Feasibility of a national programme on domestic biogas in Indonesia

Final report

SNV Netherlands Development Organisation

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This study was commissioned on request of the Directorate General for Electricity and Energy Utilisation of the Government of Indonesia by the Environment and Water Department of the Directorate General for International Development of the Netherlands Ministry of Foreign Affairs and the Royal Netherlands Embassy in Jakarta.

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It was a pleasure to conduct this study on the feasibility of a national programme on domestic biogas in Indonesia. We received full cooperation during the interviews, field visits and consultative workshop and were amply provided with valuable information and opinions. We like to extend our gratitude to all respondents and informants for their constructive contributions and hope the results of the study will serve its purpose. The mission team is fully responsible for the views, conclusions and recommendations expressed, as well as for any errors. A special word of thanks is extended to the Royal Netherlands Embassy and Hivos/Southeast Asia in Jakarta for providing logistical and administrative support to the mission.

Wim J. van Nes (team leader)
Fabby Tumiwa (team member, policy and institutional expert)
Ifnu Setyadi (team member, technical expert)

Executive summary

This report presents the finding of a study conducted by the SNV Netherlands Development Organisation to assess the feasibility to set-up and implement a national programme on domestic biogas in Indonesia. This study was commissioned on request of the Directorate General for Electricity and Energy Utilisation (DGEEU) of the Government of Indonesia (GoI) by the Environment and Water Department (DMW) of the Directorate General for International Development (DGIS) of the Netherlands Ministry of Foreign Affairs and the Royal Netherlands Embassy (RNE) in Jakarta. A mission of three weeks in Indonesia in July 2008 was included in the study applying the following methodologies:

- Field visits to get an impression on the performance of biogas plants and to collect more practical information on modalities of biogas projects implemented in Indonesia so far;
- Interviews with informants and potential stakeholders;
- A half-day Workshop to present the findings of the field visits and interviews and to generate discussion among the stakeholders on a number of key-issues, and;
- Rating of key conditions for large-scale dissemination of biogas plants in Indonesia.

A national programme on domestic biogas in Indonesia looks feasible as:

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

The tentative outline for such a programme with a longer-term vision to develop a commercial, sustainable biogas sector includes the production of 12,000 biogas plants over a period of three years and will cost about Euro 16.6 million. The biogas farmers (57%) and DGIS through the RNE in Jakarta (43%) are the proposed financiers of the programme, while the GoI is supposed to provide policy and administrative support. The cost/benefit ratio of CDM financing still needs to be determined. It has been assumed that the GoI will fully support and own a national biogas programme and that (potential) stakeholders will agree to up-grade the quality of products and services. The current practice of fully subsidising biogas plants and the lack of commitment and/or resources to continue and expand the programme after 2011/12 are considered as risks.

The following are the main recommendations resulting from the study:

- To RNE/Jakarta: To enter into a contract with a capable and dedicated civil society or private sector organisation (implementing agency) for the management of the fund and the coordination of the implementation of the proposed national programme;

- To the implementing agency: To undertake – as initial steps – the required assessment of the available biogas technology, to call for a national stakeholders workshop, to establish provincial biogas offices, to support the preparation of provincial plans and to mobilise effective credit providers;
- To DGEEU under the Ministry of Energy and Mineral Resources (MEMR) and the Directorate General of Livestock Services (DGLS) under the Ministry of Agriculture (MoA): To agree with the set-up and operation of policy coordination desks, and;
- To SNV: To explore internally whether advisory services could be provided to the programme, at least for the connection of Indonesia to the global knowledge base on domestic biogas.

Table of Contents

Abbreviations

ADB	Asian Development Bank
ARECOP	Asia Regional Cookstove Program
ASEAN	Association of Southeast Asian Nations
BAPPENA	Regional Planning Board (GoI)
BAPPENAS	National Planning Board (GoI)
BORDA	Bremen Overseas Research and Development Association
BPPT	Agency for Assessment and Application of Technology (GoI)
BPR	People's Credit Bank (*Bank Perkreditan Rakyat*)
BPS	Central Bureau of Statistics (GoI)
BPT	Biogas Practice Team (SNV)
BRI	People's Bank Indonesia (*Bank Ragyat Indonesia*)
BSP	Biogas Support Programme (Nepal)
CDM	Clean Development Mechanism (under the Kyoto protocol)
CER	Certified Emission Reduction
CGI	Chazaro Gerbang Internasional PT
CIRDAP	Centre on Integrated Rural Development for Asia & the Pacific
CMES	Centre for Mass Education in Science
CSO	Civil Society Organisation
CSR	Corporate Social Responsibility
CU	Credit Union
DGEEU	Directorate General for Electricity and Energy Utilisation (GoI)
DGIS	Directorate General for International Cooperation (Netherlands)
DGLS	Directorate General of Livestock Services (GoI/MoA)
DJLPE	*Direktorat Jenderal Listrik dan Pemanfaatan Energi (DGEEU)*
EIRR	Economic Internal Rate of Return
FFI	Frisian Flag Indonesia
FIRR	Financial Internal Rate of Return
FY	Fiscal Year
GDI	Gender-related Development Index
GDP	Gross Domestic Product
GEF	Global Environment Facility
GI	Galvanised Iron
GoI	Government of Indonesia
GTZ	German Technical Cooperation
GWh	Giga Watt hour
HDI	Human Development Index
Hivos	Dutch development organisation
HYV	High Yielding Variations
IDA	International Development Association
IDR	Indonesian Rupiah
ILO	International Labour Organisation
INGO	International Non Governmental Organisation
IPB	Bogor Institute of Agriculture (*Institut Pertanian Bogor*)
IRES	Indonesian Renewable Energy Society
ISO	International Standard Organisation
KDP	*Kecamatan* Development Program
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
LED	Local Economic Development
LIPI	National Institute of Science (GoI)
LTPT	Institute for Rural Technology Development
MC	Ministry of Cooperatives (GoI)

MEMR	Ministry of Energy and Mineral Resources (GoI)
MFI	Micro Finance Institute
MMSCF	Million standard cubic feet
MNRT	Ministry of State for Research and Technology (GoI)
MoA	Ministry of Agriculture (GoI)
MoU	Memorandum of Understanding
MTN	*PT Mulya Tiara Nusa*
MUR	Ministry of Underdeveloped Regions (GoI)
NGO	Non Governmental Organisation
PERSADA	*Pemberdayaan Maskyarakat Desa*
PERTAMINA	State Oil Company (GoI)
PGN	State Gas Company *(Perusahaan Gas Negara)*
PLN	State Electricity Company (*Perusahaan Listrik Negara*)
PNPM	National Community Empowerment Program (*Program Nasional Pemberdayaan Masyarakat*)
POME	Palm Oil Mill Effluent
PPP	Purchase Power Parity
QC	Quality Control
RCC	Reinforced Cast Concrete
R&D	Research & Development
RE	Renewable Energy
RNE	Royal Netherlands Embassy
TA	Technical Assistance
SNV	Netherlands Development Organisation
UNDP	United Nations Development Programme
USAID	US Agency for International Development
USD	Unites States Dollar
VER	Verified Emission Reduction
WB	World Bank
WPU	*Wahana Pengembangan Usaha*
WWF	World Wildlife Foundation

Exchange rate:	1 Euro = IDR 14,500
(July 2008)	1 USD = IDR 9,500

CHAPTER 1: Introduction and background

The Government of the Netherlands has earmarked for the period 2008-2011 a fund of Euro 500 million for the promotion of renewable energy in developing countries. The purpose of this fund is to combat poverty by the provision of access to modern energy services which do not have negative impacts on climate. Indonesia has been identified as one of the countries for the co-operation on renewable energy with domestic biogas as one of the possible areas of co-operation (DGIS/DMW, 2008). A feasibility study was commissioned on request (see Annex 9) of the Directorate General for Electricity and Energy Utilisation (DGEEU) of the Government of Indonesia (GoI) by the Environment and Water Department (DMW) of the Netherlands Ministry of Foreign Affairs (DGIS) and the Royal Netherlands Embassy (RNE) in Jakarta. SNV Netherlands Development Organisation was requested - based on its expertise developed in Asian and African countries - to undertake this feasibility study. The Terms of Reference for this study are provided as Annex 1.

This report presents the findings of the feasibility study conducted in July 2008 by the Biogas Practice Leader of SNV, Mr. Wim van Nes, and two independent local experts, Mr. Fabby Tumiwa (policy and institutional expert) and Mr. Ifnu Setyadi (technical expert).

Chapter 2 describes the objective, methodology and limitations of the feasibility study. A brief background including the agricultural and energy sector of the Republic of Indonesia is provided in Chapter 3. The history of domestic biogas in the country is summarised in Chapter 4. An assessment of the potential demand for domestic biogas including the financial and economic internal rates of return is presented in Chapter 5. An overview of potential stakeholders is provided in Chapter 6, while the functions required in a national programme and possible suitable actors are matched in Chapter 7. An outline for a national biogas programme including tentative budget and possible financiers is provided in Chapter 8. Main conclusions and recommendations of the study are mentioned in Chapter 9. The references, finally, are included as Chapter 10.

CHAPTER 2: Objective, methodology and limitations

2.1 Objective

The objective of the study is to assess the feasibility to set-up and implement a national programme on domestic biogas in the Republic of Indonesia.

2.2 Methodology and limitations

The following methodologies were used to achieve the objective of the study:

- Preparation of the mission to Indonesia through collection and analyses of secondary data;
- Field visits to West Sumatra, Java and Bali to get an impression on the performance of existing biogas plants and to collect more practical information on the different modalities of biogas projects implemented in Indonesia so far. The mission team was facilitated by various stakeholders like Hivos, local governments, LPTP, Bali Fokus and ILO, see Annex 2 for information on the programmes. A check-list was prepared for the collection of data during the field visits;
- Interviews with informants and potential stakeholders for a national programme on domestic biogas, see also Annex 2. To structure the interviews with the stakeholders, a check-list was prepared;
- A half-day Workshop to present the findings of the field visits and interviews and to generate some discussion among the stakeholders. A brief report on this Workshop including the list of participants is included as Annex 3.
- Rating of key conditions for large-scale dissemination of biogas plants in Indonesia. These conditions and their rates are included as Annex 4.

Prior to the mission, it proved to be quite difficult to get into contact with the stakeholders in Indonesia. Hence, it was not easy to compose in advance the mission programme. After arrival in Jakarta, however, the team received full cooperation from stakeholders and informants and the programme could be planned and implemented without serious problems. The limited availability of well documented data and information on biogas and related issues in Indonesia (in English) was felt as a limitation.

CHAPTER 3: Country background

Indonesia is composed of about seventeen thousand islands that stretch over five thousand miles along the equator. The Malay Peninsula and Indochina are situated to the north-west; the continent of Australia lies due south; and Philippines and Micronesia are in the north. The constellation of islands straddles the divide between the Asian and Australian continental plates. As a result, the islands offer a great variety of topographies and ecologies with mist-shrouded volcanoes and mountains, unexplored rain forests, thousands of miles of beaches, and endless offshore reefs. The great majority of the country's constituent islands are of negligible size, but it does hold several islands that are enormous. These include Sumatra, Kalimantan (formerly Borneo, and shared with Malaysia), Sulawesi, and Java. The Indonesian provinces of Papua and Irian Jaya Bharat occupy the western half of New Guinea, which is the world's second largest island (behind Greenland).

Indonesia provides home to about 300 ethnic groups, a result of both the country's unique geography and history. The glue that binds the people together is the usage of the Bahasa Indonesia, the national language. The most populous of the Indonesian islands by far is Java, home to the capital city of Jakarta. Other notable islands include Bali, Lombok and Flores. There are two discernible seasons in Indonesia: the dry season, which extends from June to October, and the rainy season, which lasts from November to March. Both are hot. The coastal regions, however, are often cool, and in the mountains the air is often chilly. Rainfall varies throughout Indonesia.

Figure 3-1 Map of Indonesia with the capital Jakarta on the island of Java

In recent years, Indonesia has been undergoing significant economic reforms. Its debt-to-GDP ratio has been declining steadily, its foreign exchange reserves are at an all-time high of over USD 50 billion, and its stock market has been one of the three best performers in the world

in 2006 and 2007, as global investors sought out higher returns in emerging markets. However, the country still struggles with poverty and unemployment, inadequate infrastructure, corruption, a complex regulatory environment, and unequal resource distribution among regions.

The Republic of Indonesia is divided into provinces (Indonesian: provinsi), 33 in total at the time of the study. Five of them have special status including Nanggroe Aceh Darussalam (formerly: Aceh Special Region), Yogyakarta Special Region and Jakarta Special Capital Region. Provinces consist of districts or regencies (Indonesian: kabupaten) and cities (Indonesian: kota). Province, districts and cities have their own local governments and elected councils. Since 2001, after new decentralisation laws entered in force, the local governments – especially the districts - enjoy greater role to administer their own area. However, foreign politics, defence, system of law, and monetary policy, are still being national government domain. The districts are headed by a regent and cities by a mayor.

Indonesia was hit particularly hard by the Asian economic crisis in 1997. The crisis had significant social costs, including rising unemployment, rapid escalation of food prices, and deterioration in public services. Poverty rose from 11.8% in 1996 to 23.5% in 1998/9. The economic crisis was accompanied by severe drought that caused food shortages in many provinces, and by widespread forest fires in parts of Kalimantan and Sumatra that destroyed forest and devastated local livelihoods.

Table 3-1 provides some basic data about Indonesia and other Asian countries with a national biogas programme supported by SNV (UNDP, Human Development Report 2007/2008).

Table 3-1 Basic data about Indonesia and some other countries with a (proposed) national biogas programme

Country	Population (2005, in million)	HDI (2005)	GDP per capita (2005, in PPP US$)	Gini index[1]	Below national poverty line (%)	Gender (in)equality[2]
Indonesia	226	107	3,843	34.3	27%	+1
Vietnam	85	105	3,071	34.4	29%	+1
Cambodia	14	131	2,727	41.7	35%	+1
Lao PDR	6	130	2,039	34.6	39%	-1
Bangladesh	153	140	2,053	33.4	48%	+1
Nepal	27	142	1,550	47.2	31%	-4
Pakistan	158	136	2,370	30.6	33%	-7

In many aspects, Indonesia looks quite similar to Vietnam, though the GDP per capita is 25% higher in Indonesia compared to Vietnam.

3.1 Agricultural sector

About 43% or 92.9 million people in Indonesia are in agriculture (FAO, 2005). The area of agricultural land amounts to 448 million square km which is about 25% of the total land. During 2005-2007, the average GDP growth of the agricultural sector reached 3.32%. This growth is the highest since the period of economic crisis (1997-1999) when the growth was only 0.88%, while the growth was 1.57% during the pre-crisis period (1993-1997). The contribution of the

[1] Gini lower than 35 is rather equal; higher than 40 is rather unequal
[2] HDI rank minus GDI rank

agriculture sector to the national GDP in 2006 was 12%. In 1970s and 1980s, the government programme in agriculture aimed to achieve food self-sufficiency, especially in rice. The programme faced a set back in the 90s due to massive conversion of agricultural land, poor irrigation infrastructure, stagnant crops productivity and poor production capacity of the farmers. As per the agricultural census in 2003, the number of marginal farmer households with agricultural land less than 0.5 ha had increased from 10.7 million in 1993 to 13.3 million in 2003. Those marginal farmers consisted of 55 percents of total agricultural households.

Livestock distribution over the country is quite uneven and is more related to population density than to available land area. Virtually, all commercial dairy cattle production is located in Java, near the larger urban centers. Java holds more than 50% of all mammalian livestock, followed by Sumatra with 23% and Sulawesi with 9%. The outlying islands combined hold 27% of ruminant livestock. Cattle concentrations are highest in East Java, North Sumatra and South Sulawesi. Java has very limited forage land to produce high quality forage, limiting dairy and beef cattle performance. In contrast, East Nusa Tenggara and parts of Sulawesi have large, unused land areas but relatively few cattle, and have the potential for increased cow-calf production. Buffalo populations are highest in Sumatra, exclusively used for draft power and as social assets. Sumatra leads in beef/draft cattle, pigs and buffaloes, and village poultry.

