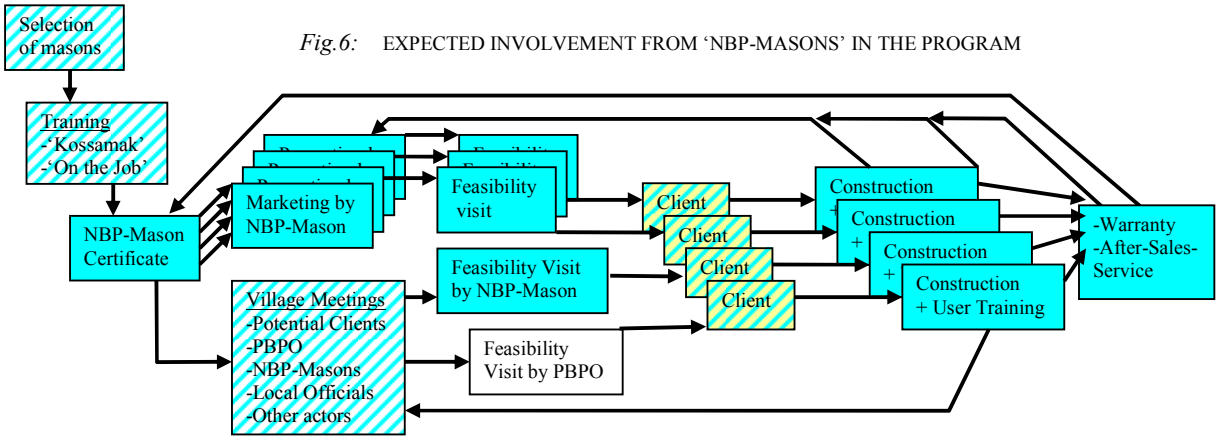


Fig.6: EXPECTED INVOLVEMENT FROM 'NBP-MASONS' IN THE PROGRAM

So far, the training under NBP focuses on single masons or plumbers of which a number are expected to develop into private companies. In reality, the NBP would like to have the role of providing the service of construction of biodigesters and related tasks to be played by private sector companies and not by masons who only have the skill to do the construction work to satisfaction. However, the fact that the national biodigester program is only in its first stage of phase-I, where the concept is new, and in which a critical mass is to be developed to create a self propelling market demand, made the choice to start with a selected group of masons (or plumbers) a reasonable choice to kick-start the construction component.

Figure-7 shows the combination of the mechanisms which were discussed separate earlier in this report.

Fig 7 PROGRAM START UP AND DEVELOPMENT

Table-2 lists to large extent the involvement and responsibilities which NBP would like to see covered by NBP-Masons cum 'Biodigester' Construction Companies.

ROLES FOR THE MASON cum BIODIGESTER CONSTRUCTION COMPANY *Table-2*

		Involvement in execution			Responsibility		
	activity	**A lot**	**Average**	**Little**	**A lot**	**Average**	**Little**
1	NBP-Masons involvement in marketing through Village Meetings		x			xx	
2	Marketing through Village Meetings, or similar, by (Biodigester) Construction Companies	xx			xx		
3	On own initiative apply targeted marketing direct to the individual client	x				x	
4	Marketing 'on-the-job' during construction and ASS		xx			x	
5	Promote the image and role of "Certified NBP Service Provider"	xx			xx		
6	Identification of potential clients and report to PBPO	xx			x	x	
7	Execute feasibility visits plus follow-up		x			x	
8	Make Clients happy and satisfied due to work attitude, work on time, and communication with the Clients		x		xx		
9	Answer questions from Clients and user/owners, solve problems, and provide relevant advice		x		x		
10	Construct the Farmer's Friend plants in time, in a safe and economic way, and with good quality workmanship. Ensure its quality.	xx			xx		
11	Ensure the use of good quality materials and that standard designs are followed	xx			xx		
12	Ensure the quality against construction defects for 2 years. From time to time visit and check the plants during that period; provide repairs and advice as required	xx			xx		
13	Provide on-site training to the Client on topics which are in the User Manual.	xx				x	
14	Maintain coordination and feedback relationship with PBPO supervisor.	xx				xx	
15	Get updated information from PBPO about the market and identified potential clients		xx			x	

These activities cover three main desired abilities and skills:

a) Able to construct the digesters at the right quality and with a suitable level of knowledge about their functioning and advantages.
b) Possess a knowledge and interest on marketing the Farmer's Friend digesters.
c) Possession of the communication and interaction skills minimum required for marketing and training of the clients/users.

5.2 Profile of a desired biodigester company

The desired profile for biodigester construction companies is a compilation of expressed requirements by the NBP-Masons, the level of existing small to medium scale contractors, and by the requirements as concluded from consultation with the program.

The NBP-Masons who were interested to develop into small contractors expressed the need for support on various issues:

a) A minimum team set-up to enable to work as a contractor is said to require 4 to 5 people who are at a level of semi-skilled to skilled in construction work. Such people are not readily available as those who have such skills are already employed or acting as small contractors. There are almost no mason trainings executed in any provinces of Cambodia[14]. The existing training mechanism is on-the-job. The NBP-Mason training is one of the few exceptions. Access to basic construction skills training is required to assist in getting enough qualified staff.
b) A minimum set of tools, equipment and a motorbike and trailer is required to work as a small contractor. The investment for this is estimated per set at an average of 590USD (refer to table-14 of this report). The NBP-Masons lack the money for this kind of investment.
c) Access to training on topics such as: book keeping, cost calculation based on drawings and bill of quantity, management and administration. ('specific entrepreneurial training')
d) Support in introduction as a qualified NBP-Mason cum contractor to usually the District officials, but preferably also to Commune and maybe to the Provincial officials.

If the NBP is going to involve suitable entities which already function as a small to medium contractor, then part of the bullets a) to d) here above may already be covered. However, if these small to medium contractors are to play the desired role and take the required responsibilities, then in addition the following must be added to end up with the desired inflow of the right contractors:

e) To have at least one mason who has legally obtained the NBP-Mason certification.
f) To have at least a minimum of staff, equipment, transport, finance, and administrative recording to be considered an active contractor.

From previous paragraph it is concluded that the NBP requires also the following abilities and skills for both the existing small to medium contractors as well of from those who may develop from the NBP-Mason training and doing subsequent work for NBP:

g) Possess a knowledge and interest in marketing the NBP digesters.
h) Possess the required minimum communication and interaction skills for marketing and training.

[14] The provincial training centers have this module as a 5 to 6 months exercise. Trainings are for free, but as the trainees have to arrange themselves lodging and food while attending the training at the center, there is almost no demand for these modules in present format.

5.3 Transition from present situation to the next stage

In order to come from present situation, using masons trained to build and 'market' NBP biodigesters, to an enhanced level a transition period is required. During this transition period at least a part of the available pool of small and medium contractors is to be identified, preferable with recommendations as to which ones are suitable as per the desired profile for NBP. These small and medium contractors will have to be approached to get them involved in a process to become "Biodigester Construction Companies" registered with NBP under NBP criteria.
At the same time a strategy has to be developed on how exactly to switch from having NBP biodigesters built by independent NBP-Masons to a situation in which registered companies are doing this. Registered as approved companies under NBP criteria. When a momentum is reached which will result in at least a minimum number of companies registering with NBP and fulfilling the NBP registration criteria, then parallel the existing NBP-Masons and cooperating entities need to be informed on the upcoming change in program implementation. It is foreseen that there will be a period in which both the original NBP-Masons and the new registered companies will be allowed to construct NBP biodigesters.

Present format of tripartite contracts will be phased out along with phasing out present individual implementation task of the NBP-Masons. A standard contract format for Client and NBP-registered contractors will have to be introduced when the first such contracting takes place.

It can be expected that the existing small and medium contractors in the five operational NBP provinces are at least to certain extent aware of the ongoing biodigester construction works in their area. In near future at least part of these small and medium contractors are to be targeted with NBP information about the desire to include them in a pool of registered biodigester Construction Companies. This includes information on:

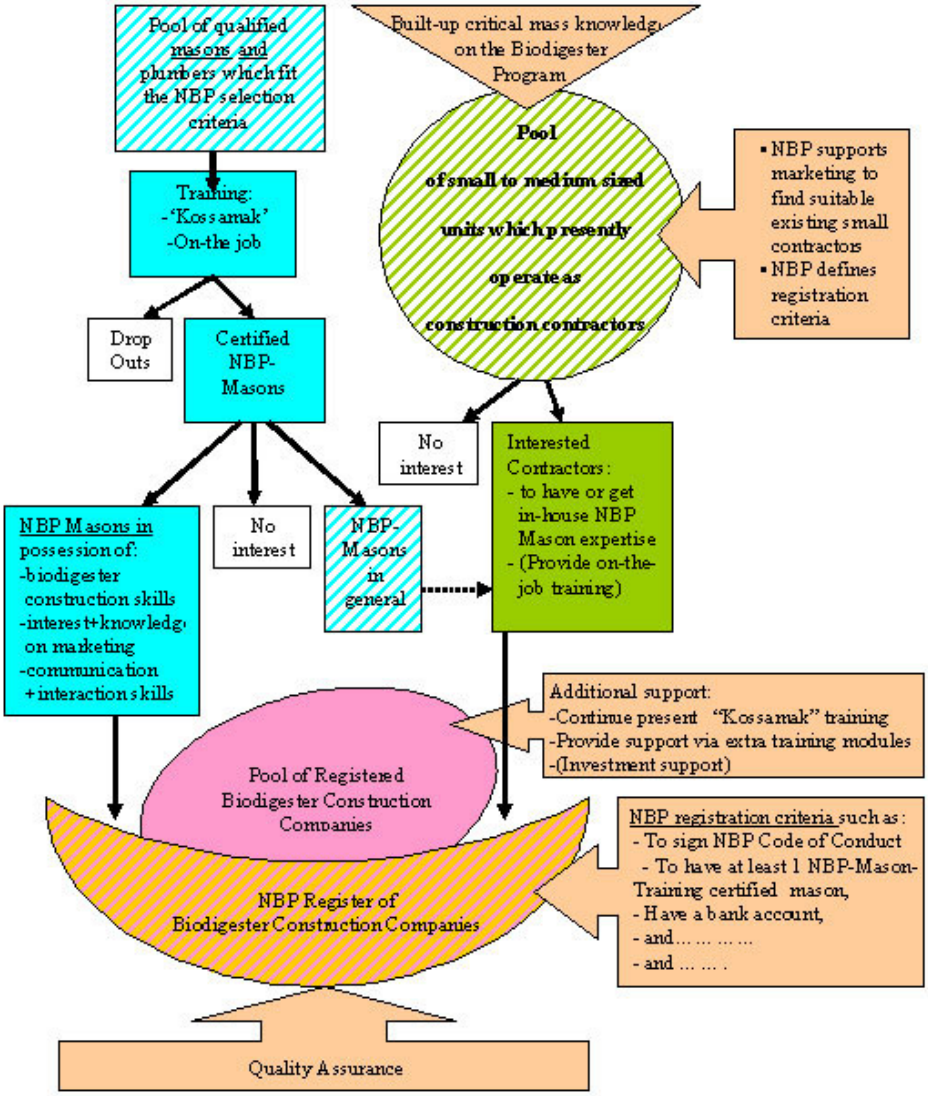
- The program
- The (future) registration requirements for Biodigester Construction Companies.
- Estimated market demand in their area.
- The tri-partite contracts.
- The financial aspects of building biodigesters.
- The expected responsibilities and involvement by the contractors in working with the NBP
- Information about the NBP masons training and certification of NBP-Masons.
- The transition strategy where present certified NBP-Masons are either required to develop into small contractors themselves, who can register as a Biodigester Construction Company, or who can work as skilled biodigester construction expert masons for NBP registered companies.
- The support NBP will provide in terms of provision of marketing tools.
- The possible other support the companies can get from the NBP.