The number of livestock farmers' groups (*kelompok tani ternak*) increased from 37,000 to 54,600 groups between 1993 and 1997, an increase of 56%. The number of livestock households increased from 3.74 million to 4.49 million between 1983 and 1993, an increase of 20% (World Bank, 2002). Livestock farmers' groups tend to be organized by livestock species, raising cattle, buffaloes, small ruminants, poultry, rabbits or ducks. Women also organize into farmers' groups, usually for the purpose of raising ducks, village poultry or rabbits, and tend to be very successful. Farmers' groups are socially well organized, in accordance with prevailing local customs, but have little or no influence outside their village. Their social cohesion - a cultural trait - makes farmers' groups very instrumental start-off points for extension workers and village service providers (*poskeswan* staff, inseminators) for introducing new animal production technologies, micro credit schemes, group saving pools, or contracted veterinary or artificial insemination services (World Bank, 2002).

3.2 Energy sector

The government of Indonesia is subsidising fossil fuels used by the households and home industries, and for transport, while the fuel price for industries is based on market prices. In the national budget 2008, a total amount of IDR 126 trillion (about USD 13.5 billion) has been allocated for subsidy on fuel; the subsidy allocated for kerosene alone amounts about IDR 30 trillion (about USD 3.2 billion). Retail fuel prices were increased by about 30% in May 2008; the price of kerosene for cooking for domestic use was increased from IDR 2,000 to 2,500 per litre. In the rural areas visited by the mission, the end user prices were found between IDR 3,000 and 4,000 per litre.

The energy consumption in the household sector in Indonesia over the period 2000 to 2007 (Handbook of Energy and Economics Statistic of Indonesia 2007) is presented in Table 3-2.

Table 3-2 Energy consumption in the household sector in Indonesia in the period 2000 to 2007

Year	Biomass	Briquette	Gas	Kerosene	LPG	Electricity
	Thousand Ton		MMSCF	Kilo Liter	Thousand Ton	GWh
2000	90,783	37	449	10,665,049	696	30,563
2001	92,399	31	487	10,515,453	724	33,340
2002	94,201	25	535	9,997,862	748	33,994
2003	95,904	25	553	10,061,787	823	35,753
2004	97,230	18	691	10,141,412	798	38,588
2005	98,245	28	693	9,747,150	704	41,184
2006	99,302	36	711	8,582,651	788	43,753

Firewood is still the primary cooking fuel used in rural areas (Intercensal Population Survey, 2005, table 47.3), see Table 3-3 for the provinces visited by the mission.

Table 3-3 Primary cooking fuel used by rural households (%) in provinces visited by the mission and for Indonesia in total

Province	LPG	Kerosene	Firewood
West Sumatra	5	22	70
West Java	4	46	48
Central Java	3	19	74
DI Yogyakarta	6	13	79
East Java	6	26	65
Bali	11	18	68
Indonesia	4	29	64

In the last few years, the Indonesian government has developed policies to promote development and utilization of renewable energy. Since 2006, the government carries out a fuel substitution programme to reduce consumption of kerosene, thereby saving subsidy on kerosene. The national bio-fuel programme was launched in 2006. In 2007, the government launched a "substitution of kerosene to LPG programme" targeting mainly households in Java and Bali. Under this program, government plan to distribute for free millions of 3 kg size of LPG tanks and associated stoves to poor households. The government also provides subsidy for the 3 kg LPG tank. During the mission, it became clear that this policy has not yet led to a significant penetration of LPG in the rural areas. Domestic biogas replacing kerosene would be very relevant to the current policies and programme, combining renewable energy development and reduction of subsidy on fossil fuels.

An Energy Act (number 30/2007) was Act enacted in October 2007, stipulating the utilisation of energy resources and national energy management to meet the objective of sustainable development and energy security. The Act stresses that every citizen has right to energy services, that the availability of energy is the responsibility of the state, and that energy resources shall be controlled by the state and utilised for the welfare of the people.

A Presidential Decree (number 5/2006) on National Energy Policy was released in January 2006. The goal of this decree is to ensure energy supply security for the country by reducing the share of oil fuels in the energy mix from the current 51% to 20% in 2025 and by increasing the share of renewable energy by share in 2025.

A Ministerial Degree (number 0002/2004) on policy on renewable energy development and energy conservation was released in 2004. The specific goal of the decree is to ensure the

security of supply of energy, to enhance the utilisation of renewable energy, and a more efficient, reliable, diversified and environmental friendly use of energy.

CHAPTER 4: History on domestic biogas in Indonesia

Based on the field visits, interviews and publications, this Chapter provides a brief overview of the history of domestic biogas in Indonesia with respect to number of plants installed and projects (paragraph 4,1), technical aspects (paragraph 4.2), benefits of biogas plants (paragraph 4.3) and financial aspects (paragraph 4.4). The overall conclusion is provided in paragraph 4.5.

4.1 Installations and projects

As in many other countries, the biogas technology in Indonesia was introduced in the 1970s by universities, notably the Bandung Institute of Technology (ITB). They used two metal oil drums of 200 litres each, one as a digester and the other as a gas holder. As the steel of such drums is susceptible for corrosion, the life of the biogas plants was quite short. Supported by the FAO, the Ministry of Agriculture started in 1981 to demonstrate fixed dome plants in several provinces. About 200 units were installed free of cost. As the construction costs were high and subsidised kerosene was easily available, the proposed dissemination of the technology did not take off.

Also NGOs started to develop domestic biogas in Indonesia. Yayasan Mandiri, a leading NGO in Bandung, started the installation of plants in 1984, supported by Tool and ITDG. The floating drum model was applied first, but then changed for the fixed dome model. This NGO also constructed public toilet plants at several traditional Islamic boarding schools in 1986. Due to religious objections, this application failed. In 1989, another NGO in Solo, being the Institute for Rural Technology Development (LPTP) carried out studies on biogas implementation in Boyolali area, the centre of dairy cattle farming in Central Java Province. These studies were followed by construction of biogas plants in 1990, in collaboration with Bremen Overseas Research and Development Association (BORDA). The Camartec fixed dome model was applied and modified during implementation. LPTP also carried out training programmes to promote and disseminate biogas plants and developed a financing model. In the first phase, LPTP installed 25 plants of free of cost for demonstration and promotion to the farmers. Later, the farmers had to invest step by step up to the full cost of the plant (as per 1995). LPTP built more than 200 biogas plants in Boyolali area and close to 100 plants spread over Kalimantan, West Nusa Tenggara, Aceh and other districts in Central Java. About half of them (150 plants) were fully financed by the farmers.

Although biogas was known since the 1970s, dissemination of the technology until 2000 was quite slow. Firewood was still available free of costs and kerosene was subsidised. This made the farmer reluctant to invest. This situation changed when the energy crisis occurred, making kerosene more expensive. Various organisations developed activities in the period 2002 to 2004. ITB and Padjajaran University developed and installed plastic bag digesters in Pangangalengan near Bandung. They used two units of plastic bags for a family of five members; one as a digester (4 m3) and another one as a gas holder (2.5 m3). Furthermore, they established a private company, named PT. Mulya Tiara Nusa (MTN), to promote and develop a business mainly through national government channels like the Ministry of Agriculture and the Ministry of Cooperative, but also through local governments.

In the province of East Java, Koperasi Agroniaga Jabung carried out in 2002 some experiments to build fixed dome biogas plant for domestic cooking in sub district Jabung - Malang. By the end of 2006, about 50 units were installed, fully paid by the farmers. Nearby, at Tutur - Pasuruan district, cattle farmers installed about 70 biogas plants (two fixed domes, all others plastic bag), facilitated by a cooperative for dairy cattle farming called “Setia Kawan”, ILO and the Laboratorium Agribisnis Prima Tani.

In 2005, the Research and Development Center for Electricity and Renewable Energy Technology (RDCERET) under the Ministry of Energy and Mineral Resources collaborated with Yayasan Persada to install 15 demonstration biogas plants (all plastic bag digesters) in Cikajang Garut in West Java Province. In 2007, RDCERET collaborated with the University of Muhamadiyah Malang on research involving three plants: one fixed dome, one floating drum and one plastic bag. At the same time in 2005, DGEEU commissioned the construction of five individual biogas plant (one fixed dome and four plastic bags) in Cikajang Garut. This project aimed to compare the two models. In 2007, DGEEU extended the study by facilitating the construction of nine communal biogas plants.

Other organization, LIPI (Indonesian Institute of Science) also implemented several biogas plants of various types (floating drum and fixed dome). Directorate General of Livestock Services also initiated a project to (further) develop various models of fixed dome (whole glassfibre dome, mixed glassfibre-brick fixed dome, and brick/concrete fixed dome), to demonstrate the use the gas for various applications (cooking, lighting, electricity generation) and to promote the use of bio-slurry.

Since 2006, the Ministry of Agriculture and local governments have been the main actors for the implementation and dissemination of domestic biogas plant in Indonesia through BATAMAS (Community Livestock Biogas Programme) and Rural Bio-Energy Programme. Three types of plants were promoted: Masonry fixed dome for communal use (10, 25, 50 and 100 m3); plastic bag (9 m3) and glassfibre fixed dome (5-10 m3) for use by individual households. At the end of 2007, 996 units were installed involving 1,693 families spread over

121 districts in 26 provinces. In 2008, BATAMAS plans to install a total of about 550 biogas plants for 1,259 families, both individual and communal.

The province of West Java through its Energy and Mining Office has been installing 750 biogas plants till the end of 2007. By the middle of 2008, another 369 biogas plants were installed. Almost all plants are plastic bag digesters, with some fixed domes as well. The size of the plants averages 4 to 5 m3 for individual households and 16 to 18 m3 for communal use by 5 to 10 families.

The State Ministry of Cooperatives promoted biogas to support members of cooperative societies that manage raising of cattle farming integrated with agriculture. By the end of 2007, a total of 450 plants were installed. Another programme was implemented by the State Ministry of Environment using biogas plants as an environmental solution for the processing of tofu waste. By the middle of 2008, around 700 biogas plants have been installed.

In total, roughly estimated, about 6,000 small-sized plants biogas for individual or communal use have been installed so far throughout Indonesia, see Table 4-1.

Table 4-1 Organisations involved in the dissemination of biogas plants in Indonesia and tentative number of plants installed

Institution/Organisation	Period	Number of Plants Installed
Department of Agriculture	1981 - 2008	1749
Department of Energy & Mineral Resources	2005 - 2007	32
State Ministry of Cooperatives	2007- 2008	700
State Ministry of Environment	2005 - 2008	700
West Java Province & District Government	2006 - 2008	1,119
West Sumatra Energy & Mining Office	2007	4
Sleman District Government & Partner	2006 - 2007	71
LPTP (Institute for Rural Technology Development)	1990 - 2007	300
Local Government in Central Java	- 2007	300
Malang District Government & Batu Regency	2007 - 2008	30
Koperasi Agroniaga Jabung	2002 - 2006	50
CSR programme PT.Petrokimia Gresik in Malang	1995	6
Koperasi Peternakan Sapi Perah Setia Kawan Kec. Nangka Jajar - Pasuruan	-2008	70
Local Government in Indonesia	-2007	500
Private Investment/Individual/NGO that unregistered	-2007	500
Total	1981 - 2008	6,131

4.2 Technical aspects

All main categories of designs for domestic biogas plants have been applied in Indonesia. The fixed dome digester was the most popular design in the period to 2000, but nowadays the plastic bag digester has become more popular, especially for the government project scheme.

The floating drum digester, also known as KVIC (Khadi and Village Industries Commission) design, is originating from India, see Figure 4-1. The digester pit is made of brick masonry and a mild steel drum is placed on top of the digester to collect the biogas. Disadvantages of this design are the comparatively high investment costs and cumbersome maintenance of the steel gas holder being susceptible to corrosion. With the introduction of fixed dome design, the floating drum plants became obsolete. In Indonesia, KVIC design has been used on a very limited scale by LIPI.

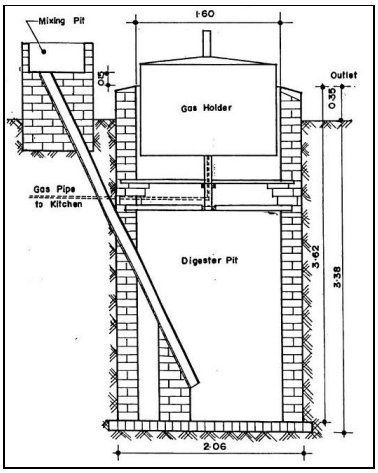

Figure 4-1 Floating drum design originating from India

The fixed dome digester is originating from China and consists of an underground brick masonry compartment (fermentation chamber) with a dome on the top for gas storage. In this design, the fermentation chamber and gas holder are combined in one unit. The technical life of a fixed dome plant – if well constructed - is long (minimum 15 years) compared to a floating drum plant. In Bantul area, units constructed in 1991 are still operating till date.

Based on the principles of Camartec fixed dome model introduced in Indonesia by BORDA, LPTP has developed and promoted its own fixed dome design since 1990, see Figure 4-2. Also other fixed dome designs were developed and practiced, sometimes also using other materials. DGLS, for example, in collaboration with PT Media Inovasi Transfer developed a dome made of fibreglass to be installed on top of a brick masonry digester pit.

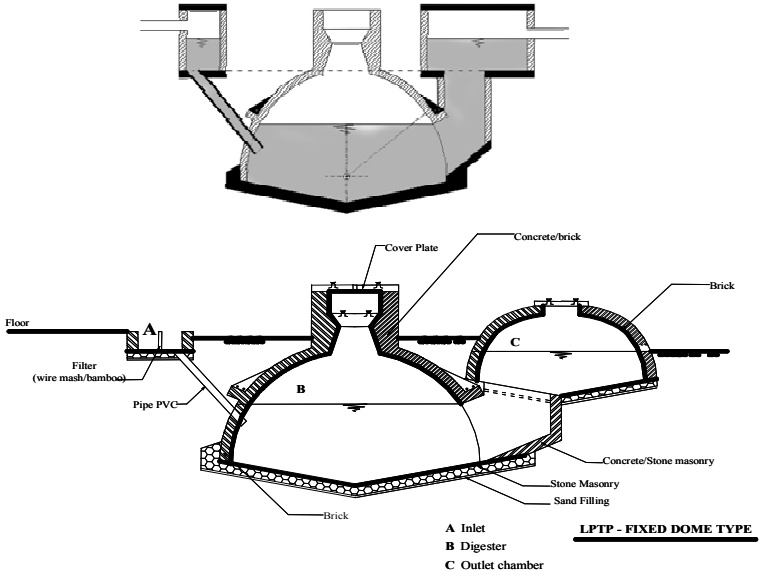

FIGURE 4.2 LPTP FIXED DOME DIGESTER, as modified from original CAMARTEC FIXED DOME

Figure 4-2 Fixed dome design as developed as promoted by LPTP in Indonesia

The plastic bag digester was developed in the 1960s in Taiwan aiming to reduce capital costs. One plastic bag is used as digester (see Figure 4-3), while another (upper) bag stores the gas. The inlet and outlet are attached directly to the skin of the plastic bag. Gas pressure can be increased by placing weights on the plastic bag. Three types of materials are used in Indonesia to make the bags: PE plastic (maximum thickness of 100 µm), then UV resistant plastic (maximum 120 µm) and LDPE (maximum 200 to 300 µm). Sizing of plastic bag digesters can vary, but most of the units installed in Indonesia so far have a length of 4 to 5 metres and a diameter of 90 to 120 cm. The main disadvantage of the plastic bag digester is its reliability. If well protected by a covered platform and under pilot conditions, the life of the plant made of a good quality of plastic may go up to 5 years. In the practice of a normal farm however, the life is about two years and in some cases even shorter than 6 months. This digester is very susceptible to leakage because of foldaway during transport or damage by rodents. Some farmers protect the plastic bag digester by a masonry structure and a roof, resulting in higher investment costs close to the costs of a fixed dome digester. It is remarkable that while the dissemination of plastic bag digesters have been stopped in countries with a well established biogas programme like India and China, this design has become most popular in Indonesia.

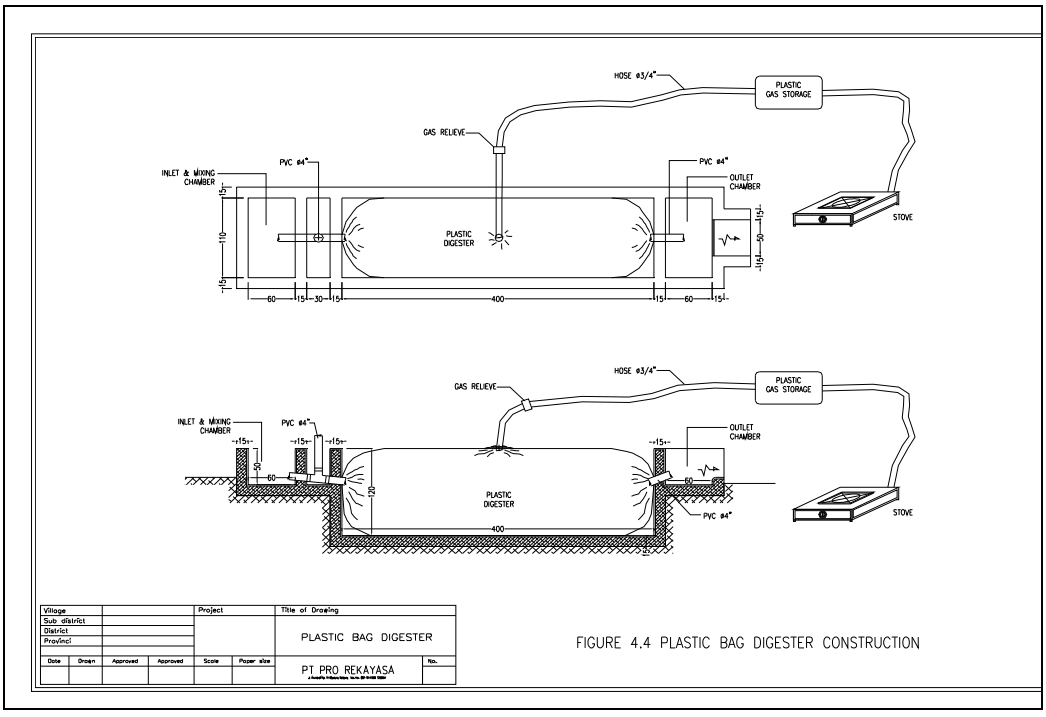

Figure 4-3 Plastic bag digester

4.2.1 Size of the plants and retention time

Two schemes for domestic biogas have been promoted in Indonesia, being the individual and the communal one. A stall-fed dairy cow in Indonesia may produce 20 kg of manure per day, with each kg having a potential gas production of 40 litres per kg. An average family of five people may require 1.5 m3 of biogas for cooking of two to three meals per day. Hence, for an individual household two cows may be required. The fresh manure needs to be mixed in a ratio of 1:1 with animal urine (preferable) or otherwise water. Assuming that this slurry will retain in the digester for 40-45 days, the average size of the digester will be 6 m3.

Larger plants will be required is more manure is fed to the digester, for example in case of communal digesters when more households jointly produce and consume biogas and bio-slurry. Often, a 16 m3 biogas plant is installed, serving the needs of three families.

The smallest size may be a 4 m3 biogas plant, requiring the feeding of about 25 kg of fresh manure per day and producing about 1 m3 biogas. Though this amount may not fully solve the cooking requirements of the household, it is still an important contribution and well worth the investment.

4.2.2 Construction materials

In Indonesia, all required materials for the construction of masonry biogas plants are available. Cement is easily available at local markets in both good quality and quantity. Regular shaped bricks of a good quality (class I) are to be found at local markets and transported to the site by the supplier. Clean sand is commonly available, of good quality and in most cases supplied to the construction site. Also natural stones and gravel are easily available in Indonesia, as is clean water for construction.

Plastics both flexible (sheeting) and rigid of various thickness have been used for the construction of biogas plants in Indonesia more recently. Availability of quality materials is often restricted to the larger cities. There is a large variation in durability of the materials when exposed to slurry, mechanical stress and UV radiation.

4.2.3 Overall quality management

At the time of all site visits, the mission team carefully observed the lay-out of the biogas plants, the materials used and the quality of the workmanship. It was not possible to inspect the digester pits from inside. Quite a number of shortcomings were observed, with the inlet and inlet pipe, the outlet and related slurry pits, and also the pipes and appliances. Striking was the lack of standardisation, of procedures for supervision during construction, of written materials providing information to the customers, of handing over, guarantee and after sales procedures. In case of fully subsidised plants, the contract is often made between the local government and the contractor, completely leaving out the rights and duties of the respective households.

4.3 Benefits of biogas plants

During the field visits, households and stakeholders were interviewed on how they perceive the positive and negative aspects of biogas plants. As advantages were mentioned: Reduction in bad smell of manure, convenient, clean and safe fuel for cooking, use of bio-slurry for agricultural production, saving of expenditures on kerosene, saving of time compared to cooking on firewood or kerosene, no dirty cooking utensils any longer, and clean kitchen and clothes. Negative aspects mentioned were shortage of manure to feed the plant, low gas production, gas leakage through plastic gas holder or dome, and short life of the (plastic) biogas plant.

As all effects of biogas plants have not yet been sufficiently investigated in a quantitative manner in Indonesia, also with respect of the application of bio-slurry, it may be considered:

- To conduct an independent and detailed biogas users' survey to collect qualitative and quantitative information on the impacts of biogas plants so far installed in Indonesia.

4.4 Financial aspects

This paragraph provides an estimate of the investment costs of an average biogas plant as well as the investment subsidies provided so far.

4.4.1 Investment costs

Quotations for a fixed dome biogas of 6 m3 were collected from LPTP and Pro Rekayasa, see Annex 6. The investment costs of a plastic bag digester are represented by a 5 m3 size plant without covered platform. The costs exclude tax and the fee for construction and after sale service. The total investment costs amount to IDR 7.6 million for the fixed dome digester and to IDR 3.0 million for a plastic bag digester.

4.4.2 Investment subsidy

Investment subsidies provided in Indonesia vary between zero (full financing by the farmer) and completely subsidised. It is a clear lesson learned from the biogas practice in other countries that a fully subsidised biogas plant will not sustain due to lack of ownership by the user. A major share (minimum 60%) of the capital costs will need to be borne by the beneficiaries in kind, cash or through a credit.

4.5 Overall conclusion

Biogas history in Indonesia has been rather limited, with approximately 6,000 domestic plants installed. Digesters are both owned/operated by individual households as well as by a group of households (communal digester). Before the year 2000, mostly fixed dome digesters were applied, but more recently the plastic bag digester has become more popular. The life of the plastic bag digester is rather low, on average two years under normal field conditions. The biogas practice in Indonesia so far lacks proper standardisation and documentation. Different actors operate in isolation, without effective coordination. Local governments have started to fully subsidise biogas plants which is in conflict with the international experience that ownership by the user is best guaranteed through a substantial investment of at least 60% of the capital costs. There seems to be an urgent need to effectively link Indonesia to the international practice and knowledge, especially on technology and financing mechanisms.

CHAPTER 5: Potential demand for domestic biogas

A number of technical, social and financial factors were investigated to arrive at an estimate of the potential demand for domestic biogas in Indonesia. Manure from (meat and dairy) cattle and buffaloes is the main source of biogas, while poultry droppings and pig manure could be utilised at limited places like Bali. Palm Oil Mill Effluent (POME) was not considered as it is being produced at industrial scale. Also waste from public toilets and tofu production was judged to be beyond the scope of this study; the primary need to digest these wastes is more related to sanitation and environmental protection and less to access to sustainable energy.

5.1 Technical factors

Climatic conditions for the production of biogas in Indonesia are favourable, as rather high temperatures remain throughout the year, even at higher altitudes. It is, however, rather difficult to get appropriate data about the number of farmers keeping sufficient heads of cattle and buffaloes for biogas production and their practice on (night) stabling. Such data are required to estimate the number of households that would be able to collect a minimum of 25 kg of manure per day and hence would technically qualify to install a biogas plant.

In 2007, Indonesia was home to about 11.3 million meat cattle, 2.2 million buffaloes and 378,000 dairy cattle, see Table 5-1. This table also shows the animal population in Indonesia over the period 2003 to 2007 (Directorate General of Livestock Services, 2007, table 4.1).

Table 5-1 Population of meat cattle, dairy cattle and buffaloes in Indonesia over the period 2003-2007

	2003	2004	2005	2006	2007*
Meat cattle	10,504,000	10,533,000	10,569,000	10,875,000	11,366,000
Dairy cattle	374,000	364,000	361,000	369,000	378,000
Buffalo	2,459,000	2,403,000	2,128,000	2,167,000	2,246,000

* preliminary figure

The population of meat cattle in this period showed a growth, of dairy cattle remained almost unchanged and of buffaloes became smaller. Another source (FAO: http://www.fao.org/ag/aga/glipha/index.jsp) provides 2003 data that are slightly higher or equal than/to the data in the table above: 11.7 million cattle (meat and dairy) and 2.45 million buffaloes. Informants interviewed during the feasibility study provided also the following qualitative information:

- Reduction in the keeping of cattle and buffaloes as draught animal has been caused by the introduction of power tillers and tractors.
- Reduction of the acreage for grazing on Java and Bali caused by an increase in the number of households. As a result, farmers face difficulties in the collection of fodder for the cattle.
- Recent increase in the number of dairy cattle due to higher demand at the world market following the reduced milk production in Australia due to draught.
- Investment capacity in the rural areas is increasing due to the availability of credit facilities (through cooperatives) and income earned and remitted by migrant workers abroad.

By 2003, Indonesia was inhabited by 43.7 million households, out of which 57% (25.0 million) were termed as agricultural (farming) households (Directorate General of Livestock Services, 2007, table 10.1). Adding the 2003 data about households and commercial households (Directorate General of Livestock Services, 2007, table 10.3 and 10.4), 7.1 million households reported to keep meat cattle (an average of 1.5 cattle per household); about 710,000 households kept buffaloes (an average of 3.5 buffaloes per households); while about 230,000 households kept dairy cattle (an average of 1.6 cattle per household). It becomes not clear to which extent households with meat cattle also kept buffaloes and/or dairy cattle.

Annex 5 provides a breakdown of the data at provincial level (Directorate General of Livestock Services, 2007, table 10.3 and 10.4). The ten provinces with the highest number of households with cattle and buffaloes are included in Table 5-2. No data were available about the province Aceh, though this province is home to a lot of meat cattle and buffaloes. The last column of this table provides – as per the opinion of informants - a rough indication on the percentage of households that practice zero-grazing. This practice has been established throughout Java and Bali, while grazing is reported as the predominant practice in other parts of the country.

Table 5-2 Number of households keeping cattle and buffaloes by province, provided with a rough indication to the extent they practice zero-grazing

Province	HHs keeping meat cattle	HHs keeping dairy cattle	HHs keeping buffaloes	HHs practicing zero-grazing
East Java	3.009.535	*100.680*	35.862	100%
Central Java	1.302.476	*71.022*	66.552	100%
Bali	388.612	2	3.328	100%
South Sulawesi	268.563	286	53.336	?%
Lampung	295.377	1.088	24.420	?%
W-Nusa Tenggara	243.062	0	62.721	?%
West Sumatra	195.740	842	83.191	?%
E-Nusa Tenggara	216.502	0	63.232	?%
DI Yogyakarta	272.525	3.540	2.574	100%
West Java	136.786	*48.511*	91.106	100%

Though a precise estimate can not be made due to lack of the required statistical data, it can be rather safely assumed that a considerable technical market potential exceeding one million households is available on Java and Bali only where zero-grazing is widely practiced. Especially the households keeping dairy cattle on Java form a very potential segment of the market, as they raise animals on a long-term basis and are often very well organised in cooperatives. This finding was confirmed by data received from ILO, PT Gikiko Kogyo Indonesia and Frisian Flag Indonesia. For example, in Pasuruan district (East Java) only, 20,204 households kept 50,367 dairy cattle (2.5 animals on average per household) in 2007, while a total number of 63,778 meat cattle was kept by 26,195 households (an average of 2.4 animals per household). In Lempang district in Bandung, 30,000 households are keeping 60,000 dairy cows (an average of 2 animals per household).

Water required for mixing cow and/or buffalo dung prior to feeding – if animal urine can not be collected - into the biogas plant is in general not a problem in Indonesia. Availability of land to install a biogas plant may be a limitation in some areas. A guideline issued by the Ministry of Agriculture (Departemen Pertanian, 2007) on keeping a minimum distance of 20 metres between the livestock shed and the house may affect more the technical potential[3]. Where such space is not available near the house, the livestock keepers are forced to keep their

[3] The team during its mission could not establish the underlying factors of this guideline nor its legal standing

animals on a communal base, sometimes far away from the house. In these cases, it will not be possible to pipe the produced biogas to the house of the farmer.

5.2 Social factors

Biogas produced from cattle and buffalo dung is widely accepted as cooking fuel in Indonesia. However, resistance exists to attach a toilet to the biogas plant as this will create hesitation among people to handle the bio-slurry. This phenomenon would need special attention in future extension and promotion campaigns. It may be considered to make the installation of a second inlet pipe to the digester compulsory, even if the biogas farmer does not (yet) consider the attachment of a latrine.

From the field visits, it appeared that women have a say in the decision-making process at household level and are involved in taking care of the operation of the biogas plant. This is important as the women are the main direct beneficiaries of the biogas plants. National level data (see Table 3-1) also indicate that biogas dissemination may not severely hindered by gender inequality.

5.3 Willingness and ability to pay

Unfortunately, no appropriate statistics could be retrieved about the income and expenditure of agricultural households required to shed more light on the possible ability to pay for a domestic biogas plant. In the interviews with the biogas farmers during the field visits, may of them expressed to be unable to bear for the (full) investment costs of a biogas plants, even if they would have access to a loan. This would be more related to unwillingness to pay, however, than to ability to pay. In case biogas plants are provided for free, one may not expect (prospective) users immediately willing to pay. As a result of the sharp increase of the energy (kerosene) price, the willingness to pay is on the rise.

By just comparing the national data with these of other countries with a national biogas programme supported by SNV, see Table 3-1, it appears that Indonesia has the highest GDP per capita, being PPP US$ 3,871 in 2005 which is 25% higher than Vietnam. This would assume a fairly good ability to pay. Definitely, access to suitable biogas credit will be required to further enlarge the group of households able to invest in a biogas plant.

5.4 Financial analysis

The financial analysis is based on the data for a biogas plant with a volume of 6 m3, requiring a daily feeding of 36 kg of fresh cow dung. The investment cost is assumed to be IDR 8,000,000 to include the fee for construction and after sale service as well as measures to increase the quality of the biogas plant, see Annex 6. To promote the dissemination of the technology, an investment subsidy of IDR 2,000,000 is proposed, being 25% of the investment cost. A down-payment of 10 percent of the gross cost by the farmer is assumed, with the remaining costs to be financed at 17 percent annual interest over a four-year term.

The basic data for the financial analyses is presented in Annex 7. The benefits associated with the use of the biogas plant derive primarily from the savings in expenditures for firewood or kerosene. The base price for these fuels is assumed to be IDR 600 per kg, respectively IDR 3,500 per litre. The value of the saved labour and the recovered nutrients in the biogas slurry are assumed to be zero. The base analysis indicates for the substitution of firewood a financial internal rate of return (FIRR) of 19 percent.

Figure 5-1 presents the results of a sensitivity analysis on the assumed price of firewood. The data indicates that the resulting FIRR is extremely sensitive to this price.

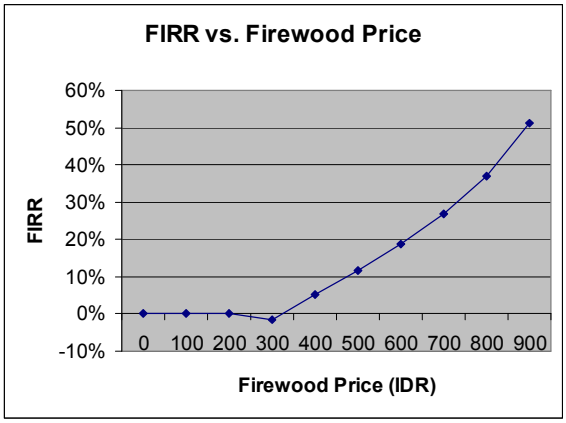

Figure 5-1 The sensitivity of the Financial Internal Rate of Return (FIRR)to the price of firewood

The FIRR becomes negative when the price of biomass is below IDR 350/kg and 51% when the price of biomass is IDR 900/kg. The actual price of biomass in Indonesia varies considerably from one area to another. The perception of some rural farmers is that the price of biomass is near zero since it can be collected by household labour which is not valued highly by them.