The format for this targeting of contractors needs to be prepared as a direct marketing strategy.

Figure-8 here below shows:

- The existing inflow of certified NBP-Masons for the construction of biodigesters
- The follow-up development of suitable NBP-Masons into Biodigester Construction Companies with registration under NBP.
- The targeting of existing pool of contractors for NBP purposes.
- The process to get interested and suitable small contractors registered with NBP as Biodigester Construction Companies.
- The development of Biodigester Company registration criteria and setting up of a register.
- The option for continued involvement of other certified NBP-Masons as employees for companies which are registered with NBP
- The continued support by NBP through arrangement of Biodigester Mason training.
- Additional support by NBP; management/marketing training and possibly small contractor company set-up investment support.
- Quality assurance linked to the Biodigester Construction Company Register.

Fig.8: INVOLVEMENT OF SUITABLE MASONS AND CONTRACTORS AS BIODIGESTER COMPANIES + MEDIUM TERM NBP SUPPORTING FRAMEWORK



6 Conclusion

NBP has made a positive entry in Cambodia. The initial set of program mechanisms and procedures have been put in place, the offices are set up, and staff has been recruited and trained on the program's operations. Implementation of the construction of biodigesters has started in most of the pilot phase target provinces and for doing this a pool of masons has been trained. From the trained masons there is a group who are interested in developing into small contractors companies but for doing this they usually lack investment money and they need training support in specific issues. Other trained masons are happy to continue either as a general mason, or to continue as a mason specialized on biodigester construction. All interviewed masons agree that the market potential for biodigesters is large, but that so far the program has not yet developed enough critical mass and thus that still considerable promotion and marketing effort is required. Program management also knows that not enough such critical mass is developed.

Having developed the program infrastructure and a basic pool of qualified and experienced masons to do the biodigesters construction, the program is now ready for the next phase in which the private sector needs to be targeted to become an active key player in the program implementation. They are needed to be both a biodigesters construction service provider and a biodigester marketer. The trained masons can be such a player at a company sized level, but from the experiences so far it is concluded that there are not too many with enough interest, resources and capacity. Partly this can be attributed on weaknesses in the selection of trainees during the past period.
There is a sufficient large pool of small to medium construction contractors in Cambodia which could be targeted by the program to become involved..

There are sufficient small to medium contractors in the provinces who can build the NBP biodigesters once they have the capacity and experience to do this specific kind of work. However, they may need support in making some investment in their business, and they should get support to improve their capability to manage their company, to do marketing, to do proper cost calculations on their work and on the cost they have to keep their company sustainable. A good cash flow is an important issue; Schedule of payments should be in line with the expenditures. Payments for work as required by a program should include all the relevant cost to enable the contractor the keep his business running with a reasonable profit and overhead margin. Except for a few, the contractors in Cambodia can not do this kind of cost calculation.
This construction sector also requires for time being continued support, supervision, checking and punitive action when necessary, in order to have projects executed at a desired proper quality level

Present cost estimation format of the NBP biodigesters can improve to fit the support and transparency the Cambodian contractors require, An adjusted version of present quality assurance in the program can provide the framework in which these contractors can execute the work at a desired quality level if combined with the requirement that a minimum of experienced biodigesters construction capacity is under their employment.
Due to the lack of a working environment with standards, checks, and controls, and the requirement by NBP to have quality work, NBP will itself have to set up a registration pool for suitable contractors. It will have to develop the criteria under which the companies can enlist, and it will have to maintain a mechanism to ensure that the register of biodigesters construction companies only retains the good companies.
NBP already has the basics for the quality assurance side, and it can build on experiences from Seila regarding setting up such a pool and developing the desired criteria.

The existing pool of trained NBP masons can be direct employable resources for interested construction companies to join the register, and/or, with additional support, part of them can develop themselves in biodigesters construction companies, ready to join in the register. NBP will have to maintain their NBP-Mason training efforts for several reasons:

- The market for biodigesters construction companies will grow in present NBP working provinces and thus the need for masons that can assure that quality digesters are built
- NBP will expand in due time to more provinces which will additional increase such demand.
- As a continued effort to maintain quality.
- As one of the only efforts to provide quality training for skilled masons in Cambodia

NBP should review its training curriculum in line with the program development end experiences gained till date.

7 Suggestions and recommendations

Based on the content in preceding chapters and on the underlying information as reported in the appendices, a set of recommendations is here listed as summary:

i. At present the selection of masons for the NBP mason training has already been improved upon by the requirement that candidates first spend time as a helper to an already qualified NBP-Mason. Still, the selection criteria for the mason training need to be strong adhered to. More strong and more continuous than has happened in the early part of the first phase and maybe also more strong than is happening right now. There is a need to find experienced and skilled masons and not just to find willing trainees. The search for trainees, where to find them, needs to be from a wider field or from more sources than is happening at present. The selection criteria need to be reviewed. During the selection process the potential trainees need to be told about the expectations which NBP has about the roles the NBP-Masons are to play in the biodigester program(see table-T2). In the interview there must be a few questions which cover the interest and willingness of the trainees for entrepreneurship, and on becoming a business person/contractor. The answers to this should be reported and kept in the records of the program. This allows in future the verification of aspects of the selection procedure and it can help to identify NBP-Masons who are interested in a second level of support to develop into a biodigester construction company. In the interview there must also be attention for the required capacity of the trainee to communicate and interact well with others.

ii. The Mason Training needs to be reviewed to check if the approaches are suitable and if at the end of the training the trainees indeed have the desired skills, knowledge and interests which the program requires. It can be acceptable to have PBPO-Supervisors attend the NBP Mason Training, but the training approach and its curriculum should be focused on the masons who are to be trained. It is advised that additional modules are developed specifically for the PBPO-Supervisors and that, if required, these are taught to the supervisors without attendance of the masons. A true Biodigester Mason manual needs to be developed which the NBP-Masons can use as a reference book. In similar way the Training Movie should be reviewed for this support purpose, and the intended additional movies for items such as O&M should be developed as planned. Present training should at least get an applied module on ‘Training’, as the NBP-Masons are expected to transfer

knowledge and train the clients on operation, maintenance and troubleshooting. This skill is now no part of the training.

iii. The program is to consider drafting a Code of Conduct document which the qualified NBP-Masons can sign. This document is to make the NBP-Masons more aware of the expected roles that the masons are to play and it should strengthen the attitude from the NBP-Masons to be true NBP service-providers.

iv. The program must include the role and identity of the NBP-Masons in the promotion materials. The NBP-Masons should be officially introduced to the District and Commune officials in their area. The value of the NBP-Mason Certificate needs to be stressed and the NBP-Masons should get a hardhat or cap and/or jacket with NBP-logo which makes it possible for the people to immediately recognize them as NBP service-providers. NBP-Masons should be more and better involved in the promotional Village Meetings. It is also advised to consider making a special promotional VCD[15] movie which the NBP-Masons can use when they do marketing at village level (refer to recommendation vi) (This movie in such a set up that it is also suitable for use by the future Biodigester Construction Company NBP service providers. Convert the poster with 6 improved scenarios in a leaflet and add this to the marketing materials available for the NBP-Masons.

v. The program must realize that present type of NBP-Masons usually do not have the finances to invest in much marketing nor for developing into a small contractor company. The program should consider providing NBP-Masons access to finances which allows them to cover the basic requirements on tools and a motobike and trailer, estimated at 600USD per set. When considering the application criteria, the format, and the contractual set up of such financing, the NBP Code of Conduct agreement should be included.

vi. A 'NBP Contractor Training' should be developed with the objective to train a number of present and future NBP-Masons on entrepreneurial skills. The training content should be focused on issues which allow a selection of the qualified and interested NBP-Masons to develop with confidence in a small construction company; It is preferred that next to training in basic skills to enable this type of development, these trainees are trained in applied marketing skills for the Biodigester Program processes and its product: the Farmer's Friend biodigesters. The content of this applied marketing to link with the outcome of recommendation vii. The minimum number of trainees for this training can be estimated based on 3 NBP-Masons per district for the area which will be covered by NBP in phase-I (but this does not have to reflect the actual distribution of trainees in future) . The number of trainees can increase when NBP starts using existing small contractors as Biodigester Construction Companies. These new to develop NBP service providers can opt to also attend these trainings, but the format, materials and approach of the training is to fit the level of present batch of interested NBP-Masons. The program is to ensure that a maximum of 3 to 4 trainees per district are allowed to attend this training; preferable those who are genuinely interested and qualified.

vii. Presently the program puts considerable effort in promotion of its product and objectives. Probably also considerable financial resources are allocated for this. To which extend present approaches of promotion and marketing are suitable and effective should at some

[15] Not a DVD movie as VCD is easier to be played in the villages.

point in future be evaluated. There are underlying motivations that provide justification for present situation. When the NBP-Masons, and in future the Biodigester Construction Companies, are to do active marketing for the program, then their marketing needs to be as direct, applied, and cost effective possible to make sense to these service providers. This because these service providers will see the effort from their own viewpoint as a business. It is advised that the program seeks assistance from a professional marketing expert to review present promotion efforts and the mechanisms of the program, and if found to be desired, to ask this expert to develop a more suitable package. This advice is to link back also to the training content in recommendation vi and to the marketing VCD mentioned in recommendation iv.

viii. The cost estimation model for the biodigesters needs to be reviewed so that a more transparent model comes on paper which can be a marketing tool and instrument for discussion and decision between the service provider and the client. Preferably it should show the options for the Client which parts he can take care of. (Present list of cost items does not show which parts are not possible to be taken care off by the Client, and this may lead to confusion when the contract is being discussed and signed versus during implementation later on. The link of cost items and responsibility is to be clear at this point. At the same time some quantities of work need to be made transparent, some need to be re-calculated or verified in reality, Due to its importance, backfilling with compaction should be separate mentioned as a cost item. In-direct cost for the service provider such as for formwork/scaffolding, small tools, transport and a management fee/profit are to be added to show the set up of a cost estimation from the point of view of a private business, and to support sustainability for these private businesses.
Cost estimation review is likely to lead to an adjustment of the cost of the various biodigester models. Thus it would likely have direct impact on a cornerstone of the program. This impact is to be considered and dealt with.

ix. The program should verify with present and potential future NBP service providers on the choice of the title of 'supervisor' for the concerned program staff at provincial level. The title does not cover the job-description and it may be that especially with increased shifting of responsibility and tasks to the private sector, within the Cambodian context, this title may lead to undesired confusion and problems.

x. It is recommended to contact in each of the NBP provinces the PSDD (Seila/PLG) infrastructure advisors[16]. They should be requested for a copy of the contractor pre-qualification lists of their province. The desire of NBP to work with and develop small entrepreneurial contractors should be explained. Preferably, also the infrastructure advisor should be asked to indicate on their contractor list which of the contractors fit in the target group of NBP and, from their village level experience, they can be asked to recommend also other candidates who would fit in the small contractor development process of NBP. The information from this should be checked and the resulting information should be combined into present process of trainee recruitment[17].

(There are probably more sources from which the right type of trainees can be recruited, but as PSDD/Seila now works all over the country for several years,

[16] In the NBP Province of Svay Rieng, the PSDD infrastructure advisor is only recently recruited, so he will not be able to provide much background information about the listed contractors.
[17] It is a fact that there is in most areas no or only limited cooperation between different offices and departments. However the requirement to get access to better qualified and interested trainees to join under NBP is so big that this must be managed to take place.

and has in each province these updated pre-qualification lists, and as it also targets small contractor development, they are an obvious source to cooperate with).

Getting these names and recommendations will result in a large pool of candidates who can either be found suitable to join in future NBP Masons Training, or in future NBP Contractor Training.

xi. NBP should draft their own registration process where contractors can enlist to be eligible for making the biodigesters under the available program support and quality. The profile for the type of companies that can enlist are basically mentioned under item a) to h) in paragraph 5.2. In addition to these characteristics the following points should be considered:

- In provinces where this is not a financial, administrative or logistical problem which is difficult to overcome, the small contractors should have a bank account on personal name or on company name. (In cases where the bank account is still a difficult issue temporary an other solution for this issue is to be agreed upon, till the situation improves).
- The Biodigester Construction Companies should be required to follow the registration at provincial level similar to the 2007 requirements for contractors who want to bid for the Seila Commune and Sangkat Funds projects. In principle a yearly provincial level tax 'Patong' is to be shown before it is possible for the contractor to sign a tri-partite NBP Contract.

  (*Present provincial level Patong payment comes to 100.000riel per small company; 25USD per year. At time of implementing the switch to registered biodigesters construction companies, it should be verified if the Patong system is still operated the same way, or if rates have increased to levels which are too steep for small companies to fulfill)*

Part of drafting this registration process will be the drafting of criteria for those entrepreneurial individuals or existing contracting companies who can apply to enlist. Once these criteria are drafted, and when the enlisting process is drafted, there should be a few meeting sessions held to check these 2 drafts with the private sector. It is advised to have these sessions in the two provinces with the most biodigesters built; where the critical mass development is furthest. The invitees for these sessions should be: the existing NBP Masons; the listed potential contractors as received from the PSDD/Seila infrastructure advisor; and maybe also others. These invitees should be explained about; the National Biodigester Program; what working with NBP can mean to them; about the NBP Mason Training and the NBP Contractor Training; about the shift from the NBP-Masons being service providers, to Biodigester Construction Companies as service provider; and about the drafted enlisting process. During the meeting the drafted underlying criteria for potential enlisting companies should be tested to see how many of the attendees would fit the drafted criteria, and the attendees should be asked for their interest for registration and for their suggestions. The result from these sessions needs to be reviewed and if necessary the underlying criteria list and the enlisting process are to be adjusted and then formalized. During these follow-up activities the timeframe needs to be set for the required transition period in which the right to build biodigesters for the NBP program is transferred from present: by the NBP-Masons, to the future: by registered Biodigester Construction Companies.

(In this recommendation there are no suggestions added as to which administrative procedure could be followed to do the actual registration. If advice or feed back is required on this, it is advised for this to check the procedures in

place for pre-qualification of contractors at PSDD/Seila.)

xii. At the same time as switching to construction implementation via biodigesters construction companies, a new NBP Contract Format is to be developed and introduced, switching from the existing tripartite version to one which is only to be signed by the Client and the Company, and which still guarantees the standards as intended by the NBP.

xiii. It is assumed that when the Biodigester Construction Company registration process starts, and thus the new type of NBP service provider enters the market, that then the NBP promotion methods will be adjusted to include and emphasize these new service providers. At the same time NBP should start to introduce the new enlisted companies to Provincial, District and Commune level officials. This introduction should in future be re-done each time an updated registration list is prepared.

xiv. For time being NBP should manage the Biodigester Construction Company Register and this register should link up with the quality assurance component of the program. From time of development of this register on NBP should consider who in due time can take over the management of this register. It is not foreseen that the construction sector environment in Cambodia will improve enough in next 10 years to assure an overall good level of quality workmanship.

Next chapter shows a listing of activities in line with the recommendations here above, it gives a timeframe in which it could be implemented, and shows who is expected to be involved.
This timeframe has a minimum of 5 months for pre-transition activities, and a transition period of 9 months.

8 Actions required in the coming 3 years and timetable

TIME SCHEDULE FOR FOLLOW-UP ON RECOMMENDATIONS — *Table-3*

	Actions	timing						Involvement				
		May 07 to Sept 07	Oct 07 to Mar 08	Apr 08 to Sept 08	Oct 08 to Mar 09	Apr 09 to Sept 09	Oct 09 to Mar 10	NBPO	PBPOs	external hire	pot.Service providers	Other
	Normal advised schedule of activities											
	Kossamak' / On the Job / Contractor trainings											
	Tight schedule option											
	Acceptance of Report											
i	Recruitment for Mason Training											
	Improve selection process							X				
	Train PBPOs and implement improved process								X			
ii	Mason Training											
	Execute the NBP Mason Training							X			X	X
	Review content vs NBP desires							X	X	X	X	X
	Review Training Movie									X		X
	Implement required changes							X				
	Prepare NBP Mason Manual							X				
	Develop a Code of Conduct							X				
	Introduce and start Using CoC							X			X	
iii	Improve visibility of NBP Masons /Service providers											
	Prepare and implement the advised improvements							X			X	
	Make a marketing VCD for the NBP-Service Providers							X			X	
iv	Financial support to NBP-Masons											
	Develop a support option							X				
	Introduce and implement							X	X		X	
v	NBP Contractor Training											
	Develop a curriculum							X		X		
	Arrange the logistics for such trainings							X				
	Pre-select and Select trainees							X	X			
	Execute the NBP Contractor Training										X	X
	Align the applied marketing module to the expert advice							X				
vi	Marketing											
	Obtain expert advice							X		X		
	Implement the advice							X			X	
vii	Digesters Cost Estimation											
	Review existing model							X				
	Implement desired changes							X				
	Train NBP-Masons and PBPOs on revised model							X	X		X	
viii	'Supervisor' title											
	Review the issue							X	X	X	X	
	implement adjustment if desired							X	X		X	
ix	Visualize the potential on small contractors											
	Get lists and advice from PSDD							X	X			X
	Check the obtained information							X	X			
	Involve new pool in training selection (for 2 training types)							X	X		x	
x	Biodigester Company Registration											
	Draft underlying criteria							X				
	Draft the registration process							X				
	Meetings in 2 provinces							X	X		X	
	Review feedback and results and adjust the drafts							X				
	Decide on transition period							X				
	Introduce the new registration to stakeholders							X	X		X	X
	Start and run the registration process							X	X		X	
	Transition period										X	
	Abandon old system							X	X		X	
xi	Follow-up changes due to new implementation process											
	Implement the required changes							X	X			

notes:
-'External hire' refers to a temporary external hired expert.
-'Others' refers to contracted institutes like Kossamak and other stakeholders

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APPENDICES

APPENDIX-A General Data

QUANTIFICATION OF NBP RESULTS UP TO APRIL 2007 IN REGARD TO PSD							*Table-4*
#	description	Kandal	K.Cham	Svay Rieng	Takeo*	K.Speu*	remarks
1	Nr. of biodigesters finished per 03/07	95	163	93	87	40	Total 479 plants
2	Year in which the first mason training took place	March 2006	March 2006	March 2006	October 2006	November 2006	--
3	Nr.of masons trained by NBP	41	33	22	29	18	143 total trained
4	Estimated nr of masons still active in NBP	20	28-30	18-19	23-24	14-15	--
5	Nr.of active masons in PSD study meetings	10	10 (7+3)	Not visited	11	Not visited	--

** In these provinces the NBP construction component has only recently started.*

DATA ON FUELWOOD USE FOR COOKING * (during field meeting period)			*Table-5*
Household size	K.Cham	Takeo	Kandal
Small (4p)	1000-1500r / day		1000-1200r / day
Big (6p)	2500-3000r /day	3000r /day	2000-2500r / day

** unit sizes (bundle sizes), wood type/quality, and prices per unit, these all differ per province.*

APPENDIX-B Information from the NBP-Mason interviews

BACKGROUND AND INTEREST OF THE INTERVIEWED MASONS																		*Table-6*	
Prov	Number of years working in construction																	Occupation/Aspiration	
	0.3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Only Mason	Contractor / Mason
KCM			**xxx**	**xxx**	**x**								**x**		**x**	**x**			**xxx**	**xxxxxxx**
TK	**x**	**x**	**xxxx**	**xxx**														**x**	**xxxxx**	**xxxxxx**
KD		**xx**	**xxx**	**x**	**xx**	**x**		**x**											**xxxxxxx**	**xxx**
Other experience indicator; involvement in Seila local village level infrastructure projects:																				
Previous Seila experience:			KCM: not asked					TK: no experience in Seila projects							KD: 40% has some experience as labor/mason in Seila projects					

EXPERIENCE OF THE INTERVIEWED MASONS 1: BIODIGESTERS BUILT																							*Table-7*
Prov	Program in progress	Number of biodigesters completed alone or with others																					
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
KCM			**x**		**x**		**x**				**x**	**xx**				**x**	**x**	**x**					**x**
TK					**x**		**x**	**x**	**x**		**xxx**	**x**	**x**		**x**								
KD		**xx**	**x**	**x**		**xxx**	**x**		**x**														