A sensitivity analysis on the amount of the subsidy provided is presented in Figure 5-2. The data indicates that the FIRR is not as sensitive to the percentage change in the level of the subsidy as it is to the price of firewood. The FIRR becomes less than 10 percent when the subsidy is IDR 400,000 per biogas unit (5% of the investment cost), 19% when IDR 2,000,000 is provided (25% of the capital cost) and arrives at 37% with a subsidy of IDR 3,600,000 per unit (45% of the capital cost).

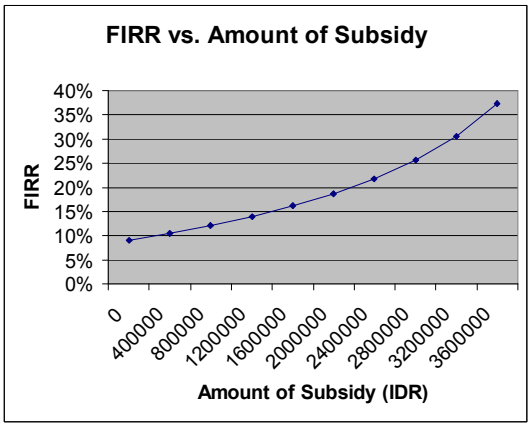

Figure 5-2 The sensitivity of the Financial Internal Rate of Return (FIRR) to the amount of investment subsidy (replacement of firewood)

The financial analysis indicates that an amount of IDR 2,000,000 as investment subsidy is generally sufficient to attract potential farmers while not being significantly excessive as to result in relatively high FIRRs for the farmer. The actual FIRR realized by the farmer is largely dependent on the actual financial price for biomass. It may be considered:

- To recalculate the FIRR and the required amount of subsidy after obtaining the results of the additional surveys on the price of firewood in targeted areas in Indonesia to be conducted in the first year of a national programme.

In case kerosene is replaced, the base analysis indicates a financial internal rate of return (FIRR) of 31 percent. Figure 5-3 presents the results of a sensitivity analysis on the assumed price of kerosene. The data indicates that the resulting FIRR is extremely sensitive to this price.

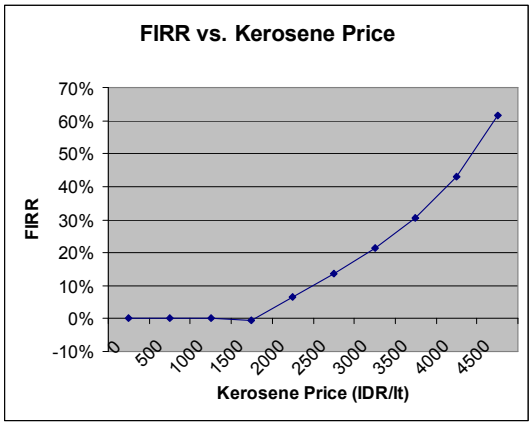

Figure 5-3 The sensitivity of the Financial Internal Rate of Return (FIRR) to the price of kerosene

The FIRR becomes negative when the price of biomass is below IDR 1,500/litre and not less than 62% when the price of biomass is IDR 4,500/litre.

A sensitivity analysis on the amount of the subsidy provided is presented in Figure 5-4. The data indicates also here that the FIRR is not as sensitive to the percentage change in the level of the subsidy as it is to the price of kerosene. The FIRR becomes 20 percent when the subsidy is IDR 800,000 per biogas unit (10% of the investment cost), 31% when IDR 2,000,000 is provided (25% of the capital cost) and arrives at 70% with a subsidy of IDR 3,600,000 per unit (45% of the capital cost).

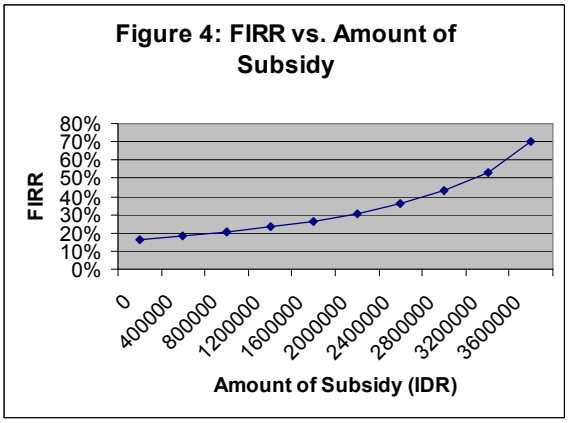

Figure 5-4 The sensitivity of the Financial Internal Rate of Return (FIRR) to the amount of investment subsidy (replacement of kerosene)

In case kerosene is replaced, the financial analysis indicates that an amount of IDR 800,000 as investment subsidy is generally sufficient to attract potential farmers while not being significantly excessive as to result in relatively high FIRRs for the farmer. However, as most of the prospective biogas households still depend on firewood as their primary cooking fuel, it is proposed to apply a flat rate of IDR 2,000,000 as investment subsidy, also for other sizes of biogas plants, like 4 and 10 m3.

5.5 Economic Analysis

An economic analysis of a fixed dome biogas plant with a size of 6 m3 was undertaken to assess the benefits to society of the use of biogas plants. Due to the scope of this study, the economic analysis had to rely on data presented in a publication of a large-scale biogas programme in Nepal (Mendis and Van Nes, July 1999). These data provide a reasonable basis for the economic analysis.

The principal assumptions relate to the conversion from financial prices to economic prices. A summary of the conversion factors and resulting economic prices for the costs and benefits associated with the analysis is presented in Annex 8. Economic benefits resulting from improved sanitation through toilet attachment and employment generation were left out of consideration. The analysis is based on calculating the economic internal rate of return (EIRR) for the net annual benefits associated with the biogas plant. All investment costs for the plant were assumed to be expended in the first year and all maintenance costs and all resulting benefits were assumed to be constant over the 15 year life of the plant. A summary of the resulting EIRR for the biogas plant is presented in Figure 5-5. The EIRR for just the economic benefits derived from the savings of biomass that result from the use of a biogas plant is estimated at 28 percent. This EIRR, as in the financial case, is very sensitive to the assumption of the economic price for biomass. The economic price of biomass is assumed to be IDR 600 per kg. If the economic price of biomass is IDR 400 per kg, the resulting EIRR is 14 percent and if the price is IDR 800 per kg, the resulting EIRR is 44 percent.

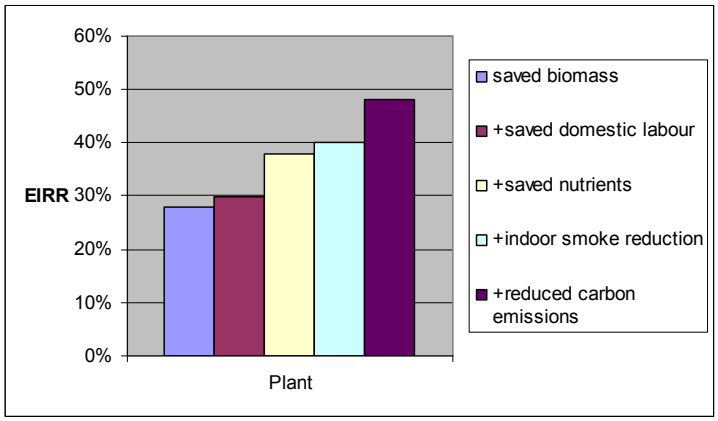

Figure 5-5 The Economic Internal Rate of Return (EIRR) varies between 28 and 48%, dependent on the benefits taken into account

Assuming a base economic price for biomass of IDR 600 per kg and adding a saving of 1.0 hours a day of domestic labour valued at IDR 250 per day results in increasing the EIRR to 30 percent. Assuming an annual value of IDR 250,000 for the nutrients in the dung that are saved and returned to the land as a result of the biogas plant, the EIRR increases to 38 percent. When the economic value of smoke reduction is added at IDR 60,000 per year (Reid, 1986), the

resulting EIRR increases to 40 percent. Finally, if the reduced carbon emissions associated with the use of a biogas plant are valued at USD 5 per tonne CO2-eq., the resulting EIRR increases to 48 percent.

Based on the assumptions used for this analysis, it is clear that there is an economic justification for the subsidy of IDR 2,000,000 per plant proposed in this study. Furthermore, it is unlikely that the Indonesian farmers would have sufficient financial incentives to adopt the biogas plants. The earlier financial analysis clearly indicated how sensitive the FIRR is to the price of firewood. As many farmers do not directly purchase biomass, their perception is that the price of biomass is at or near zero. As a result, their perceived FIRR is negative. Alternately, if the economic value of biomass is IDR 600 per kg, then the resulting EIRR for the biogas plant is 28 percent. When the other principal non-market benefits of the biogas plant are added, the EIRR rises to 48 percent. This provides an additional justification for the subsidy for the biogas plants. It may be considered:

- To recalculate the EIRR and the required amount of subsidy after obtaining more and realistic data about the price of firewood used by the farmers in the last year of the (first phase of the) national programme.

5.6 Overall conclusion

Based on the number of households keeping sufficient number of cattle and/or buffaloes, there is a substantial technical potential of minimum one million biogas plants in Indonesia. In some areas, availability of land to install the biogas plant may be a limiting factor. The guideline issued by the Ministry of Agriculture to keep a minimum distance of 20 meters between the animal shed and the house may reduce the technical biogas potential. Apart from hesitation to attach a toilet to the digester, there are no limiting social factors for domestic biogas. The ability of most farmers to invest in a biogas plant with a total cost (after subsidy) of say IDR 6,000,000 could not be established, but may be better compared to other countries with a national programme supported by SNV. A suitable and effective credit facility in a future national programme on domestic biogas will definitely add to the dissemination of the technology. The financial analysis indicates that an amount of IDR 2,000,000 as investment subsidy is generally sufficient to attract potential farmers while not being significantly excessive as to result in a favourable financial rate of return (FIRR) of 19 percent for the farmer, in case firewood is replaced. The actual FIRR realized by the farmer, however, is largely dependent on the actual financial price for firewood. When kerosene is replaced, the FIRR amounts to 31%. The economic internal rate of return (EIRR) for the biogas plant is 28 percent in the base case.

CHAPTER 6: Overview of (potential) stakeholders

The mission was privileged to meet and discuss in less than three weeks with more than 30 (potential) stakeholders in six provinces on the feasibility of a national programme on domestic biogas in Indonesia. Most of these stakeholders gained already some experience in this field and showed a strong interest to be engaged in a national programme. This Chapter provides a brief overview of the stakeholders, divided into government, civil sector, private sector and development organisations. Under 'local government', governments at provincial, district and village level are included. Indonesia is endowed with quite a number and variety of institutes, organisations and companies.

6.1 Government organisations

Ministry of Energy and Mineral Resources (MEMR) and Ministry of Agriculture (MoA) are the ministries mostly related to a possible national biogas programme because of the links to energy respectively livestock and organic manure (bio-slurry) aspects. However, also other Ministries like Health, Forestry, Environment, Women's Empowerment and Cooperatives do relate, based on other biogas benefits like reduction of indoor air pollution, deforestation and greenhouse gas emissions, generation of employment and organisational support to cooperatives.

6.1.1 Ministry of Energy and Mineral Resources

The Directorate General Electricity and Energy Utilization (DGEEU) (www.djlpe.esdm.go.id) is a directorate to carry out the several tasks and functions of the Ministry of Energy and Mineral Resources (MEMR). The main tasks of DGEEU are to plan, regulate and oversee electricity and energy utilization. The role of DGEEU is as follows:

- To develop the ministry's policies in energy and electricity;
- To carry out the implementation of energy and electricity policies;
- To set up standard, norms, code, guidance, criteria and procedure in the area of electricity and energy utilization;
- To conduct technical assistance, technical supervision and evaluation;
- To conduct administrative function for the DGEEU.

The DGEEU has five departments/directorates, each led by a Director: Secretariat of DGEEU, Directorate of Electricity Program; Directorate of Electricity Enterprises Supervision; Directorate Electricity Technique and Environment; and Directorate of New, Renewable Energy and Energy Conservation. The last Directorate is dealing with rural energy programmes, rural electrification, development of new and renewable energy and energy conservation programmes. The MEMR also established a Center for Research and Development of Energy and Electricity Technology.

6.1.2 Ministry of Agriculture

Under the Ministry of Agriculture, the Directorate General of Livestock Services (DGLS) (www.ditjennak.go.id) undertakes several tasks and functions in the area of livestock service and provision. The Directorate General is the central government authority responsible on behalf of the Ministry of Agriculture (MoA) for the planning, implementation and monitoring of national livestock production. This includes the formulation of policy, planning and

implementation of national livestock development programmes, provision of technical support services, regulatory oversight and livestock quarantine. DGLS comprises of five Directorates to carry out its mandate, namely the Directorates of Animal Breeding, Livestock Production, Animal Health, Veterinary Public Health, and Programmes. Each Directorate has a number of Sub-Directorates involved with specific functions and programs. Until decentralisation began in early 2000, this central organisational structure was replicated at the provincial, district (kabupaten) and sub-district (kecematen) levels as the Dinas Livestock Services (Dinas Peternakan). After Laws 22/1999 and 25/2000 came into effect, which granted autonomy to district governments to reorganise into autonomous units, many of these Dinas offices have been undergoing restructuring or were even abolished. The local governments, in accordance with their mandate, now decide on local operational and financial local priorities in accordance with demand and available financial resources.
DGLS, on behalf of MoA, has the legal and operational authority to carry out livestock policy, staff accreditation, programme standardisation, disease surveillance and control, testing and quality control, and food safety. This national authority overrides any local authority concerning food safety measures carried out by local governments.

In 2007, DGLS launched the Community Biogas Livestock Programme or BATAMAS programme. This programme aims to install individual and communal biogas plants of various types and sizes in 19 provinces. Apart from the provision of land and sometimes also unskilled labour, all installations are fully subsidised. The BATAMAS programme is linked with the government plan to reduce the consumption of kerosene.

6.1.3 Local governments

The mission visited a number of local governments already involved in the promotion of biogas, both at provincial level (West-Sumatra, West-Java and Bali), district level (Sleman district in Central Java, Pasuruan and Malang districts in East Java) and village level (Haurgombong village in Sumedang district). Without exception, all governments were very eager to get further engaged and to be included in a national biogas programme.

The province of West-Sumatra financed the installation of 2 units in 2007, 4 units in 2008 and aims to facilitate an additional 30 units in 2009. The systems, most of them plastic bags of 4 m3, are provided free of cost to poor households keeping a sufficient number of cows.

Sleman district has a special unit for mining and energy which is promoting various RE technologies. Three biogas units (fixed dome, 9 m3) were installed for poor households. The costs of the plants (IDR 12 million each) have been fully financed by the district. In 2008, an additional 6 communal units, also 9m3 of size, will be installed.

6.2 Civil sector organisations

The mission met with a number of NGOs like PERSADA, WPU, Small Hydro Power Association, LPTP, ARECOP, a farmers group in Salatiga and various cooperatives. A few of them are highlighted below. Dairy cooperatives could play a very effective role in a national biogas programme. They normally collect milk from dairy farmers for sale to processing companies, provide credit to farmers and offer extension advice.

6.2.1 Institute for Rural Technology Development

The Institute for Rural Technology Development (www.lptp.or.id) is NGO based in Surakarta, Central Java. The Institute was established in 1978 by a former leader of an university student council. LPTP is specialised in rural development and agricultural technology development. For

LPTP, all activities are aiming to build social movement in order to achieve freedom society, sovereign, democratic and social justice. LPTP's main programmes are Sustainable Agriculture Development, Rural Business Development, Community Based Housing Technology, Appropriate Technology Development, Popular Education and Training, Civil Society Strengthening and Good Governance.