EXPERIENCE OF THE INTERVIEWED MASONS 2: INCENTIVE PAYMENTS AS INDICATOR OF MARKETING INVOLVEMENT												*Table-8*
Prov	Program in progress	% of masons who earned marketing incentive	5$ incentive received					10$ incentive received				
			0x	1x	2x	3x	more	***0x***	1x	2x	3x	more
KCM		*Not asked*	*Not asked*					*Not asked*				
TK		45%	*All*	-	-	-	-	*6*	2	2	1	No
KD		30%	*All*	-	-	-	-	*7*	2	-	1	No

TRAINING SELECTION OF THE INTERVIEWED NBP MASONS				*Table-9*
Prov	NBP masons in meeting	Interviewees less than 2 years mason experience*	Selected by / via	Interview as part of selection
KCM	10	30%	*Not asked*	*Not asked*
TK	11	50%	PBPO supervisor; Work at or trained at prov.Agr.dpmt; Vill/Commune contacts	All interviewed
KD	10	50%	PBPO supervisors; livestock persons	Only loosely talked to

** Minimum 2 year "mason experience" is required as a criteria at time of selection for the NBP mason training (see table-6)*

OPINIONS FROM THE NBP-MASONS ON COMMON NBP ISSUES	*Table-10*
-A- Project components which were mentioned by the NBP-Masons as causing problems or for improvement:	
1	Some of the experienced masons said that several trainees were not qualified for the training as they lacked basic work experience skills and that thus they could not understand several of the issues one faces in the field on a construction job. This is also reflected through complaints that in the on-the-job training phase, several trainees considered that stage of training to be not of good quality. The trainer mason in such cases was mentioned not to be experienced enough, or not willing or able to transfer knowledge to the trainee.
2	The program is still much unknown and has not developed yet any critical mass. Therefore it is not easy for the masons to get new clients; "There is much a wait and see attitude".
3	Masons have no start-up money available to go out and do marketing like is intended under the 5 or 10$ incentive system for successful finding new clients.
4	Within present group of NBP-Masons not often enough cash-flow is available to do activities as marketing nor to buy a set of basic equipment and transport to operate as a small contractor.
5	More copies requested of the existing marketing materials such as the leaflets. Request was to have also the poster with 2 improved situations on it in a leaflet format for their marketing work.
6	Present mason training approach of NBP is recognized by majority of the present trained NBP masons that it has the risk that they will get too much competition from new trainees.
7	Some areas the soil conditions are difficult for excavation while the cost estimate is only using one work nrom for excavation
-B- Common project components on which the NBP-Masons had no negative comments:	
10	The various aspects of mason training were all considered good/OK (food, location, trainers, duration, topics covered) *It needs to be realized that Cambodians are eager to learn almost anything. As such they will not easily complain about training and not be critical about topics which are covered and those which may actually be a waste of time. If trainees are experienced and need to learn additional skills then it could be expected that additional topics which are not covered, would be requested, but that is still quite an utopist expectation in Cambodia.*
11	There is enough support by the supervisors to the masons. (frequency of visits, level of support, willingness to assist in explaining issues to the clients), and there was no mention that any irregular payments had to be made to supervisors.
12	There were no complaints about conflicts with the clients. ▪ None about the contract (cost, warranty, participation fee). ▪ None about choice of materials. - In Takeo province the supervisors are on request of the clients much involved in purchase of materials for the biodigesters. Then while purchasing the emphasis is not enough on the good quality of these materials. The masons say that therefore the quality of materials is not always up to the standard as they should be. ▪ No complaints about the design features. - *In the field non-standard inlet/mixing structure was observed*. - From the MSME program info was obtained that pig farmers from their target group had visited NBP sites on study tour. As a result additional biodigesters were built in same NBP provinces as well as in Banteay Meancheay. Several of these were of a larger capacity such as up to 20m3. It is not clear if any of these larger and smaller ones were constructed in present NBP provinces within NBP scope, or independent of the NBP program. It was mentioned that some of them were built by NBP-Masons. ▪ It was mentioned that no one was unhappy after completion. ▪ No one complained they did not know enough about how to run the plant after construction. ▪ No one complained that the trouble shooting section in the manual was not understood.
13	The masons made no complaints about the payment system.
14	In general there were no complaints about the warranty system. This even though no one even knows where they could eventually, maybe?, get the outstanding amount!. (But, the program is running so far only a short time, no real defects reported as yet, and as such the financial workings of this component are not yet in operation. The masons are clearly not yet aware of major parts of this quality assurance component, and NBP has admitted that large part of this system is not yet worked out in procedures/instruction/training)
15	Supervisors have moto-bikes that they can use to cover areas to do promotion. Usually the NBP masons do not have moto-bikes.

MASON'S OPINION ON BEING A GOOD NBP-MASON / CONTRACTOR – SERVICE PROVIDER					*Table-11*
	answers	**KCM**	**TK**	**KD**	**remarks**
1	Need to have the NBP certificate*	100%	X	X	**Refer to the report para 5.8, item 4 in the table*
2	Ensure quality and designs of construction works	60 %			
3	To maintain good contact with the client and be on time with the work		X		
4	Be involved in marketing		X		Village meetings; but also presentations at schools/Wats and be a channel providing promotion materials and info.
5	For interested potential clients organize visits to existing plants		X		

ISSUES STRESSED BY THE MASON'S ON BECOMING A SMALL CONTRACTOR					*Table-12*
	answers	**KCM**	**TK**	**KD**	**remarks**
1	(Financing of) A basic set of tools and equipment allowing to run a small team as a contractor; This includes (financing of) transport to go around with workers and materials plus for client visits	100 %	X moto bike		*See table-14*
2	Mentioned required training:				
	Book keeping (related to construction work: incl. cost calculation from BoQ)	15 %	X	X	
	Management/Administration	15 %	X	X	
	Biodigesters extra training*	45 %			
	Basic construction training to new team members** (skilled/semi-skilled level)	60 %			Either NBP to arrange these trainings, but then see remark* or facilitate it via others. Preferable at provincial level. Desired to have 4-5 persons trained per certified NBP small contractor.
	Material testing and uses			X	
	How to read a construction drawing			X	
	BoQ calculation from drawing			X	
	Marketing training		X		
3	Form a team with whom masonry, simple construction work can be contracted	100 %			
4	Ensure to get good masons in the team	45 %			
5	Take responsibility for the works	15 %			
6	Organize the work, labor and equipment	15 %			
7	Do self direct marketing on biodigesters	15 %			
8	Service provision to farmers	15 %			
9	Promotion by/with NBP	45 %			

** This may have to do with knowledge about larger models of digesters, but this has not been verified*

*** This is supposed NOT to be the Biodigester training as then the trained people become competitors; The new-to-be trained are supposed to keep working under the NBP-certified mason/contractor.*

DESIRED NBP SUPPORT BY NBP-MASONS TO BE A GOOD SERVICE PROVIDER					*Table-13*
	answers	**KCM**	**TK**	**KD**	**remarks**
1	All NBP qualified masons do not yet have their certificate. (April 2007)	X	X	X	**Refer to the report para 5.8, item 4 in the table*
2	NBP to arrange assistance in on-the-job training or to ensure that the on-the-job trainer is a qualified person who can do it.	X			
3	NBP to increase/change its promotion activities				The KCM group suggested to focus on a "happy family image"
	More frequent NBP promotion on TV (and then in prime moments during good movie)	X		X	
	Promotion via central and local radio	X		X	
	Promotion via newspapers			X	
	More of the existing promotion leaflets to be available for the NBP masons	X		X	Level of leaflets is deemed to be good/appropriate for promotion if it is combined with explanations.
	Convert the large poster with 6 good and 6 improved situations on it into a small leaflet which can be used by the masons for use during promotion. Provide these leaflet formats in sufficient quantity to the NBP masons	X		X	This poster is deemed to be good for promotion if it is combined with explanations. It seems that this poster is not really effective as a stand-alone tool without explanation.
	Introduction of an "NBP-girl"	X			Similar to beer-girls, 'All sizes OK'
	Use of NBP-promo/recognition banners in public areas and/or at specific events	X			
4	The incentive system for successful marketing should be increased to 15$	X			
5	Assure that the money for incentives is paid quick so that the cash can be used for additional marketing trips.		X		It is not clear if late payments here were structural problem or in some specific cases; Refer to complaint that the masons have no cash to start promotion activities.
6	The masons consider the subsidy of 100$ not the best option as the potential clients have the means to invest. They say it is better is to have a loan scheme available.	X			*The underlying policy is explained in para 5.1 of the report. Apparently the masons are not aware or still do not agree.*
7	The NBP-Masons are to get better recognition in the provinces. Now the recognition level is too low and overshadowed by the supervisors. Only limited number of the interviewees have so far been invited at the village meetings in their area	Not asked	X	X	Certificate; Standard caps (hard hats?) and/or long sleeved sturdy button shirts with standard logo; Introduction to Commune and District officials; More involved in the village workshops
8	Reduce the participation and warranty fee for the clients			X	

BASIC BIODIGESTER CONTRACTOR TOOLS-EQUIPMENT-TRANSPORT SET (as defined by NBP masons of Kompong Cham)				*Table-14*
item	1 moto bike*	1 trailer	Tools & equipment set	
Minimum	330 $	50 $	150 $	Basic set for a minimum sized company set up with 4-5 fixed staff: Baskets for concrete etc; leveling water hose; plumb; pickaxe; timber formwork; mortar trowel; smoothening trowel; gloves; boots; S-irons
Maximum	400 $	70 $	170 $	
Average	370 $	60 $	160 $	
Average total investment estimated : 590 $**				

** There was request for only 1 moto bike (good quality second hand); No one needed 2 bikes.*

*** The local interest on borrowed money for such amounts is mentioned as being 3% per month.*

APPENDIX-C

Remarks on NBP-Mason Training and Construction Training DVDs

NBP MASON TRAINING	*Table-15*
Please note that the interviewed masons had no negative comments at all except some of the experienced masons complained that the experience level of some of the participants was too low General conclusion is that present Mason Training is not well lined up to a strategy in which the trained NBP-Masons are to develop into small contractors that can and will function as Biodigester Companies. This issue is covered in chapter-6 of this report. The program wants to maintain present training and if required add additional training and support to create a solid pool of Biodigester Construction Companies. It is understood that the 10-day training at Kossamak is followed by a required on-the-job training time while co-constructing 3 biodigesters. Only then the total training is completed and then the masons are 'NBP-certified'. Below are summarized comments which are meant to improve the Mason Training; a training with the sole purpose of training masons who can build good quality biodigesters and who can provide user training and after sales service. These comments are based on the interviews with the masons, the studied training curricula including the training CD movie (only the English version was consulted, and the Khmer version was scanned through in comparison).	
General remarks:	
1	The training does not have a module on how to teach the owners/users. When the contents of the User Manual is covered in the training, then there should be a module added on what are the best ways to teach the clients on the topics mention on operation, maintenance and trouble shooting.
2	The manual mentions as a side item that the NBP-Masons have also a task and responsibility to do marketing. Even in the training movie this task is not mentioned in the beginning of the movie where the 3 main tasks of an NBP-Mason are mentioned. This task should be integrated from the beginning. The masons should be informed in a training module of the responsibilities and involvement they are expected to take up while working with NBP. (refer to table-2 in the report). In addition there must be a module on Marketing. One which covers the basics of marketing as well as some applied practices for marketing using program materials and program information. Such a module must be set up by a resource who is capable of preparing such a module which is also to be practical for the level of NBP-Masons.
3	Present English mason training curriculum is not a training manual for masons. It needs to be converted into a manual for masons if that is desired. Present curriculum seems to be for the instructor, including the training evaluation sheet which is attached. At each module the text under the heading 'handouts' is not a handout.
4	It is advised that a separate study is done on how present training is perceived by the trainees and compare this with the desires from the program. This separate study is to advice on which improvements are required to get to the desired curriculum standard and to include the suitable approaches and content. Present observations are that the level of material is not at a consistent level and without an underlying thought through strategy
5	It seems that parts in the training are providing too much information about program and biodigesters in a way which is not required for the expressed training objective and training level. It should be checked if there are parts which should be removed or exchanged for better topics.
6	In the Training Manual provide copies on all the used NBP forms and certificates.
7	Background knowledge related to the Farmer's Friend biodigester design is not provided in the modules. It should be considered to include such additional knowledge. (Why is the digester round and not square?; Why is a dome used?; Why is it important that the dome is gas-leak proof? Basic principles of cement and concrete as well as the use of acrylic emulsion paint; Simple way to set up an inlet pipe under 60 degree[18]) (Advised to add in the training also the know how on making a simple rebar bending table and make their own S-hooks)
8	The training focuses on material (and construction) quality check by only referring to the right type of materials. No examples are provided from the bad materials, not on how they can be recognized, nor on

[18] For instance a person standing straight and arm outstretched; The angle of the line from toe to the fingertop equals approximately 60 degree.

	how some bad materials can be treated to improve them to become acceptable. (Bad quality PVC pipe?; Bad quality bricks; Damaged cement? (And yes, both in English and Khmer version: re-bar is allowed to be rusty but should not be fully corroded through) (How to sieve and wash sand?)
9	To add a module which covers the responsibility by the NBP-Mason for quality of the biodigesters; Risk of losing warranty money and risk of losing NBP certification? Include a clear division on what is under responsibility of the NBP masons, and what is under which other party's responsibility. Additional explanation on the warranty system is required including the interest on the outstanding money.
10	Add a module which covers each item of the trouble shooting as listed in user manual. Presently the masons have only very limited knowledge on these issues. Some items are to be added such as on biogas lamps.
11	Add a module on the total timeframe and steps involved in constructing a biodigester. The result to be a timeline which can be explained to the client-farmer from when he signs a contract, to the moment he will likely be able to cook first time on their biogas, to the moment of 2 year successful completion check. This timeframe is also a basic marketing tool for the NBP-Mason.
12	The market of construction materials and fittings is not big in Cambodia. The appliances as being appropriate for biogas are also so far only limited available. Cambodia has no standards and specifications for many things, including no standards for construction materials and not for quality of construction works. All this means that it is best practice to check the market for available materials and judge if they are acceptable for the biodigester construction or not. Thus make pictures of the common available accepted brands/types and of the ones that are not accepted. Provide instruction on these and include this in the modules and instruction movie: - Cement: Do not only say that it needs to be 'portland cement', but check which of the brand names qualify and which ones not. (Experience shows that here a brand name implies the quality) - Do not use only the name "blue plastic pipe" but show which quality of pipe in case of pipe available in the market. (show also that the pipe and fitting sizes are different if the same brand and classification is not used) - Acrylic Emulsion paints good ones available and the wrong ones. (latex emulsion?) - Which valves to use and which ones not to use. (Present movie shows brass gate valves fitted to the stoves!) - PVC solvent cement; The good ones and which glue is not the right one. - (Simplify the specification for the use of gravel; Now mentioned as being in relation to the thickness of the slab. Just simplify saying maximum 25mm diameter.) - Round smooth gravel is just as acceptable for concrete as broken gravel. It is actually even better. It just needs to be clean. - The available good type of lamp mantles. Including how the packing looks like;
13	Add a module on the upcoming development in NBP regarding NBP registration of Biodigester Construction Companies, and which roles the NBP-Masons can play in future.
14	The "On-the-Job-Training Plan Of Action Form" needs to have also the signature of the assigned supervisor which shows this supervisor knows about the content of the Action Plan, and that he agrees to it.
Specific remarks in relation to the Training CD Movie	
Here above is mentioned the advice to have person with experience on such matters review the training curriculum. This is intended to include actually both of the 2 CD movies produced by NBP so far	
15	On the label of the DVD add the duration of the movie and add the intended audience or objective of the movie. It would be an improvement if at the beginning of the CD there is an introduction which explains the intention of the movie, who is targeted as audience, and how the users can shift between the various chapters.
16	There is a lot of duplication of images and text in the chapters. Where something in one chapter links to some knowledge in an other chapter, there this link should be mentioned while duplication of information should be minimized. Information should be limited to its true relevant chapter.
17	In Cambodia different levels of language are used. The words used in the movie are not at mason/farmer level but are at government office use level. Advised is to adjust the language to the target group for which the movie is intended to be. Even the normal used language at Kossamak institute is not at the most effective level.
18	The beginning of movie shows 3 responsibilities of an NBP mason. But in the end chapter there is a 4th responsibility added being 'farmer instruction'. This should be coherent from the beginning and not as an add-on.
19	Movie mentions that "farmer should look for a good mason" but it should say "farmer is to work together with a mason/contractor who is certified by NBP".

20	The movie uses the word 'farmer' while actually it would be better to use client/farmer where appropriate. This would support the intended role which NBP expects from the masons; To become a service provider active looking for clients.
21	There is no explanation about the use of units for mixing ingredients for concrete and plaster layers as per the required volume ratios. There should be instruction on this to use things like buckets and bottles etc. Explanation required that one bag of 50kg cement equals 40 liter of cement powder. (are in Cambodia at present all brands of cement bags 50kg/40 liter?
22	There us no mention in the movie about protection of the pipe by burying it and having the trench free from rocks around the pipe. (Actually also the posters should be adjusted to show that the main pipes are buried from digester to the place where the gas is used.)
23	Movie does not explain why it is required to close the main valve after each time using it. If this is not explained then there can also not be a high expectation that the users keep on doing it.
24	Movie mentions all of a sudden "shut off" when the gas pressure gauge shows a high pressure. It is not explained why this is required and it does not explain why the pressure is high. Plus not on how to prevent this apparent risky situation.
25	At the end of the movie there is mention of something similar to "after completion of construction the mason has to stay with the farmer for a certain number of days". This probably needs revision in its wording.
26	Some shots in the movie show the use of a work floor, a mixing floor. That is a very good concept which should be a required practice and as such should be part of the instructions in the movie. But this practice is not used in each part of the movie. Leaving it out of the instructions is not advised; and having two different approaches in the movie is confusing.
27	Bad practices presently included in the movie: (Part of these bad practices shots should be used in a separate chapter showing "bad practices") - PVC pipe is not cut straight but under an angle. - PVC pipe after cutting is not cleaned from cuttings and immediately glued into place. - Vertical piece of PVC pipe down from the dome outlet (after the valve) . In the movie this is cut at a too short length. - Masons apply PVC solvent cement with the finger which is not a good practice to put in the movie. - Movie shows the common practice in Cambodia of using both Teflon tape and glue for fitting PVC with a brass fitting (program to decide if this practice is allowed or if it should be shown correct. Cambodian practice next level is to add silicone over the joint!) - The sequence shown on putting the fittings to the dome outlet pipe is wrong and too much force is thus put on the fittings. Decide on the best sequence and show only that option. Now a sequence of fittings is used which does not allow removing the main valve without demolishing part of the PVC pipe work. (This is also the case in the demo pipe work show at the entry to the NBP office in PNH!!). - There are different options for how to do this part of the plumbing work depending on the local available materials. To check in the markets which are the 3 most common types of available fittings? For these 3 cases make proper drawings on the sequence of fitting and instructions on how these need to be assembled; Include these drawings and instructions and doing it in practice as a component in the training. In the movie show only 1 variety and tell that there are more good other ways depending on available materials. - Worker on bare feet.

APPENDIX-D Company Licensing in Cambodia

Table-16

CONSTRUCTION AND COMPANY REGISTRATION / LICENSING IN CAMBODIA *Data per 2001**

Agency	Licensing Characteristics	Targeted Companies	Commercial or Construction ?
Min.of Commerce MoC	▪ 2 type of application forms (domestic and international applicant) ▪ application forms 100US$ ▪ Total additional registration cost should be around 50-100US$ ▪ Additional registration should be done at Tax Department (‘±50$ fee’) ▪ Construction companies additional are requested to register also with MUPLM&C ▪ Can only register at the Ministry; NOT at the province office (maybe these can ‘facilitate’) ▪ Declaration off ‘Non-Civil-Servant’ required	▪ Actually all businesses in Cambodia but no systematic checking is executed. ▪ No difference who registers, what type of activities ▪ Any activity that you want can be listed, no checking. ▪ No database where can check who is registered for what type of business.	▪ Purely commercial licensing; ▪ One time registration fee, later on payment of Taxes per an interval.
Min.of Economy and Finance (MoEF)	▪ Listing of construction companies which want to bid for internationally funded projects of which the money flows from donors through MoEF as loans/grants etc. (per sub-decree in 1995 established arrangement at Department of Public Procurement) ▪ Pre-registration required at MoC and MUPLM&C	▪ Classification in Small, Medium, Large companies ▪ Small can bid upto 31.250$; Medium upto 125.000$ and Large for all amounts ▪ Presently 10 construction categories for which separate registration	▪ Construction companies that want to bid for the international funded construction projects ▪ Fee for registration is 20$, 35$, 50$ for respectively Small, Medium, and Large companies; per each category of work.
M.Urban Planning, Land Development and Construction MUPLM&C	▪ Ministry established only in 1998. Has a sub-decree since 1999 to list construction companies that want to bid on official projects. ▪ 3 categories of companies; Big, Medium, Small. ▪ Criteria: Experience of staff, Number of staff, Money in the bank ▪ Started the listing in 2001	▪ Eventually all construction companies in Cambodia	▪ Country wide Construction License
Public Works MPWT	▪ No own licensing or listing for construction projects. ▪ Some of the loan/grant projects under MPWT have an own short listing procedure for contracts		
Rural Development (MRD)	▪ No own licensing or listing for construction projects. ▪ Some of the loan/grant projects under MRD have an own short listing procedure for contracts. (and in 1 case the project requires LBAT trained contractors		
Provincial Authorities	▪ Each Province has its own set of licensing, but the enforcement is not structural but ad-hoc. ▪ If listed at Central Level this overrules most provincial requirements. ▪ Often requirement is that there is a ‘tax’-certificate from the provincial or district Tax-Office ▪ Sometimes additional an ‘Approval’ is required from a provincial authority, usually at a yearly ‘Fee’	▪ All companies which are getting involved in the provincial business scene. ▪ There are many exceptions, or non- enforcement for which there is no clear reason	▪ All are actually normal commercial business licenses which should have been registered at MoC but it seems at Provincial Level to be accepted if actually only Tax is being paid. ▪ Yearly tax fees are fixed at various levels depending on the perceived ‘size’ of company. ▪ Some provinces have additional monthly fees
Seila/NCDD Provinces	▪ Since 1999 Seila has been making pre-qualification lists and uses this method countrywide. Many contractors have already been removed from these lists due to bad results. ▪ Listing not related anymore to pre-registration as a company. Only required to pay the provincial ‘patong’ prior to award of a contract.	▪ Should be from very small to reasonable sized	▪ Initially for Seila/NCDD construction contracts only
Association: Contractors Association c/o ITC	▪ Initiative, open for all contractors willing to work for an improved sector with internal codes of conduct; ▪ Eventually internal licensing based on experience record and behavior	▪ The whole private construction sector in Cambodia	▪ Construction but non-commercial intended; ▪ Private Sector initiative to improve and protect the construction sector.