LPTP started biogas program in 1989 in partnership with Bremen Overseas Research and Development Association (BORDA) of Germany. The first location is a village called Cepogo located in Boyolali District, Central Java. From 1991 to 1997, LPTP build more than 200 biogas plants for dairy cow farmers. The size of plant varied from 9 m3 to 24 m3. Most of the plants are still in operation today. LTPT has trained hundreds of masons on biogas plant construction, based on a standardised design. Many of trained masons have started their own business. The activities of LTPT in developing and promoting biogas technology have been acknowledged by many NGOs, governments and local groups.

Since 1998, LPTP has developed and built Decentralized Wastewater Treatment Systems (DEWATS) with the assistance of BORDA. The basic DEWATS plant is rather similar to conventional biogas plant for animal husbandry. LPTP-DEWATS, a business unit dealing with commercialization of DEWATS, was established in 2000. Later, also C-BETech was founded, an NGO under LPTP specifically developing and disseminating DEWATS and biogas technology. Both institutions are based in Sleman, Yogyakarta, and have built a number of wastewater treatment facilities for hospitals, hotels and tofu industries in different cities and provinces. In partnership with the State Ministry of Environment and local (district and city) governments, LTPT developed the Community Sanitation (SANIMAS) project focussing on sanitation facilities in the urban and semi-urban areas.

6.2.2 Bali Fokus

Bali Fokus (www.balifokus.or.id) is an NGO based in Denpasar, Bali. It was established in 2000 by several environmentals activist and academician in Bali. Bali Fokus works on environmental and waste management, cleaner production, pollution control and prevention, and sustainable development issues. In the early years, Bali Fokus started with environmental management programmes managing and processing waste from hotels in the touristic areas of Bali. Later, in 2002/2003, technology was developed and applied to anaerobically treat waste water for small-scale (tofu) industries and animal farms in Bali and NTB. Later, Bali Fokus was involved in the SANIMAS programme, a community managed sanitation programme in six slums in East Java and Bali. They also initiated community based solid waste management in two areas of Denpasar city in cooperation with Denpasar Environmental Agency.

6.2.3 ARECOP

The Asia Regional Cookstove Program (ARECOP) (www.arecop.org) was initiated in 1991 as a network facilitating the development and dissemination of improved cook stoves and the execution of biomass energy programmes at the level of households and small industries. For more than a decade (ARECOP) has consistently focused its activities on the traditional

wood/biomass energy using population, the millions upon millions of people who depend upon wood and other biomass as their main source of energy for their daily livelihood.

As a network, ARECOP has made significant contribution toward establishing effective cooperation between diverse stakeholders in addressing improved cookstove and related energy issues. Through the establishment of Country Contact Points in 7 countries (Bangladesh, Cambodia, Indonesia, Nepal, Philippines, Sri Lanka and Vietnam), The Program has successfully facilitated the creation of nationally based networks in the region and has functioned as a bridge for the exchange of information, skills, expertise and resources.

Bringing its course of action in line with emerging issues, ARECOP has taken steps to address the issues of indoor air pollution, and its related health impacts and has put greater focus on the popularization of advanced and modern biomass technology application. Besides a regional focus, ARECOP also dedicates equal emphasis in building country based capacities to deal with national level issues.

ARECOP and its Indonesian network could be used by a national biogas programme to collect more data on the availability of biomass fuels in target areas and for promotion.

6.3 Private sector organisations

Also from the private sector, a number of organisations were contacted like PT Gikoko Kogya Indonesia, Pro Rekayasa, Benedict Mulia Utama, SPAT, Credit Union Sawiran, Frisian Flag Indonesia and MICRA. These and other organisations could play valuable roles in product development, construction and after sales of biogas plants, provision of credit, promotion and networking. Unfortunately, no meetings could be established with PT Media Inovasi Transfer (PMT) in Bogor and PT Mulya Tiara Nusa (MTN) in Jakarta. These companies are quite active in the area of product development and marketing of biogas plants (especially plastic bag digesters) and related equipment.

6.3.1 PT Gikoko Kogya Indonesia

PT Gikoko (www.gikoko.co.id) is an engineering company with manufacturing capabilities in Indonesia since 1993. The principal shareholders are investors from Japan and Hongkong. The company developed in 2006 a carbon credit (CDM) project for a landfill in cooperation with the WB Carbon Finance Unit. More recently, PT Gikoko is investigating the feasibility of developing and investing in a biogas project in Pasuruan district, East Java, not primary looking to sell its equipment but to provide an environmental solution that can pay back through CER/VER trading for the investment and sustain operation and maintenance for the households involved.

6.3.2 Credit Union Sawiran

Credit Union Sawiran (www.cusawiran.org) is a microfinance institution. Initially, it was a credit cooperative founded in 1989 by a catholic priest to serve the employees of Sawiran retreat house, in Sawiran village, Pasuruan District, East Java. In 1998, the cooperative started to open its membership to the local and non-employee of the retreat house and by then the CU Sawiran

was established. CU Sawiran poses itself as an alternative to the conventional banking system. The mission of CU Sawiran is to improve the quality of life and welfare of members and to manage a financial services institution that is professionally managed in accordance with the values and principles of the cooperative.

Over the years, CU Sawiran has developed impressively in terms of assets, products and services, business volume and membership. Currently, the credit union has 3,400 members and is serving around 8,000 clients through eight branches in three different cities. The products include different types of loans, saving and transfer services. Prospective biogas customers in the biogas potential area of operation of CU Sawiran could benefit from a loan if they are or would become a member.

6.3.3 Frisian Flag Indonesia

Frisian Flag Indonesia (FFI) produces and markets a wide range of products including powder milk, ready-to-drink milk and sweetened condensed milk. The company runs two production facilities in Pasar Rebo and Ciracas in Jakarta. The company is based in Jakarta with seven sales offices and sales representatives across Indonesia employing more than 1,600 people. Besides the core business, FFI implements corporate social responsibility programmes, aiming to improve community health and nutrition through public-private partnerships. The programmes focus on nutrition education as well as basic healthcare education specially targeted to community, healthcare professionals and farmers.

In Lembang (Bandung) only, about 60,000 milk cows are kept by 30,000 small farmers residing often in areas with a higher altitude. Higher world market prices for milk powder, especially in 2007, have raised interest among rural households to start or extend dairy farming. In some areas, (quality) fodder is a limiting factor for milk production. These farmers could be a very interesting target group for a biogas programme, provided that a reliable and affordable technology could be made available. FFI could play a role in the provision of credit, training and collection of construction materials. A plastic bag digester was tested by FFI in the past, but proved to be unreliable.

6.4 Development organisations

Finally, also some development organisations were consulted in the framework of the mission like Hivos, ADB, CARE, UNDP, ILO and GTZ. Though their experience with biogas has been limited or even absent, they all showed a varying interest to engage in biogas activities, projects or programmes.

Hivos is a Dutch non-governmental not-for-profit development organization (www.hivos.nl) inspired by humanist values, seeking to contribute to a free, fair, and sustainable world. The regional office for Southeast Asia was established in Jakarta in 2004 and is registered with the Department of Social Affairs. The office provides financial and political support for local NGO's in Indonesia and East Timor, and is also active in networking, lobbying

and in exchanging knowledge and expertise. Currently, about 20 staff members are employed and 80 non-governmental partner organisations are supported. One of the primary domains of Hivos is 'Access to Opportunities' aiming at sustainable economic development through sustainable production and sustainable energy, financial services and enterprise development including microfinance. Other programmes in Indonesia are related to human rights, gender and IT for campaigning by NGOs. Hivos supported two domestic biogas plants in two villages in Aceh. The challenges for further dissemination of biogas in Aceh are lack of institutional infrastructure and free roaming livestock.

Dissemination of biogas would very well fit into the domain of 'Access to Opportunities'. The possible role of Hivos would be in fund management, preferably through non-governmental channels.

The Asian Development Bank (ADB) in Indonesia (www.adb.org/Indonesia/) supported in the 1980s the Kalimantan Livestock Development Project. In the framework of this project, a review was made in 1988 of the Indonesian experience with biogas development (G.R.M. International Pty. Ltd., 1988). More recently, studies were commissioned on the feasibility of biogas production from effluent of palm oil mills. Possible future commitments should have a clear link to climate change programmes as recently endorsed by ADB/Manila.

CARE is non-profit and non-sectarian charitable agency, founded in 1946, with a federation of 12 members. These members implement development, emergency and rehabilitation projects in more than 65 countries around the world, with an annual budget of more than US$ 700 million.
CARE Indonesia (www.careindonesia.or.id) has been operating in the Republic of Indonesia since 1967 and was initially involved in food distribution, building medical capacity, school feeding programs and small infrastructure projects. By the 1980s, CARE emphasized community development (particularly in health), environment, water and sanitation. The organisation employs more than 750 employees and has six regional offices throughout the country. CARE's current strategy includes a broad range of long-term development programmes in disaster risk reduction, emergency response, environment and natural resource management, health, livelihoods, water and sanitation.

UNDP in Indonesia (www.undp.or.id) is providing for more than 30 years with technical assistance and capacity-building in support of the country's development goals. As per its newest country cooperation framework, UNDP is focussing on governance reforms, pro-poor policy reforms, conflict prevention and recovery, and environmental management. Currently, UNDP is developing a renewable energy initiative with the government, private sector and CSOs.

ILO in Indonesia (www.ilo.org/public/english/region/asro/jakarta) works in close collaboration with the government, the workers' and employers' organisations to promote decent work for all. The concept of decent work is built on four strategic pillars: The promotion of fundamental principles and rights at work; employment, enterprise creation and human resource development; social protection; and social dialogue. In two districts in East Java (Pasuruan and Malang), ILO is managing a Local Economic Development (LED) project. The participants are mainly farmers and have expressed a clear need to improve their production capacity in farming and horticulture (flowers), looking for ways to develop better fertilizers or improve the yield of their seeds. A complementary need which has emerged is that of developing biogas. ILO is keen on supporting this in the context of support to rural economies, response to climate change and creation of "green jobs".

GTZ in Indonesia (www.gtz.de/en/aktuell/608.htm) is currently concentrating on the following priority areas: Health, transport, economic reform and decentralisation. The work in these areas is supplemented by projects in basic education, advice on forestry policy and renewable energy. In relation to a possible national biogas programme, GTZ/Indonesia has shown interest to develop a CDM project in cooperation with PT Gikoko Kogya Indonesia. In some other countries, GTZ is also undertaking biogas activities, mostly focussed on larger units for small enterprises.

CHAPTER 7: Required functions and suitable actors

National programmes require multiple actors to conduct distinguished functions in a coordinated manner, see Figure 7-1, rather than single actors conducting all functions on their own.

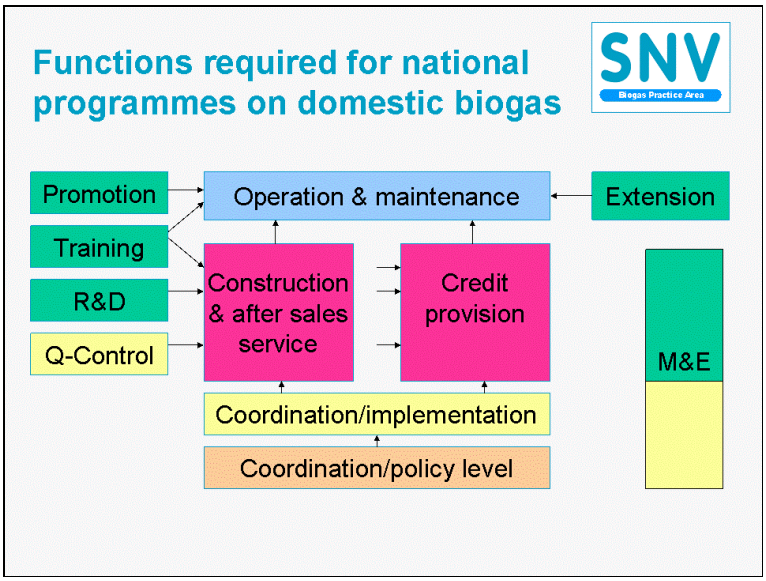

Figure 7-1 Functions required to be executed in a national biogas programme

In this chapter, a provisional match between required functions and suitable actors is presented. Some of the functions are supposed to be conducted by one actor only; others by multiple actors, with a third category of functions that could be executed by both single or multiple actors, see Table 7-1.

Table 7-1 Suitable actors proposed by respondents to execute functions in a national biogas programme in Indonesia

Function	Suitable actor(s)
Operation & maintenance (multiple actor)	Eligible farmers having sufficient cattle dung at their disposal will operate and maintain the biogas plants.
Promotion (single/multiple actor)	Various actors from the government and civil society sector at central and local level will be able to promote the use of biogas including the dissemination of reliable information on the costs and benefits of biogas plants towards eligible farmers. As possible actors, DGEEU, DGLS, local governments, ARECOP and NGOs were mentioned.
Construction & after sales service (multiple actor)	Based on a level playing field enabling fair competition, different kind of actors could very well construct and service biogas plants like private companies and NGOs. It is for various reasons not recommended to involve government organisations in conducting this function.
Provision of credit (multiple actor)	MFIs, cooperatives and banks could very well provide loans to eligible farmers to finance the installation of biogas plants. Especially, dairy cooperatives could be very effective as loans could be repaid by the milk delivered by the members.

	It is not clear whether these actors will be able to refinance these loans by their own sources.
Quality control (single actor)	Quality control is closely related to the administration of investment subsidy. In the initial stage of national biogas programmes, this function may be best executed by the actor who takes care of the coordination at implementation level. In a later stage, also independent consultants could be mobilised.
Training (multiple actor)	Various actors could be involved in conducting training activities, depending on the kind of training. Some of the required trainings are (female) user training, mason training, supervisor training, business development training and loan officer training. Possible actors are the national and regional training centres of MNER, MoA, local governments, universities and NGOs.
Extension on use of bio-slurry (single/multiple actor)	Proper use of bio-slurry needs to be promoted through extension programmes to be executed at local level. Extension agents from the MoA or NGOs could be well placed to provide these services.
Applied R&D (single/multiple actor)	Also with applied R&D, various actors could be involved in executing activities, depending on the nature of the R&D, like universities and R&D centres.
Monitoring & evaluation (single/multiple actor)	Multiple actors could qualify for execution of external monitoring & evaluation activities on the condition that they are independent. Local government could play a significant role here.
Coordination at implementation level (single actor)	NGOs, government and private sector were all mentioned as possible actors to implement the national programme.
Coordination at government/policy level (single actor)	For the coordination at government/policy level, the establishment of an advisory committee with broad representation from all sectors could be established. Such committee could be facilitated by the coordinating body at implementation level.

The suitable actors are presented in Figure 7-2. Eligible farmers will operate and maintain biogas plants constructed and serviced by private sector, cooperatives and NGOs, while MFIs, cooperatives and banks provide them – if required – with a micro-credit. Promotion, training, R&D, extension and M&E are functions that will be conducted by various institutes based on ToRs. A capable and dedicated NGO may be selected as an implementing agency of the programme, to coordinate the programme and to manage the fund. An advisory committee linked to the national government (MEMR/DGEEU and/or MoA/DGLS) will need to be established to coordinate the programme at policy level.