**Source: Small Contractor Survey CMB/01/R72/RILG- UNOPS/UNDP, 2001 and with some modifications per April 2007*

APPENDIX-E BoQ and Cost Calculation of the standard digesters

Below in table-17 various labor rates are shown as surveyed in 2007. These rates for 2007 are only indicative values as the sampling was done only in the meetings with the NBP-Masons. These indicative rates are in same table compared with the rates used in NBP-cost estimation.

NBP USED LABOR RATES FOR 2007 and INDICATIVE VALUES FOR 2007 LABOR RATES IN NBP WORK PROVINCES****					*Table-17*
#		K.Cham *	Takeo*	Kandal*	NBP rate **
1	Skilled labor	17.000r (19.000r =4.75$)	12.000r (14.000r=3.50$)	16.000r (18.000r=4.50$)	4.00$
2	Semi skilled labor	13.000r (15.000r =3.75$)	11.000r (13.000r=3.25$)	13.000r (15.000r=3.75$)	
3.1	Un-skilled labor	10.000r (12.000r =3.00$)	6.500r (8.500r=2.15$)	7.500r (9.500r=2.40$)	1.50$
3.2	Un-skilled excavation of soil				3.00$***
4	Daily food	(+ 2.000r)	(+ 2.000r)	(2.000r)	
5	Overseer/Technician	7.50 USD	12.50USD	10.00 USD	
6	Difference in rate for male or female labor	Same	Same	Same	
7	Differences in work done by male and female	Man can do certain work better. Women work longer	Male can do more work.	Can do work equal. Sometimes men are lazy.	

**Source: April 2007 PSD study meeting with the NBP-Masons*
***Source: NBP Bill of Quantities2006- 2007*
**** NBP Bill of Quantities states 1.50$ per cu.m: Using the practical work norm of earthwork[19] at 2 cu.m/day this equals to 3.00$ per day*
*****Rates survey from more sources is required to verify if these indicative rates reflect reality or not.*

Following comments can be made on the rates in Table-17, partly assuming that the indicative rates represent reality:

- NBP uses 1 rate for skilled workers and 2 rates for un-skilled work in the 2007 cost estimations for the biodigesters.
- The different rates for unskilled labor are probably a mistake due to use of a different method of presentation.
- In some provinces the used NBP rate for skilled work would be seriously too low and in some it is acceptable.
- The normal NBP used unskilled labor rate would be much too low compared with the rates presently mentioned in the mason meetings.
- These differences in used rates and stated in the meetings justifies a further survey about the actual going rates in the provinces. Rates should include the cost for food provided to the workers.

For comparison table-18 is added below. It shows surveyed rates in 2001. The 2004 rates were derived from 3 different sources per provinces. Comparison of the 2 tables shows the following main conclusions:

- Skilled labor rates have remained the same in last 6 years.
- Un-skilled labor rates have increased a lot in past 6 years.

CONSTRUCTION LABOR RATES 2001 (for comparison to 2007)					*Table-18*
#		K.Cham	Takeo	Kandal	remarks
A	Skilled labor	18.000r	12.000r	No data	Only limited local available/imported
B	Semi skilled labor	No data			
C	Un-skilled labor	5.500r	5.000r		Not much available/part of year only
D	++ Add on for food	No data			
E	Difference in rate for male or female labor	same	same		

Source: Small Contractor Survey CMB/01/R72/RILG- UNOPS/UNDP, 2001

Table-19 on next page shows the cost calculation presently used by NBP for the 4m3 biodigester.

[19] See for this work norm the part in this appendix about 'Justified work norms in Cambodia'

Reviewing the cost calculation and the way it is presented provides several reason for comment:

i. Reference to the existing rates for un-skilled and skilled labor as mentioned above; Per province the actual situation should be surveyed properly and the results considered so that a true valid cost calculation for NBP biodigesters can be made.

ii. There is reason to reconsider the used work norm for earthwork. Here in table-22, further below, is a recent outcome included from a review which was done for WFP Cambodia for their food for work programs. *(Cambodians are very well aware what going rates per m^3 are for this type of work and will not easily work for a lower rate than perceived market value; Even if there is unemployment and people are not having cash)*

iii. Present set up of the cost calculation is in some aspects not transparent, such as not separate mentioning the backfilling of soil with compaction. As this is an important work items for good plant construction, it should be mentioned separately. Also the quantities for un-skilled work and skilled work can be questioned and it is advised to re-evaluate these quantities by actual monitoring present ongoing NBP-digester construction work.

iv. Present set up of cost calculation misses several cost items which are to be included to show the true cost of the works:
   a) A cost for temporary works should be included which covers items such as scaffolding, formwork, a "roof" against sun and rain, lighting while working inside the dome (together maybe at a lumpsum of 5$ per digester)
   b) A cost for depreciation and waste of small tools (together at maybe 3% of the total cost for the building materials)
   c) A cost for transport of worker, equipment and materials (together at maybe 2% of the combined total cost of building materials and appliances)
   d) A management/overhead fee for the "contractor" (This could be put in the range of 5 to 10% of the total cost of the works as supplied by the contractor)

Reviewing and adding above mentioned items will provide a better insight in the true cost per biodigester. Adding the mentioned items under iv, and improving transparency under iii will provide needed support to the (small) contractor sector in Cambodia. In Cambodia the small contractors and many of the larger ones can not prepare a Bill of Quantity based on a design, and can thus also not calculate the price which would be reasonable to ask for the construction work. This issue is in this report also mentioned as an issue under 'training'.

Reviewing the above and changing and adding the various items accordingly may lead to an increased cost of the biodigesters up to 20% (for the $4m^3$ unit).

NBP Quotation for Construction of Farmer's Friend Biodigester – 2007 (copied values of 4 + 6m3 model)							*Table-19*
SN	**Item**	**Unit**	**Unit Cost USD****	**4m³**		**6m³**	
				Quantity	**Total Cost $**	**Quantity**	**Total Cost $**
I	**Construction Materials**						
1	Solid Brick	piece	0.04	2000.0	80.0	2400.0	96.0
2	Cement	bag	4.00	14.0	56.0	18.0	72.0
3	Gravel 1x2	m^3	18.00	0.5	9.0	0.8	13.5
4	Coarse sand	m^3	8.00	0.4	3.2	0.6	4.8
5	Fine sand	m^3	10.00	1.1	11.0	1.2	12.0
6	Inlet PVC pipe 10cm Ø	piece	4.00	2.0	8.0	2.0	8.0
7	Iron bars ø 6	kg	0.70	10.0	7.0	12.0	8.4
8	Binding wire	kg	0.90	0.5	0.5	0.5	0.5
9	Acrylic emulsion paint	Litre	3.00	1.0	3.0	1.2	3.6
				Subtotal 1	**177.7**		**218.8**
II	**Appliances /Accessories**						
10	G.I, Gas outlet pipe Ø 2", 0.6 m long	piece	5.00	1.0	5.0	1.0	5.0
11	GI nipple, Ø 0.5"	piece	0.35	1.0	0.4	1.0	0.4
12	Main gas valve Ø 0.5"	piece	1.70	1.0	1.7	1.0	1.7
13	Male-female socket Ø 0.5"	piece	0.45	1.0	0.5	1.0	0.5
14	PVC 90° elbow	piece	0.12	4.0	0.5	4.0	0.5
15	Tee Ø 0.5" (aluminium thread inside)	piece	0.40	1.0	0.4	1.0	0.4
16	Glue for PVC connection	bottle	0.70	1.0	0.7	1.0	0.7
17	Water drain Valve	piece	4.00	1.0	4.0	1.0	4.0
18	Gas tap	piece	6.00	1.0	6.0	1.0	6.0
19	Teflon tape	piece	0.30	1.0	0.3	1.0	0.3
20	PVC pipe Ø 0.5	metre	1.30	10.0	13.0	10.0	13.0
21	Gas hose pipe Ø 0.5"	metre	0.40	1.0	0.4	1.0	0.4
22	Stoves single burner	piece	12.00	1.0	12.0	1.0	12.0
23	Lamp	piece	5.00	1.0	5.0	1.0	5.0
24	Pressure Gauge	unit	2.00	1.0	2.0	1.0	2.0
				Subtotal-II	**51.9**		**51.9**
III	**Labours**						
25	Skilled Labour	No.	4.00	10.0	40.0	11.0	44.0
26	Unskilled Labour	No.	1.50	10.0	15.0	11.0	16.5
27	Excavation of soil	cu.m	1.50	8.0	12.0	9.0	13.5
				Subtotal III	**67.00**		**74.00**
				Total	**297**		**345**
				Guarantee	10		15
				Participation Fee	15		15
	Total (Including guarantee and after sales services)				**322**		**375**

***** Indicator price, actual price will vary depending on location and market developments***

Justified work norms in Cambodia for excavation, backfilling, and for cases of "difficult soil".

Following references to a 2004 report for WFP Cambodia is here are added for 2 purposes:
1) Support and justification of several recommended cost calculation adjustments as introduced in previous part of this appendix.
2) As information which can be used by NBP staff to consider the adjustments and to consider the issue of difficult soil cases.

In 2004 WFP ordered a review of the labor and work norms for their Food For Work activities. There was in Cambodia much difference in rates used in the various provinces and in the methods used for calculation per the various activities and provinces.
The resulting report[20] streamlined the Cambodian situation with international acceptable norms and practices (mainly with ILO guidelines), and adjusted these to local conditions. These norms are now incorporated in WFP Cambodia practices.

- For the NBP works the relevant work norm to use for soil excavation is S.N.2 here below. 2.0m^3 per workday. Actually this is for soil up to 1 m depth but as it includes also a level of compaction this compensates the soil excavation deeper than 1m. It is better that NBP uses only 1 rate.
- The same rate can be used for backfill, as the work is the same.

Table-22

SN	Generic type of activity for all earthwork based FfW projects (roads, ponds, canals, dams/dikes) excluding structure works	Unit per Worker Day	Base Productivity recommended for Cambodia	(1) Per extra 30m Lead reduction by	(1) Per extra 1m Lift reduction by	(1) For difficult soil reduction by
1	**Basic earthwork**: (such as for ponds) on ordinary soil with a lead up to 15 meters and a lift (for a pond) up to one meter without the finishing work	Cubic meter (cum) of **finished** work	**2.2 m^3/wd**	20%	20%	30%
2	**Complete earthwork:** (such as for roads, canals, dam/dikes) including basic and finishing earthwork on ordinary soil up to a lead of 15 meters and a lift of within one meter	Cubic meter (cum) of **finished** work	**2.0 m^3/wd**			
3	**Turfing/grassing**: This includes cutting at least 10-15 cm thick of turf/sod, carrying it to the site, spreading and compacting	Square meter of finished work	**15 m^2/wd**			
4	**Tree planting:** The tasks include pitting 30 cm diameter by 30 cm depth, transplanting, composting and placing tree guards for the containerized seedlings.	Number of trees planted	**40 pc / wd**			
5	**Maintenance of trees**: for six months including ensuring at least 80 percent survival (based on one tree per four meter)	Kilometers of planted row	**0.04 km / wd**			
6	**Field level project management, supervision and quality control**	% of the total labor cost	**4 %**			

Difficult soil

Similar the report had a recommendation for cases where the soils were to a large extent difficult to deal with compared with normal soils. The following is quoted from the report paragraph 3.5:

> *"The variations in defining the soil types in terms of **difficulty level** also quite obvious. The recent trend is moving towards defining them in two categories: the ordinary (easy) soil and the difficult soil. Some have four to five categories: ordinary, medium, hard, and marshy with the productivity norms reduced by 10 to 20 percent for every additional level of difficulty. (The case of rock, both hard as well as soft is not considered here.) In some cases with two levels, the labor productivity norm is reduced by around 25 to 30 percent for the difficult (heavy) soil. For the purpose of food-assisted activities in Cambodia, we would recommend two types of soil, the ordinary and the difficult, with the productivity norm reduced by 30 percent for the difficult one. (And, with the understanding that ordinary soil can contain up to 15% difficult soil lumps)"*

[20] Work Method Review-Cambodia FFW Activities. By Gerrit Klerx and Kumar Upadhyaya for WFP Cambodia. July 2004

APPENDIX-H Example of some NBP Formats

Sample of the Certificate for the Masons upon completion NBP Mason training

Sample of the Certificate for the Supervisors upon completion NBP Mason training

National Biodigester Programme
Biodigester Construction Contract

PBPO Province:……. Plant code no.:…….

1. Party A: National Biodigester Supported Household.

   Head of Household Name:……

   Address:……

   Tel: .....

   ID document type and number:……

2. Party B: Provincial Biodigester Programme Office (PBPO).

   PBPO Director Name:……

   PBPO Address:……

   PBPO phone no.:……

3. Party C: Biodigester Mason.

   Biodigester Mason Name:……

   Address:……

   Tel:.....

   ID document type and number:……

All parties agree to participate in the construction of a biodigester at the premises of Party A, upon the following conditions:

Article 1. Scope of work
To construct a biodigester, according the quality standards set by the National Biodigester Programme, **sized …….m^3** at the premises of Party A.

Article 2. Obligations
Party A. The Biodigester Household

- Prepare the construction site and material according the instructions of Party C.
- In consultation with Parties B and C, set a deadline for the start of the work.
- Provide adequate labour for the digging work and to assist the Biodigester Mason during the construction.
- Pay for the construction work as agreed in Article 3.

Party B. The Provincial Biodigester Programme Office

- Conduct a survey at the premises of Party A to determine the conditions for biodigester construction and advise Party A accordingly.
- Provide Party A with an information sheet containing required building material quantities, cost of appliances, cost of skilled labour, and cost of warrantee and participation fee.
- Assures that Party C, the Biodigester Mason, is trained, experienced and certified in his profession.

- Give full essential technical support to Parties A and C.
- Monitor the quality of the construction work through sample construction inspections.
- Conduct a Plant Completion Inspection. If the plant is considered by the PBPO Supervisor to be complete and fit to function without problems, it will be handed over to Party A. Party A will receive a signed a stamped Completion report from Party B.
- Guarantees the provision of US$100 subsidy upon completion of the biodigester.
- Provision of user training on biodigester operation and bio-slurry application.
- Deposits the warranty fee, paid by Party A, at warrantee savings account and enforce Party C to repair plant the plant if so required under the warrantee conditions.. Within two years if the plants have no any problem, Party B has to release the warranty fees to Party C.
- Issue a warrantee certificate, on behalf of Party C, to party A

Party C. The Biodigester Mason

- Constructs the biodigester according to the National Biodigester Programme quality standards.
- Completes the construction work, including pipefitting and appliances connection, within 20 calendar days. If there delays due to reasons beyond the influence of the mason such as high ground water or rocky soil, a new completion date will be determined in consultation with Party A and B.
- If Party C, due to illness or other personal reasons, is unable to complete the work in time, he will contact Party B for consultation on how to complete the assignment within the agreed period.
- Instructs the biodigester user (Party A) on the proper filling procedure of the biodigester and on the proper use of the biodigester appliances.
- Will work in a responsible manner and therewith minimise the risks of accidents.
- No claims can be made by Party C to Parties A or B in relation to injuries sustained during the construction process.
- After completion, leaves the construction site in a fit to be seen state.
- Provides warranty on the construction within a 24 months period since the completion date mentioned on the completion report.
- Repair the biodigester if any technical problem occurs, in accordance with the warrantee conditions described in the warrantee certificate.
- Visits the biodigester at least once a year during the 2 year warrantee period to check the plant and appliances, also if no complaints have been lodged by Party A.

Article 3. Cost and Payment

The cost of construction materials, sand, gravel, cement, reinforcement rods, PVC pipe, will be paid by Party A directly to the supplier. Party A will also make sure these materials will be at the construction site in time. Party C will advise Party A on the required quality and quantity of these materials.

The cost of the skilled labour, amounting to US$....., will be paid directly by Party A to Party C upon completion of the construction.

Party A will pay Party B:

Item:	Number	Cost per Item	Total Cost
Main valve	1		
Dome gas pipe	1		
Water drain	1		
Stove incl. tap			
Lamp			
Warrantee fee			
Participation fee	-	-	15

Party A has to fulfil all financial obligations to Parties B and C upon completion of the construction including the pipefitting and the installation of the appliances.

Article 4. Construction Starting and Completion Date
The construction will start on ……..(day)/……(month)/……..(year) at the latest.
The construction will finish on ……..(day)/……(month)/……..(year) at the latest.

Article 5. Unilateral Termination of construction contract and compensation:
Each party has right to terminate the construction contract unilaterally and can request for compensation when the other party offend contract provisions.

The offending party has to compensate all expenses which the other party had paid for the lost, unless otherwise stated.

Article 6. Complain and dispute settlement:
All complains and disputes will be considered and settled by both parties base on mutual interest. If both parties can not reach final agreement then the matter will be brought before Civil Court for final.

This contract is made in 3 copies of the same value and become effective since the signing date.

Date:…….(day)/…….(month)/……..(year)

Party A: Head of Household
Full name + Thumb Printing or signature ----------

Party B: PBPO Director
Full name + signature ----------

Party C: Biodigester Mason
Full name + signature ----------

APPENDIX-F Terms of Reference

TERMS OF REFERENCE

Terms of Reference for:

Private Sector Development Study
National Biodigester Programme

Date: March 2007 By: National Biodigester programme Office Phnom Penh Status: Draft 1

0 Introduction.

Based on a feasibility study executed in November 2004, The Ministry of Agriculture, Forestry and Fisheries of the Kingdom of Cambodia (MAFF) and The Netherlands Development Organisation (SNV) have agreed on cooperating in the set-up and implementation of a National Biogas Programme.
The terms of this cooperation are laid down in a Memorandum of Understanding which was concluded in May 2005. An implementation document for the programme period was compiled early 2006 and agreed upon by MAFF and SNV during an official ceremony in March 2006.

The duration of first phase of the National Biogas Programme is 4.5 years of which the last 6 months of 2005 and the first 3 months of 2006 were used for preparation and the years 2006-09 for implementation.

The overall objective of the first phase of the National Biodigester Programme is **'The dissemination of domestic biodigesters as an indigenous, sustainable energy source through the development of a commercial, market oriented, biodigester sector in selected provinces of Cambodia'.**

The programme aims to support the construction of 17,500 biodigesters in at least 6 provinces, and will run up to December 31, 2009. The programme is currently operational in 5 provinces after being started on April 3rd 2006.

In a permanent sector a very important part will have to be played by private parties. In the biodigester sector this means mainly (1) contractors who will take charge of marketing, construction, after-sales service and repair and to a lesser extent (2) workshops who produce the necessary appliances for plant construction and operation. This assignment will deal only with the first group.

1 Objective

The objective of this study is to determine the ideal but realistic profile of biodigester construction companies who will be active in the national biodigester sector and what actions need to be undertaken and/or support to be provided to establish these companies.

1.2 Specific objectives

The specific objectives include the study of:

a. the status and requirements (tax and other obligations) of a small registered company in Cambodia; Plus possible alternatives.
b. the structure a small biodigester company can/should have for it to take legal responsibility for its products and services within an acceptable period;
c. the extent present active biodigester masons are willing to develop in this direction;
d. the educational background of the masons; do they have enough writing and calculating skills to run a company?;
e. the entrepreneurial spirit of the active masons, is it enough to establish sufficient companies?;
f. support required by potential entrepreneurs, management skills, bookkeeping skills, marketing skills, …; initial/basic support and/or continued support?
g. actors (institutions, private sector development programmes, …) that have the expertise, presence and willingness to support developing entrepreneurs with the issues resulting from F;
h. an action/time table format to achieve the objective as mentioned under 1, and as far as possible adapted per present involved province;

2 Approach and methodology.

After awarding the contract, the consultant will start with a desk study covering relevant programme documents, available information on the biodigester programme in Cambodia and particularly on the involvement of masons at present and the methodology of biodigester promotion and marketing.