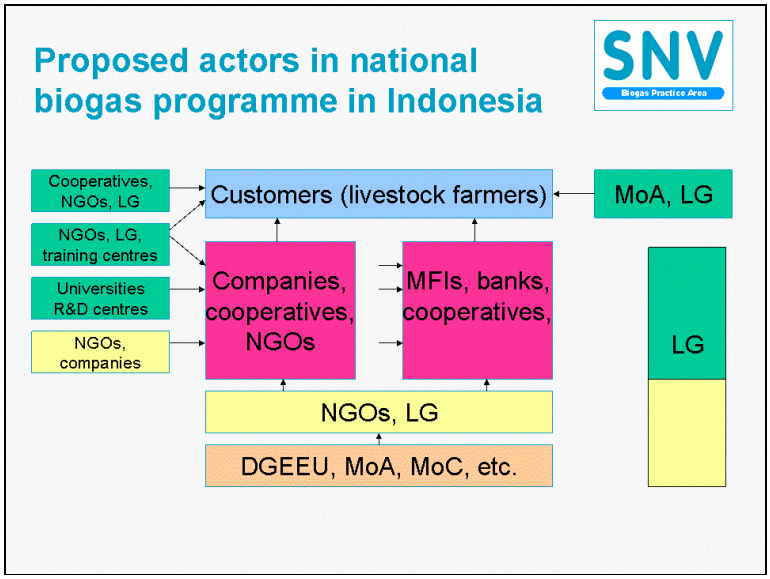

Figure 7-2 Summary of suitable actors to execute functions required in a national biogas programme

CHAPTER 8: Outline for a national biogas programme

This Chapter provides an advice for a national programme on domestic biogas in Indonesia. The majority of the conditions for large-scale dissemination of biogas plants in Indonesia are fully or just met (see Annex 4), with a few other conditions doubtful, not (yet) met or falling short. The latter conditions need attention during the implementation of the programme. Respondents were requested to explain why a national programme would be required.

8.1 Need for a programme

Most of the respondents mentioned the high prices of oil-based fuels (kerosene, LPG) as the most important reason to (further) disseminate biogas in Indonesia. Other reasons brought forward were the agricultural value of bio-slurry; improved life for rural households, especially women; environmental protection to reduce firewood for cooking purpose, and; generation of employment in rural areas.

8.2 Objectives of the programme

The overall objective of the proposed national programme is to further develop and disseminate domestic biogas through a market-based approach in rural areas of Indonesia. The specific objectives contributing to its overall objective are:

- To increase the number of quality biogas plants (fed by animal manure) by 12,000 (individual and communal) households over a period of three years;
- To ensure the continued and optimal operation of all plants installed under the programme;
- To develop a commercially viable, market oriented biogas industry;
- To further strengthen institutions for sustainable development of the biogas sector, and;
- To effectively exchange knowledge between all actors in the programme and with relevant international actors.

The word 'national' refers more to a programme that is fully owned by the Government of Indonesia and that effectively tries to provide a framework for all actors to play their role and (initially) less to its geographical coverage. It will be a long way to establish the required 'infrastructure' in all provinces of Indonesia. In addition, not all provinces will have a substantial market potential for domestic biogas required to justify a programme intervention.

To finally achieve sustainability of the programme, a long-term approach is definitely required, requiring additional phases of a national programme beyond the outline presented here.

8.3 Geographical coverage

In order to firmly found and test the modalities and institutional arrangements of the national programme, it is proposed to start the programme in three potential provinces of Java (West, Central and East)[4] and extend in both 2010 and 2011 with a maximum of another 4 provinces. Criteria proposed for the selection of the additional provinces are high cattle and buffaloo

[4] Central Java and DI Yogyakarta to be taken as one implementation area

population stabled at least during the night and potential actors at the supply side, notably constructors and financers.

8.4 Institutional set-up

Two different options are proposed for the institutional set-up of the national programme:

- Option 1: An entity (private sector, (I)NGO) at national and provincial level, and policy coordination desks as DGEEU and/or DGLS, or;
- Option 2: An entity (private sector, (I)NGO) at national level with partners (private sector, NGOs) at provincial level, and policy coordination desks at DGEEU and/or DGLS.

DGEEU and DGLS are proposed as they are most related to the development and dissemination of the technology and also to make sure the national programme will incorporate the experiences gained through their past and present activities, for example through BATAMAS.

At national level, a National Advisory Committee is proposed to coordinate the policies and activities of the major stakeholders. Also at provincial level, such kind of committees could be very instrumental. It is proposed to conduct in 2010 a study of the institutional set-up of the national programme required for its next phase, from 2012/13 onwards.

8.5 Production, budget and financing

It is proposed to carefully start the programme in some provinces and to gradually expand to other provinces. The preparation of the programme could start after the commissioning of the programme by RNE/Jakarta and would include the installation of a limited number of biogas plants (900) already in 2009/2010 to be installed on Java. The implementation could run for a period of two more years (2010/2012) and aim at the construction of another 11,100 plants[5]. Hence, the total production of the programme would amount to 12,000 biogas plants, see Table 8-1.

Table 8-1 Production targets for the national biogas programme

No. of provinces	Year 1	Year 2	Year 3	Total
3	900	2,700	5,400	9,000
2	-	600	1,800	2,400
2	-	-	600	600
	900	3,300	7,800	12,000

The total indicative budget for the national biogas programme amounts to Euro 16.6 million, see Table 8-2.

It is assumed that the prospective biogas households will invest about Euro 7.5 million and in addition will pay about Euro 1.9 million on interest on biogas credits issued for about 45% of all biogas plants, and will pay the other units in cash. The costs of investment subsidy, programme support activities and international TA amount to Euro 7.1 million and are proposed to be financed by DGIS through RNE/Jakarta.

[5] This number is quite ambitious to be achieved in a period of two years. During the Consultative Workshop, RNE/Jakarta indicated that an extension into 2012 could be an option.

Table 8-2 Indicative budget for the national biogas programme

Summary project budget by cost centre		(corrected for inflation)			[Euro]
		Summary project budget			
		1	2	3	total
1a	Household investment	535.959	2.039.083	4.999.561	**7.574.604**
1b	Credit financing costs	87.655	444.648	1.362.772	**1.895.074**
1c	Investment subsidy	135.849	498.113	1.177.358	**1.811.321**
2a	Programme support activities	937.979	1.444.472	2.264.831	**4.647.282**
2b	International TA	225.000	229.500	234.090	**688.590**
	Total project	**1.922.442**	**4.655.816**	**10.038.612**	**16.616.870**
	million IDR	*25.472*	*61.690*	*133.012*	*220.174*

The budget excludes possibly required funds for credit provision. It will be therefore required to explore the availability of funds, in-country and abroad, required to refinance the credit requirements of the programme. The cost/benefit ratio of CDM financing still needs to be determined for this case. Based on experiences to mobilise carbon credits for large-scale biogas programmes in Nepal and Vietnam in 2009, it may be possible to estimate the cost/benefit ratio for a smaller-scale programme in Indonesia.

8.6 Kick-starting the programme

A number of steps are to be taken to get the national programme started. First of all, RNE/Jakarta in consultation with MEMR (DGEEU) and MoA (Directorate General of Livestock Services) has to enter into a contract with a qualified NGO or private sector organisation for the implementation of the programme. This implementing agency may then:

- Undertake – in consultation with relevant stakeholders - an assessment of the available biogas technology in Indonesia, identifying the most appropriate technology for promotion, followed by standardisation and documentation;
- Call for a national stakeholders workshop;
- Establish the provincial biogas offices;
- Prepare the promotional plans for each province, and;
- Mobilise potential credit suppliers.

8.7 Assumptions and risks

It will be of great importance for the national biogas programme to get the full support from the GoI for the market-based approach of the programme. So far, representatives of different governmental stakeholders both at national and local level showed a clear interest and will to participate and/or support such a programme, and thus it is assumed that the GoI support will also formally materialise. The multiple benefits of the proposed biogas programme have clear linkages to the poverty reduction strategy and the attainment of the millennium development goals envisioned by the GoI and also will reduce the environmental pressure or dependency on fossil fuels.

Another assumption is that the (potential) suppliers will agree to upgrade and standardise the quality of products and services. Once the prospective customer has decided to install a biogas plants, he/she needs to be ensured to get the stipulated quality with respect to construction, after sales service and also financing.

It may take time to mobilise effective credit schemes that could fulfil the credit requirements of the programme. It is assumed, however, that arrangements can be established during the first year of the programme.

A clear risk is associated with the present practice of fully subsidising biogas plants. If this practice will be continued, it will distort any effort related to market development. Another risk is the lack of commitment and/or resources to continue and extend the national programme after its first phase.

CHAPTER 9: Main conclusions and recommendations

This Chapter only presents the main conclusions and recommendations. One is referred to the various chapters for more specific conclusions and recommendations.

9.1 Main conclusions

A national programme on domestic biogas in Indonesia looks feasible as:

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

The tentative outline for such a programme with a longer-term vision to develop a commercial, sustainable biogas sector includes the production of 12,000 biogas plants and will cost about Euro 16.6 million. The biogas farmers (57%) and DGIS through RNE/Jakarta (43%) are the proposed financiers of the programme, while the GoI is supposed to provide policy and administrative support. The cost/benefit ratio of CDM financing still needs to be determined. It has been assumed that the GoI will fully support a national biogas programme and that (potential) stakeholders will agree to up-grade the quality of products and services. The current practice of fully subsidising biogas plants and the lack of commitment and/or resources to continue and expand the programme after its first phase are considered as risks.

9.2 Main recommendations

The following are the main recommendations resulting from this feasibility study:

- To RNE/Jakarta: To enter into a contract with a capable and dedicated civil society or private sector organisation (implementing agency) for the management of the fund and the coordination of the implementation of the proposed national programme;
- To the implementing agency: To undertake – as initial steps – the required assessment of the available biogas technology, to call for a national stakeholders workshop, to establish provincial biogas offices, to support the preparation of provincial plans and to mobilise effective credit providers;
- To DGEEU and DGLS: To agree with the set-up and operation of policy coordination desks, and;

- To SNV: To explore internally whether advisory services could be provided to the programme, at least for the connection of Indonesia to the global knowledge base on domestic biogas.

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Annex 1: Terms of Reference (excluding annexes)

1. Brief introduction

Recently, the Government of the Netherlands earmarked for the period 2008-2011 additional funds (€ 500 million) for renewable energy in developing countries. The objective of these funds is to combat poverty by the provision of access to modern energy services which do not have negative impacts on climate. Indonesia is one of the countries for the co-operation on renewable energy and domestic biogas has been identified as one of the possible areas of co-operation.
In order to develop the programme, a feasibility study on domestic biogas in Indonesia is considered necessary by the Embassy of the Netherlands in Jakarta. This document presents the Terms of Reference (ToR) for such study.

2. Objective of the study

The objective of the study is to thoroughly assess the feasibility to set-up and implement a national programme on domestic biogas in the Republic of Indonesia.

More specifically, the study will address the following areas:

- Country background including agricultural & livestock sector, energy demand and supply, energy policy and plans;
- History of domestic biogas and experiences with existing projects, including the ADB project;
- Potential demand for domestic biogas;
- Financial (FIRR) and tentative economic feasibility (EIRR) at household level;
- Possible supply of services for domestic biogas, and if feasible;
- Outline for a national programme on domestic biogas, including potential partners and proposed organisation structure, in case a national programme appears to be feasible.

3. Activities and methodologies

The following activities and methodologies are proposed:

A. Preparation of a mission to Indonesia by collecting secondary information, contacting key respondents and informants in Indonesia and abroad, and drafting checklists for field visits and interviews (5 days);
B. Mission to Indonesia, to meet key respondents and informants for interview and discussion and to pay field visits to potential areas including biogas plants installed in the past, see Annex I for a provisional list. The field visits will be limited to maximum three areas being Sumatra: Aceh and/or West Sumatra; Java: Central, Yogyakarta and/or East Java) and Bali. The selection of these areas is based on FAO statistical data on the density of cattle, buffalos and pigs (see Annex III) and will finally also depend on the opportunities to meet key respondents and informants. The mission shall include a workshop to share the preliminary results of the mission with the Netherlands Embassy in Jakarta and relevant stakeholders (to be decided in consultation with the Embassy) to discuss the possible roles of the different stakeholders as well as the outline of a possible national biogas programme (17 days, in Indonesia);

C. Formulation of the draft study report and submission for comment to the Netherlands Embassy in Jakarta, the Environment and Water Department of the Netherlands Ministry of Foreign Affairs (DGIS/DMW) and relevant stakeholders in Indonesia, to be decided in consultation with the Embassy (3 days);
D. Submission of the final study report by incorporating the comment from the Netherlands Embassy in Jakarta, DGIS/DMW and relevant stakeholders in Indonesia (5 days).

4. Expected output

The output on the feasibility study shall be:

- A clear presentation of the preliminary results of the mission with tentative conclusions and recommendations, to be delivered through a PowerPoint presentation during the stakeholders meeting at the end of the mission in Indonesia, and;
- A well-structured and clearly written report not exceeding 50 pages excluding annexes providing informed recommendations on the possibilities to set-up a national biogas programme in Indonesia. Annex II presents a tentative table of contents for the report.

5. Time schedule

The mission to Indonesia shall be completed within a period of three weeks in July 2008. The Netherlands Embassy in Jakarta, DGIS/DMW and relevant stakeholders in Indonesia will provide within 10 working days comment on the draft report. After that, the final study report will be presented within five working days, preferably before 15 August 2008, but not later than 31 August 2008.

6. Composition of the team

The mission team shall consist of three members: an international team leader and two independent national experts. The team leader (to be engaged for 30 days) will be a senior general biogas expert of SNV Netherlands Development Organisation. One of the national experts (to be engaged for 25 days) will have a profound institutional background on renewable energy in Indonesia, while the other expert (to be engaged for 20 days) has a proven technical background in rural infrastructure, preferable with some experience in domestic biogas.

7. Budget

The costs of this study will consist of the fees of the three team members and their costs for travelling and DSA. The estimated expenditures amount to a total of Euro 45,000. On behalf of the Netherlands Embassy in Jakarta, the costs will be paid by DGIS/DMW from the budget of the Support Group.

8. Further arrangements

In Indonesia, the mission will work under the supervision of the Netherlands Embassy in Jakarta. The team is free to discuss any matter concerning the assignment with any institution or individual, but is not authorised to make any official commitments on behalf of the Embassy or DGIS/DMW.

Annex 2: Programme of the mission

Sunday, 6 July 2008:		
	Arrival of Wim van Nes by air in Jakarta	
Monday, 7 July 2008:		
09.00-10.45	Meeting with and preparation by the team	
10.45-12.30	Briefing with: -Ms. Renate T. Pors -Mr. Wiebe J. Anema -Mr. Ben Zech -Mr. Lukas Rahmidin	RNE: -Counsellor, Head of the Economic Division -Deputy Head of Economic Division -First Secretary Environment -Policy Advisor Economic Division
14.00-16.30	Meeting with: -Mr. Ben Witjes -Mr. Panca Pramudya	Hivos: -Director Regional Office Southeast Asia -Program Officer Sustainable Economic Development
Tuesday, 8 July 2008:		
09.00-11.00	Kick-off meeting at DGEEU with representatives of MEMR, DGEEU, DGLS, MUR, MC and BPPT, chaired by: -Mr. Dadan Kusdiana	 -MEMR/DGEEU/Head of Rural Energy Division
14.00-15.00	Meeting with: -Mr. Tulus Laksono -Mr. Budi Kurniawan -Ms. Tantri Endavini	Ministry of Environment: -Head of Division for Small Scale Enterprises -Head of Section for Standards & Regulation -Head of Section Strengthening of Cooperation
Wednesday, 9 July 2008:		
08.30-09.30	Meeting with: -Mr. Ir. Yahya Hidayat Msc.	Bappenas: -Director for Energy
10.00-11.00	Meeting with: -Mr. Martin Djamin	BPPT: -Expert Staff to the Minister of Research on Alternative and Renewable Energy
11.30-13.45	Meeting with: -Mr. Joesh Hwang	PT Gikoko Kogyo Indonesia: -Production Director
14.30-15.30	Meeting with: -Mr. Rehan Kausar	ADB: -Infrastructure Specialist
1615-17.15	Meeting with: -Ms. Heather van Sice -Ms. Rieneke Rolos	CARE: -Assistant Country Director Program -Program Leader Sulawesi
Thursday, 10 July 2008:		
	Air travel from Jakarta to Padang, West-Sumatra	
14.00-16.00	Meeting with: -Mr. Jon Khamberli -Mr. Zimahadi	 -Provincial Government of West-Sumatra, Head of Section for Energy Utilisation -Head of Evaluation & Programme Section of EMR Office
Friday, 11 July 2008:		
	Field visit to two domestic biogas plants in Sorong Haru and Guguk Nyaring village in Tanah Datar district ; one community biogas plant in Rao Rao village in Tanah Datar district, and one non-biogas household Manggis village in Padan Panjang city, accompanied by -Mr. Jon Khamberli -Mr. Ibnu Syahrudin -Mr. Iryan Nazrul	 -Provincial Government of West-Sumatra, Head of Section for Energy Utilisation -MEMR, Rural Energy Division -Pro Rekayasa, Supervisor

Saturday, 12 July 2008:		
	Air travel from Padang to Jakarta and by car to Bandung	
16.30-20.00	Field visit to two community biogas plants Cihideung village in West-Bandung district, accompanied by: -Mr. Dadan Kusdiana -Mr. Haruman	 -MEMR, Head of Rural Energy Diviision -Pro Rekayasa, Supervisor
Sunday, 13 July 2008:		
	Field visit to Sumedang district in West-Java including visit to one domestic and two community biogas plants in Haurgombong village, accompanied by: -Mr. Ali Hamid -Mr. Dadan Kusdiana -Mr. Haruman -Ms. Elly Roosma Ria -Ms. Winy Garwini	 -Staff of Provincial Energy R&D unit of West-Java -MEMR, Head of Rural Energy Division -Pro Rekayasa, Supervisor -Benedict Mulia Utama (company) -PERSADA (NGO)
Monday, 14 July 2008:		
09.00-11.30	Meeting with: -Mr. Tb. Hisni -Mr. Sumarwan -Mr. Bisarwono -Mr. Dadan -Mr. Ali Hamid -Mr. Tubagus Nugraha together with: -Mr. Alex R. Baihaki accompanied by: -Mr. Efendi Manurung	Provincial Government of West-Java, EMR office: -Head - - - - - Provincial Government of West-Java, Agriculture & Livestock - -MEMR, Rural Energy Division
11.45-13.00	Meeting with: -Mr. Faisal Rahadian -Mr. Sentanu accompanied by: -Mr. Efendi Manurung	 -WPU, Renewable Energy Consultant -Small Hydro Power Association -MEMR, Rural Energy Division
	Travel from Bandung to Jakarta by car	
Tuesday, 15 July 2008:		
08.30-10.00	Meeting with: -Mr. Dadan Kusdiana -Mr. Dothor Pangaitan -Mr. Agus Saptono	MEMR/DGEEU: -Head of Rural Energy Division -Rural Energy Division -Rural Energy Division
11.00-12.30	Meeting with: -Mr. Hasmi Harun -Mr. Choirul Anwar -Mr. Albert T.	MoA/DG for Livestock Services -Head of Unit Equipment & Machines -Quality Assistance -Analysis & Equipment
14.00-15.15	Meeting with: -Mr. Alex Heikens	UNDP: -Environment Unit, Technical Advisor
19.00-20.00	Meeting with: -Mr. Peter de Rooij -Mr. Matthieu Cognac -Mr. Marcus Powell	ILO: -Deputy Director -LED Advisor -Chief Technical Advisor
Wednesday, 16 July 2008:		
	Air travel from Jakarta to Yogyakarta	
10.00-13.00	Meeting with: -Mr. Popo Riyanto -Mr. Suryanto together with: -Mr. Purwoko	LPTP: -Director DEWATS -C-BETech -Sleman district, Division Energy & Minerals

13.00-17.00	Field visit in Sleman district including two individual biogas plants	
17.00-18.30	Meeting with: -Ms. Christina Aristana -Mr. Erwan Kow -Ms. Prianti Utami	ARECOP: -Manager - -
Thursday, 17 July 2008:		
08.30-16.00	Field visit in Sleman district including individual and communal plants, tofu waste plant, public toilet plant and two non-functioning plants	
16.00-17.30	Travel from Yogyakarta to Solo by car	
Friday, 18 July 2008:		
09.00-11.00	Meeting with: -Mr. Agung Wahyana -Mr. Sumino -Mr. Lilik -Mr. Popo Riyanto	LPTP: -Director -Coordinator Renewable Energy & Water Resources -Staff Technical Academy -Director DEWATS
14.30-17.30	Field visit in Solo to office toilet plant, tofu waste plants and public toilet plant	
Saturday, 19 July 2008:		
11.00-12.30	Meeting with: -Mr. Muslim Abdul Wahab -Mr. Bahruddin -Mr. Qaryah Thayyibah	Farmers group in Salatiga
12.30-18.00	Field visit to Salatiga and Boylali including three individual plants	
21.30-23.00	Travel from Yogyakarta to Denpasar by air	
Sunday, 20 July 2008:		
08.30-15.00	Meeting with representatives of cooperative at Bangli and official of Office of Cooperatives, followed by field visit to two individual plants	
16.00-18.00	Meeting with Bali Fokus (Ms. Yuyun Yunia Ismawati, Director) and field visits to tofu waste plant, pig manure plant and slaughterhouse waste plant	
Monday, 21 July 2008:		
	Travel from Denpasar to Surabaya by; from Surabaya to Malang by ILO car	
11.30-13.30	Meeting with senior representatives of Cooperative Setia Kawan and Pasuruan district	
13.30-15.00	Field visit to Tutur sub-district including two individual biogas plants	
16.00-18.00	Meeting with Mr. Endiyatmo Widagdo, including a visit to an individual plant in Batu village	SPAT (Integrated farming Development Centre)
19.00-21.30	Dinner with: -Ms. Janti Gunawan -Mr. Muhamed Nour	ILO: -Local Programme Coordinator -Local Project Coordinator (Labour Migration)
Tuesday, 22 July 2008:		
07.00-10.00	Meeting with: -Mr. Rendra Kresma	Malang district government: -Deputy Head

	-Staff of several sections	
10.00-11.30	Meeting with Mr. Kokok Budianto	Credit Union Sariwan
11.30-13.30	Field visit to Slamparejo village including two individual plants (KAN)	
15.00-19.00	Travel from Malang to Jakarta by air and taxi	
Wednesday, 23 July 2008:		
08.30-09.30	Meeting with: -Mr. Cees H.M. Ruygrok -Mr. Hendro H. Poedjono	Frisian Flag Indonesia: -President Director -Director
11.30-12.30	Meeting with: -Ms. Renate T. Pors -Mr. Lukas Rahmidin	RNE: -Counsellor, Head of the Economic Division -Policy Advisor Economic Division
14.00-	Preparation of the Workshop	
Thursday, 24 July 2008:		
09.00-13.00	Workshop at RNE	See Annex 3 for a brief report and list of participants
13.15-14.00	Meeting with: -Mr. Fadri Effendy	MICRA: -Business Development & Marketing Manager
14.15-16.00	Debriefing with: -Ms. Renate T. Pors -Mr. Wiebe Anema -Mr. Marnix Segers -Mr. Jaap van der Velden -Mr. Lukas Rahmidin	RNE: -Counsellor, Head of the Economic Division -Deputy Head of Economic Division -Second Secretary of Economic Division -First Secretary Water Resources -Policy Advisor Economic Division
Friday, 25 July 2008:		
11.30-14.30	Last discussions and division of remaining tasks among the team	
18.30-	Departure of Wim van Nes from Jakarta by air	

Annex 3: Brief report on the Consultative Stakeholders Workshop

Date : 24 July 2008, 09.00-13.30h
Place : Embassy of the Kingdom of the Netherlands, Jakarta

At the end of its mission, the study team desired to present its preliminary findings for discussion to representatives of various organisations. This workshop was hosted by the Royal Netherlands Embassy (RNE) in Jakarta. In total, 29 persons participated in the Workshop, see the list of participants included at the end of this Annex.

After registration, the Workshop was opened by the Counselor of the RNE, Ms. Renate Pors. She welcomed all participants and provided some background information about the development cooperation (water & sanitation, education, governance and environmental protection) provided by the RNE to Indonesia. Also she explained the rationale of the biogas mission, disclosing that the Netherlands Minister for Development Cooperation aims to avail a global fund for the dissemination of renewable energy. Domestic biogas for Indonesia could be an option, but get gather more concrete ideas about possible implementation, the RNE wished to field a team. SNV Netherlands Development Organisation was requested to lead the mission, based on its experience with the set-up and implementation of national programmes on domestic biogas in a number of countries in Asia and Africa. Two national experts were added to the team. The results of the study will be reported to the related ministry in the Netherlands, after which a decision will be made on the possible implementation of a biogas programme in Indonesia. She invited the participants to briefly introduce themselves.

After the personal introduction, Mr. Wim van Nes delivered a brief presentation about domestic biogas around the developing world. Since more than 40 years, valuable experience has been gained with dissemination strategies. Leading countries are China (more than 20 million units), India (more than 4 million) and Nepal (about 200,000 in total).

Mr. Fabby Tumiwa presented the first part of the preliminary findings of the study on the feasibility of a national programme on domestic biogas in Indonesia, covering the background of the study, methodology, links with relevant policies and programmes and the biogas history of Indonesia. The second part of these findings was presented by Mr. Van Nes, dealing with potential demand, possible actors at the supply side, conclusions and recommendations. The mission proposed to set-up and implement a national programme on domestic biogas in Indonesia.

After these presentations, Ms. Pors invited all participants to raise issues for discussion. Mr. Aditya Kusuma, Policy Advisor to the Netherlands Counsellor for Agriculture, Nature and Food Quality moderated the discussion.

Mr. Johan Kieft (UNDP) referred to the BATAMAS programme as executed by the Department of Livestock Services of the Ministry of Agriculture. The mission visited this

Department and also few biogas plants (plastic bag) disseminated through this programme. Mr. Fadri Effendy (MICRA) recommended to undertake market research, to further analyse the possible demand for domestic biogas. As the benefits of domestic biogas are less productive and more consumptive, he assumed that a collateral would be required in case of a credit. Ms. Ratna Ariati remarked that the use of the resulting bio-manure has an economic value. She also informed the participants that the government has recently launched a credit programme that will not require any collateral. Mr. Lukmanul Hakim Lubis (MUR) explained he has been working on biogas for a considerable time already, about 20 years. He experienced that some farmers are too lazy to feed the digester. As the climate in Indonesia differs, this may also require different designs of the digester. Ms. Endah Agustina (METI) remembered a report issued by the ADB about ten years ago on domestic biogas involving about 100 units. As the installations were provided free of cost, the households did not assume ownership. She will provide the mission with a copy of this report. She assumed that more than 10,000 domestic biogas plants have been installed in Indonesia; however, the coordinates of many of these plants are not recorded. The mind-set of the people in the rural area will have to be changed. Perhaps, there is no strong need for an investment subsidy, expect for the poor households who can not afford a down-payment. She emphasised the importance of extension on the optimal use of bio-manure for increased production.

Mr. Chayun Budiono (CGI) added to the information earlier provided by Ms. Ariati about the governmental credit schemes, consisting of three models (retail, micro and 2-step loan). Indeed, no collateral is required if the project is feasible. He recommended also taking the social factors into account. For some families, more feeding could be available, but the resulting gas may not be required. Finally, he expressed that the market-based approached as recommended by the mission may fail to alleviate poverty. The national programme should include therefore the promotion of bio-manure for productive use. Mr. Marcus Powell (ILO) made a plea to mainstream the proposed national programme – though private sector driven - in the various frameworks of the government's planning for the purpose of proper coordination. Mr. John Blair (GKI) wondered whether larger communal plants would also be promoted in the proposed programme, as this may result in cost advantages. Mr. Van Nes replied that a maximum size of 15 m3 will be proposed, enabling the operation (feeding, use of gas) by about four families. Experience abroad and in Indonesia learned that large, communal plants will fail by social factors like the feeding of the plant, the use of the produced gas and maintenance. Mr. Ben Witjes (Hivos) wondered whether the programme could also generate income through the sale of Emission Reductions (ERs). Mr. Van Nes replied that this could indeed be an opportunity, but - if realised – would mainly contribute to a next phase of the programme. Mr. Witjes questioned whether a quick start of the programme would be required to secure funding by the local governments (LG) in the coming fiscal year. Mr. Van Nes answered that a quick start of the programme will be beneficial for several reasons, but that the proposed indicative budget will not depend on the financial contributions by the LG. Finally, Mr. Witjes was raising the issue of the linkages between all actors at the various levels (provincial, district, sub-district, village). Mr. Tumiwa replied that the proposed non-governmental biogas offices at provincial level will have to coordinate with all other relevant actors at different levels. These provincial biogas offices will have to play a crucial role and need to be selected or established with utmost care.

Mr. Elfi Lutfillah (FFI) remarked that more recent data about livestock population are available. Dairy cattle farmers in West Java have an increased income from the sale of milk. The prices of milk and cooking fuels (firewood, kerosene) have been increased, so it is a good time to introduce biogas. Fodder is scarce in the dry season, forcing the husbands to leave the house and look for it outside. The housewives will stay home and therefore the operation of the

digester (feeding) should be convenient. Mr. Lutfillah inquired whether the proposed programme would also include construction of stables. Mr. Van Nes replied negatively, as other organisations are already active in this area and it would seriously complicate the proposed programme. Mr. Agus Saptono (MEMR/DGEEU) observed in the field visits that people are very interested in the technology and are also willing to pay. He expressed his concern about the large-scale application of plastic bag digesters in Bali through the debt-to-environment project. Mr. Tumiwa replied that an evaluation of this project was beyond the scope of the assignment. Ms. Agustina offered her help in the collection of relevant data, and this offer was gratefully accepted by the mission. Mr. Martadinata (ME) explained that the selection of the technology for the debt-to-environment project in Bali was based on affordability. The plastic bag digesters are protected by a masonry floor and walls. The project will also apply digesters made of fibreglass.

Ms. Janti Gunawan (ILO) informed the participants about the success of the Local Economic Development (LED) Forum as established by ILO in two sub-districts of Pasuruan and Malang district. In such Forum, local government, private sector and civil society organisations meet and work together. Also, she mentioned a case about a cooperative in Tutur sub-district of Pasuruan district serving as collateral for its members to the bank. Mr. Powoko (DG Sleman district) expressed the hope to become a target area of the proposed programme as the DG aims to protect the forest. Ms. Ariati finally underlined that MEMR is ready to assume a facilitating role in the set-up and implementation of the national programme.

Ms. Pors thanked all participants for their contributions and invited all to join and enjoy the lunch.

List of participants:

SN	Name	Organisation and function
1.	Mr. Purwoko	District Government, Sleman District, Yogyakarta
2.	Mr. Suryanto	DEWATS/LPTP, Yogyakarta
3.	Mr. Ifnu Setyadi	Member of mission
4.	Ms. Yasmin	Charazo Gerbang Internasional PT
5.	Mr. Chayun Budiono	Charazo Gerbang Internasional PT
6.	Mr. Choirul Anwar	Ministry of Agriculture, Department of Livestock Services
7.	Mr. Wim J. van Nes	SNV, team leader mission
8.	Mr. Fadri Effendy	MICRA, Business Development & Marketing Manager
9.	Mr. Fotok Sunarto	Ministry of Cooperatives
10.	Mr. Efi Lutfillah	Frisian Flag Indonesia
11.	Ms. Janti Gunawan	ILO
12.	Mr. Marcus Powell	ILO
13.	Mr. Jacky JA Latuheru	Gikoko Kogyo Indonesia
14.	Mr. Leo Indra Perdana	Gikoko Kogyo Indonesia
15.	Mr. John Blair	Gikoko Kogyo Indonesia
16.	Mr. Benny F.D.	MEMR/R&D Center for Electricity and New – Renewable Energy Technology
17.	Mr. Latief Pakpahan	WPU
18.	Mr. Yudi Satriadi	WPU
19.	Ms. Endah Agustina	METI
20.	Ms. Elke Wiederhold	GTZ/ProLH
21.	Ms. Rieneke Rolos	CARE
22.	Mr. Lukmanul Hakim Lubis	Ministry for Underdeveloped Regions
23.	Mr. Ben Witjes	Hivos
24.	Ms. Novita Sari	GTZ/ProLH
25.	Ms. Elly Roosma	Benedict Mulia Utama
26.	Ms. Winy Garwini	PERSADA
27.	Mr. Ibnu Syahrudin	MEMR/DGEEU
28.	Mr. Agus Saptono	MEMR/DGEEU
29.	Ms. Ratna, Ariati	MEMR/DGEEU

30.	Mr. Panca Pramudya	Hivos
31.	Mr. Martadinata	Ministry of Environment
32.	Mr. Johan Kief	UNDP
33.	Mr. Bisarwono	Provincial government, West Java
34.	Mr. Fabby Tumiwa	Member of mission
35.	Ms. Renate T. Pors	RNE/Jakarta
36.	Mr. Wiebe J. Anema	RNE/Jakarta
37.	Mr. Marnix J. Segers	RNE/Jakarta
38.	Mr. Jaap van der Velden	RNE/Jakarta
39.	Mr. Lukas Rahmidin	RNE/Jakarta
40.	Mr. Aditya Kusuma	Policy Advisor to the Netherlands Counsellor for Agriculture, Nature and Food Quality

Annex 4: Key conditions for large-scale dissemination of biogas plants in Indonesia

This Annex presents the findings of the mission with respect to key conditions to be met for large-scale dissemination of biogas plants in Indonesia. The majority of the conditions are fully or just met, with a few other conditions doubtful, not (yet) met or falling short. Especially the latter conditions need attention during implementation.