Based on the desk study, the consultant will formulate the data-collection tools, such as structured questionnaires for masons, PBPOs and possible other potential actors.

The consultant, together with the head of the NBP technical unit, will visit at least 3 out of the 5 provinces to have discussions with the most active (6-12) masons per province as well as with other stakeholders such as the PBPOs.

In the provinces the consultant will identify the organisations involved in private sector development to discuss: (1) the problems faced for small and medium companies to get established and develop, and (2) the scope to which these organizations can develop and are willing to participate.

3 Work schedule.

Tentatively, the survey will be implemented from …… to …… , for a period of 2 weeks, including ~ 2 days for the preparatory works, ~4 days for the field visits and ~ 4 days for data processing and formulation of the draft report. The final report will be submitted within one week after submission of comments on the draft report by the NBP.

5 Deliverables.

5.1 Proposal of the consultant.

Based on this ToR and information provided by the NBP to the PSD consultant, interested consultants will develop a proposal for the survey. Consultants are encouraged to suggest improvements to the ToR. The proposal shall be submitted in two separate sections:

Section 1, technical proposal, including:

- a tentative work schedule for the survey;
- any suggestions for improvement of the ToR and/or the survey
- the names, CVs and responsibilities of the proposed members of the Study Team.

Section 2, financial proposal, including:

- cost break down;
- proposed budget.

5.2 Interim report.

Prior to the field visits, the consultant will submit for approval to the NBP an Interim Report in English. This report will incorporate:

- a detailed work schedule for the survey;
- the proposed table of content for the draft report.

The NBP shall provide comments and suggestions on the Interim Report within 1 working day.

5.3 Draft PSD study report.

The data collected form the field survey shall be checked and verified by the consultant expert team prior to processing.

- The Draft Report will be concise and is expected to be approximately 15 pages

The consultant shall submit one copy in soft and hard format each of the PSD study report.
The report shall include:

- approach and methodology of the study;
- review of the relevant desk-study findings;
- present situation of biodigesters dissemination with regard to involvement of masons/contractors
- review of the relevant findings from discussions with stakeholders (masons and others);
- formulation on major findings;
- profile of a feasible and sustainable biodigester company;
- listing of identified suitable actors and their tasks in the PSD trajectory;
- action – time table for the coming 3 years.

- suggestions and recommendations;

The NBP shall provide comments and suggestions on the draft report within 5 working days.

5.4 The final PSD study report.

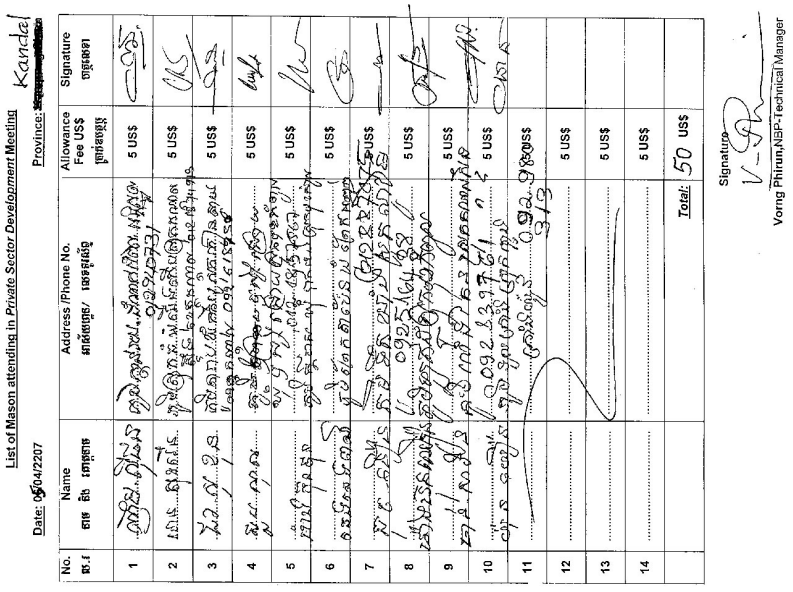
The consultant will finalise the draft report, incorporating the comments and suggestions received from the NBP and –if necessary- other relevant and knowledgeable institutions and persons. The final report will be submitted in soft and hard copy format as a Word document in English.

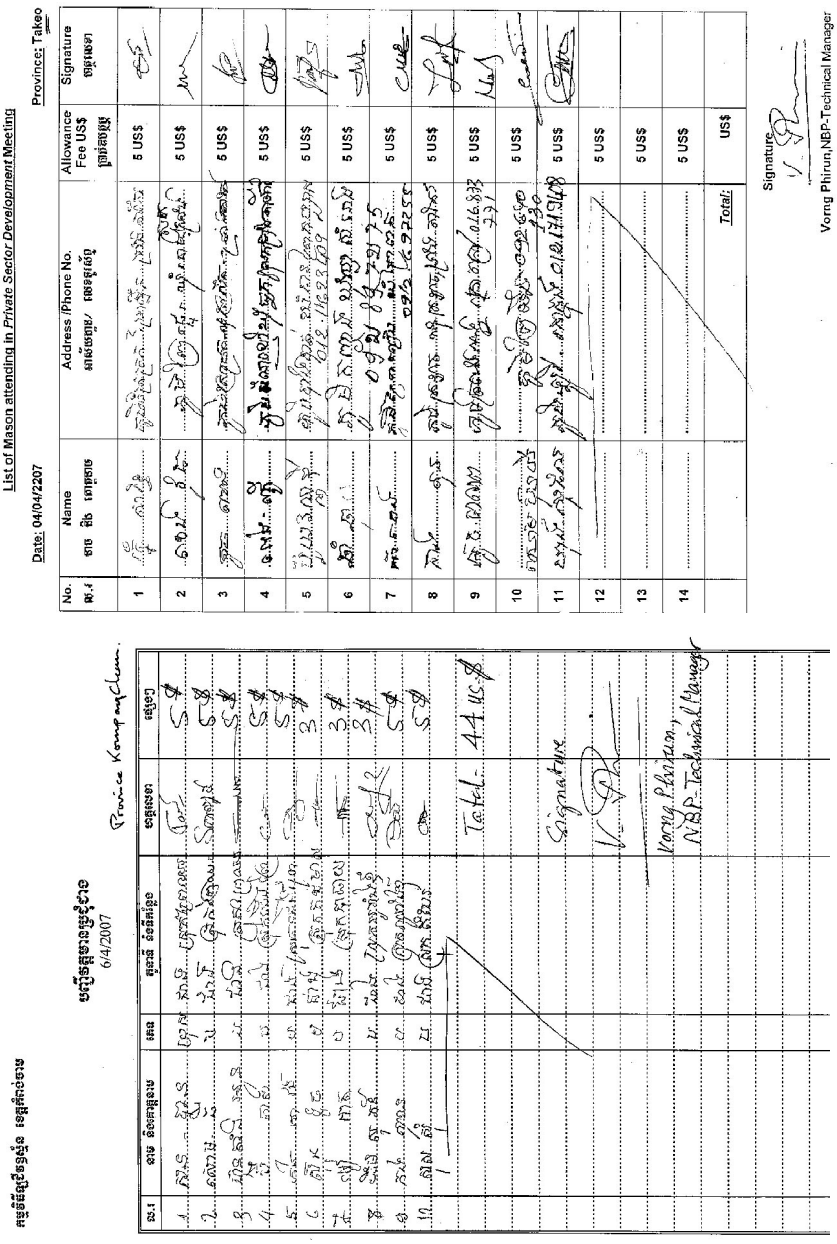
APPENDIX-G Bibliography and Meeting/Consultation List

BIBLIOGRAPHY		*Table-23*
1	NBP Information Folder, 3rd print, November 2006	
2	Biodigester User Survey Report (Draft per April 2007), Dr. Kang Chandararot - Liv Dannet - Cambodia Institute of Development Study for NBP	
3	Small Contractor Survey CMB/01/R72/RILG- by Gerrit Klerx + Chanty Lay for UNOPS/UNDP - 2001	
4	Work Method Review-Cambodia FFW activities, by Gerrit Klerx and Kumar Upadhyaya for WFP Cambodia, July 2004	
5	NBP DVD movie Promotion of biodigester technology. Dec.2006, approximate 10 min.duration	
6	NBP DVD movie, Khmer language, Dec.2006, approx. 1hr duration	
7	Promotion posters, leaflets and the User Manual.	
8	Curricula for New Mason's Training. C-NBP, November 2005 (English version)	
9	NBP 8th Mason Training (handouts), November 2006	
10	Various NBP policy memos, job descriptions, the tripartite Contract, the Household Feasibility Visit survey and the database	
11	NBP Biodigester Cost Estimation model and Office Running Cost model	

PEOPLE CONSULTED / PLACES VISITED		*Table-24*
name	**position**	**date**
Phirun Vorng	NBP Engineer; PSD study team member	intermittent
Huong Piseth	CEDAC NBP liaison; PSD study team member	intermittent
Chheng Rottanak, Jan Lam	NBP key staff	intermittent
Jan Lam	NBP Senior Advisor	intermittent
4 owners/users biodigesters in Takeo province	BNP clients	3/4
11 masons from Takeo province	Trained and active in BNP (see next page)	4/4
10 masons from Kandal province	Trained and active in BNP (see next page)	5/4
Chrey Chamroeun	Prov.Infra.Advisor Seila PSDD/Seila Kandal	5/4
10 masons from Kompong Cham province	Trained and active in BNP (see next page)	6/4
2 owner/users biodigesters K.Cham province	BNP client and active mason	6/4
Sam Bona + Preap Prathna (Curtis Hundley)	DAI-USAID Cambodia MSME Value Chain/BDS specialists (dep.chief of party)	13/4
James McAuley	Consultant on skills training and SME development	6/4-12/4-17/4

ATTENDANCE LISTS OF THE 3 MEETINGS WITH NBP-MASONS





List of Mason attending in *Private Sector Development* Meeting

Date: 04/04/2007

Province: Takeo

No. ល.រ	Name នាម និង នាមត្រកូល	Address /Phone No. អាសយដ្ឋាន/ លេខទូរស័ព្ទ	Allowance Fee US$ ប្រាក់ឧបត្ថម្ភ	Signature ហត្ថលេខា
1			5 US$	
2			5 US$	
3			5 US$	
4			5 US$	
5			5 US$	
6			5 US$	
7			5 US$	
8			5 US$	
9			5 US$	
10			5 US$	
11			5 US$	
12			5 US$	
13			5 US$	
14			5 US$	
		Total:	US$	

Signature

Vorng Phirun,NBP-Technical Manager