Key conditions for large-scale dissemination of biogas plants	Findings
(++ fully met; + met; -+ doubtful; - not (yet) met; -- falls short)	
Technical factors	
Even, daily temperatures over 20^0 C throughout the year	++
Full stabling (zero-grazing) of animals (cows and pigs)	+
At least 20 kg dung per day available per plant	++
Availability of water	++
Biogas plant can be well spaced in the compound of the farmer	+
Performance of existing biogas plants	-+
Financial factors	
Use of organic fertilizer is traditionally practiced	-+
Dairy farming is the main source of income	-+
Farmers are owners of the farm and live on the farm	+
Farm products are the main source of income	+
Moderate pricing of the plant in relation to the farmer's income	-+
Economically healthy farms open for 'modernisation'	+
Insufficient and expensive supply of fossil sources of energy	++
Building materials and gas appliances locally available	++
Availability of potential masons	+
Potential users have easily access to credit	-+
Social factors	
Biogas plant can be integrated into the normal working routine on the farm	+
Operation of the plant can be easily done by the members of the household	+
Regular demand for biogas	++
Awareness on biogas technology by potential users	-+
Willingness among potential users to attach a toilet to the plant	-
Willingness among potential users to invest in biogas plants	-+
Awareness among potential users on non-financial costs and benefits of biogas	-+
Role of women in decision making	+
Organisational and institutional factors	
Availability of organisations having access to potential users	++
Possibilities to engage private sector organisations	+
Organisational experience with dissemination of biogas plants	+
Institutional experience with dissemination of biogas plants	-+
Political will of the Government to support biogas technology	+
Government policy on renewable energy	-+
Government policy on practical gender needs (reduction of workload for women)	+
Willingness of stakeholders to develop a biodigester sector	++

Annex 5: Number of households in Indonesia keeping cattle and buffaloes

Households with cattle and buffaloos (source: Agriculture Census, Central Bureau of Statistic 2003)

A	B	C	D	E	F	G	H	I=C+F	J=D+G	K=E+H	L=I+J+K	M	N	O	P=M+N+O	Q=M/I	R=N/J	S=O/K
	Province	No. of households with			No. of commercial households with			Total no. of households with				Cattle and buffalo population				Average animal population/house		
		beef cattle	dairy cattle	buffalo	beef cattle	dairy cattle	buffalo	beef cattle	dairy cattle	buffalo	total	beef cattle	dairy cattle	buffalo	total	beef cattle	dairy cattle	buffalo
1	Aceh (NAD)											701.777	73	403.838	1.105.688			
2	North Sumatra	55.460	695	36.369	40.509	555	21.703	95.969	1.250	58.072	155.291	248.673	6.575	261.734	516.982	2,6	5,3	4,5
3	West Sumatra	128.148	463	57.149	67.592	379	26.042	195.740	842	83.191	279.773	583.850	505	317.789	902.144	3,0	0,6	3,8
4	Riau	31.436	198	9.505	20.437	140	6.345	51.873	338	15.850	68.061	112.861	0	47.936	160.797	2,2	0,0	3,0
5	Jambi	32.497	156	14.725	19.461	115	9.034	51.958	271	23.759	75.988	145.845	0	70.154	215.999	2,8	0,0	3,0
6	South Sumatra	65.528	582	9.112	42.411	402	5.943	107.939	984	15.055	123.978	419.937	220	83.104	503.261	3,9	0,2	5,5
7	Bengkulu	19.307	101	6.799	12.124	74	4.646	31.431	175	11.445	43.051	77.953	157	63.596	141.706	2,5	0,9	5,6
8	Lampung	188.139	654	14.884	107.238	434	9.536	295.377	1.088	24.420	320.885	387.350	112	52.351	439.813	1,3	0,1	2,1
9	DKI Jakarta	908	408	211	229	373	30	1.137	781	241	2.159		3.611	210	3.821	0,0	4,6	0,9
10	West Java	87.490	24.819	60.128	49.296	23.692	30.978	136.786	48.511	91.106	276.403	223.818	95.513	146.758	466.089	1,6	2,0	1,6
11	Central Java	863.384	36.575	39.052	439.092	34.447	27.500	1.302.476	71.022	66.552	1.440.050	1.345.153	127.658	144.384	1.617.195	1,0	1,8	2,2
12	DI Yogyakarta	185.135	1.818	1.526	87.390	1.722	1.048	272.525	3.540	2.574	278.639	224.247	6.645	5.618	236.510	0,8	1,9	2,2
13	East Java	1.932.188	51.832	21.560	1.077.347	48.848	14.302	3.009.535	100.680	35.862	3.146.077	2.516.777	131.827	112.241	2.760.845	0,8	1,3	3,1
14	Bali	240.845		2.128	147.767	2	1.200	388.612	2	3.328	391.942	539.781	28	7.225	547.034	1,4	14,0	2,2
15	West Nusa Tenggara	148.096		35.248	94.966		27.473	243.062	0	62.721	305.783	419.569	0	161.359	580.928	1,7		2,6
16	East Nusa Tenggara	138.058		40.680	78.444		22.552	216.502	0	63.232	279.734	512.999	0	134.900	647.899	2,4		2,1
17	West Kalimantan	41.276	72	1.117	26.847	39	650	68.123	111	1.767	70.001	148.303	14	5.772	154.089	2,2	0,1	3,3
18	Central Kalimantan	10.054	6	797	6.690	1	503	16.744	7	1.300	18.051	42.095	0	8.285	50.380	2,5	0,0	6,4
19	South Kalimantan	33.274	10	4.444	23.602	9	2.563	56.876	19	7.007	63.902	166.469	79	37.550	204.098	2,9	4,2	5,4
20	East Kalimantan	12.086		2.531	6.712		1.323	18.798	0	3.854	22.652	56.145	0	15.507	71.652	3,0		4,0
21	North Sulawesi	30.777			17.515			48.292	0	0	48.292	124.262	0	27	124.289	2,6		
22	Central Sulawesi	49.082	5	1.595	25.579	2	805	74.661	7	2.400	77.068	194.099	0	4.614	198.713	2,6	0,0	1,9
23	South Sulawesi	158.724	173	34.329	109.839	113	19.007	268.563	286	53.336	322.185	737.538	602	175.617	913.757	2,7	2,1	3,3
24	Southeast Sulawesi	31.629		863	22.586		497	54.215	0	1.360	55.575	208.227	0	8.626	216.853	3,8		6,3
25	Maluku	10.732	2	1.801	8.560	2	1.519	19.292	4	3.320	22.616	62.727	0	24.109	86.836	3,3	0,0	7,3
26	Papua	19.332	156	374	13.431	135	296	32.763	291	670	33.724	70.089	97	1.111	71.297	2,1	0,3	1,7
27	Bangka-Belitung	581		124	438		27	1.019	0	151	1.170	15.407	0	1.429	16.836	15,1		9,5
28	Banten	3.461	27	53.543	1.408	22	24.763	4.869	49	78.306	83.224	9.936	37	163.564	173.537	2,0	0,8	2,1
29	Gorotalo	44.397		11	14.690		4	59.087	0	15	59.102	174.460	0	0	174.460	3,0		0,0
30	North Maluku?	10.742			6.625			17.367	0	0	17.367	33.781		26	33.807	1,9		
		4.572.766	118.752	450.605	2.568.825	111.506	260.289	7.141.591	230.258	710.894	8.082.743	10.504.128	373.753	2.459.434	13.337.315	1,5	1,6	3,5

Note: Total land for Irian Jaya and Maluku

Note: The provinces of Central Sulawesi, North Maluku, Riau islands and West Papua were non-existent up to 2003

Annex 6: Tentative investment costs of biogas plants (fixed dome and plastic bag)

COST BREAKDOWN OF FIXED DOME DOMESTIC BIOGAS										
Item	Unit	VD=6 m3 (R=1.50 m)	VD=11 m3 (R=1.70 m)	VD=13 m3 (R=1.90 m)	VD=16 m3 (R=2.10 m)	Unit Price	Amount			
							V = 6 m3	V = 11 m3	V = 13 m3	V = 16 m3
Construction of digester										
Stone for Foundation	cbm	2,50	3,00	4,00	5,00	125.000	312.500	375.000	500.000	625.000
Sand (clean river sand)	cbm	4,50	5,50	7,00	8,50	110.000	495.000	605.000	770.000	935.000
Portland Cement, 40 kg	bags	30	37	47	56	39.000	1.170.000	1.443.000	1.833.000	2.184.000
Bricks (best avail), 4x12x24	pieces	2200	2700	3400	4000	400	880.000	1.080.000	1.360.000	1.600.000
Tricosal (or Epox), 1 litere	tins	3	3	3,50	4	40.000	120.000	120.000	140.000	160.000
Caluit (lime), 40 kg	bags	1	1	1,00	1	30.000	30.000	30.000	30.000	30.000
Inlet Pipa ~ 4", PVC	4 m	0,50	0,50	0,50	0,50	250.000	125.000	125.000	125.000	125.000
Inlet Pipa ~ 6", PVC	4 m	0,25	0,25	0,25	0,25	475.000	118.750	118.750	118.750	118.750
Steel bars ~ 8 mm	12 m	2	2	2,50	2,5	61.500	123.000	123.000	153.750	153.750
Steel bars ~4 mm	7 m	4	4	4	4	39.000	156.000	156.000	156.000	156.000
Handles for lid ~ 12 (14) mm	pieces	6	6	6	6	5.000	30.000	30.000	30.000	30.000
Gas pipe ~ 3/4 ", G.I. , 0.40 m	pieces	1	1	1	1	26.250	26.250	26.250	26.250	26.250
Pipe ~ 3/4 ", G.I. , 0.12 m	pieces	3	3	3	3	6.000	18.000	18.000	18.000	18.000
Bars ~ 12 mm, 0.25 m	pieces	3	3	3	3	6.000	18.000	18.000	18.000	18.000
Binding wire	kg	0,10	0,10	0,10	0,10	20.000	2.000	2.000	2.000	2.000
Insulation tape (for marking)	rolls	2	2	2	2	10.000	20.000	20.000	20.000	20.000
Wedges (timber)	pieces	6	6	6	6	6.000	36.000	36.000	36.000	36.000
Labour Cost for Construction										
Skill Mason	mandays	7	7	10	10	60.000	420.000	420.000	600.000	600.000
Helper	mandays	14	14	20	20	40.000	560.000	560.000	800.000	800.000
unskill labour for Excavation	mandays	6	6	8	8	40.000	240.000	240.000	320.000	320.000
Gas pipes and assecoiries (minimum requirement, demand, depends on site)										
Gas pipe 1/2", 4 m long	pieces	10	10	10	10	160.000	1.600.000	1.600.000	1.600.000	1.600.000
G.I. / PVC joint 3/4", ins. Tread	pieces	1	1	1	1	8.000	8.000	8.000	8.000	8.000
PVC joint 1/2", out. Tread	pieces	4	4	4	4	5.000	20.000	20.000	20.000	20.000
Joints, PVC 1/2", ins. Tread	pieces	3	3	4	4	5.000	15.000	15.000	20.000	20.000
Red. Piece, PVC 3/4" - 1/2"	pieces	1	1	1	1	4.500	4.500	4.500	4.500	4.500
Valve 1/2"	pieces	2	2	2	2	90.000	180.000	180.000	180.000	180.000
Joints, PVC 1/2"	pieces	5	5	5	5	3.000	15.000	15.000	15.000	15.000
Bends, PVC 1/2"	pieces	15	15	20	20	3.000	45.000	45.000	60.000	60.000
T-Joint, PVC 1/2"	pieces	2	2	3	3	4.500	9.000	9.000	13.500	13.500
Nozzles, bronze 1/2", tread	pieces	2	2	3	3	15.000	30.000	30.000	45.000	45.000
Plugs, PVC 1/2"	pieces	1	1	1	1	3.500	3.500	3.500	3.500	3.500
Rubber hose pipe ~ 10 mm	m	1,20	1,20	1,80	1,80	15.000	18.000	18.000	27.000	27.000
Clamps and nails for 1/2"	paires	30	30	30	30	1.750	52.500	52.500	52.500	52.500
Teflon Tape	rolls	5	5	6	6	10.000	50.000	50.000	60.000	60.000
PVC-glue, 1/2 kg	tins	1	1	1	1	22.500	22.500	22.500	22.500	22.500
Sandpaper	sheats	4	4	4	1	3.000	12.000	12.000	12.000	3.000
Stoves	pieces	2	2	3	3	200.000	400.000	400.000	600.000	600.000
Lamps	pieces	1	1	2	2	250.000	250.000	250.000	500.000	500.000
H_2S-Filter	pieces	1	1	1	1	50.000	50.000	50.000	50.000	50.000
For installation work add 3 daily wages and coat of modifying stoves and lamp										
TOTAL COST							7.685.500	8.331.000	10.350.250	11.242.250

COST BREAKDOWN PLASTIC BAG DIGESTER (5 M3) WITHOUT COVERED PLATFORM

DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT
I. MATERIAL/EQUIPMENT				
Plastic Digester *(ϕ 1.15 m, t = 250 micron, Length 5 m)*	unit	1	375.000	375.000
Plastic Gas Storage 2.5 m3 *(ϕ 1.15 m, t = 250 micron, Length 2.5 m)*	unit	1	187.500	187.500
Plastic Hose ϕ 3/4 "	m	5	5.000	25.000
Plastic Hose ϕ 1/2 "	m	15	4.500	67.500
Box water indicator *(ϕ 10 cm x 17 cm)*	unit	1	25.000	25.000
Inlet- outlet PVC 4" , 4 m length	piece	0,5	250.000	125.000
PVC pipe 1/2" , 4 m length	piece	1	160.000	160.000
Joint PVC 1/2"	unit	10	5.000	50.000
Elbow, PVC 1/2"	unit	5	3.000	15.000
T - joint PVC 1/2"	unit	1	4.500	4.500
Valve, PVC 1/2"	unit	1	20.000	20.000
PVC Glue, 0.5 kg	tins	1	22.500	22.500
Stove	unit	1	200.000	200.000
II. MATERIAL CONSTRUCTION				
Sand	m3	1	110.000	110.000
Gravel	m3	1	125.000	125.000
Cement, 50 kg/bag	bags	14	49.000	686.000
Brick	pieces	1120	400	448.000
III. LABOUR COST				
Skill labour (mason)	mandays	3	60.000	180.000
Helper	mandays	4	40.000	160.000
T O T A L				2.986.000

Annex 7: Basic data for the financial analysis of biogas plant of 6 m3

The data in this Annex provides the information on the costs and savings associated with a biogas plants with a size of 6 m3. The investment cost of this is assumed to be IDR 8,000,000, see Annex 6. The annual maintenance costs are assumed to be two percent of the investment costs. The base subsidy is put at IDR 2,000,000, being 25% of the investment costs. A down-payment of 10 percent of the gross cost by the farmer is assumed and the remaining costs are financed at 17 percent annual interest over a four-year term.

The savings associated with the use of the biogas plant derive primarily from the savings in expenditures for firewood or kerosene. The base price for firewood is assumed to be IDR 600 per kg, resulting in annual savings of IDR 1,560,000/year. The value of the saved labour, the recovered nutrients in the biogas slurry and the reduced GHG emissions are assumed to be zero for the financial analysis. The financial analysis is carried out over a 15-year period, which is the assumed minimum life of the biogas plant.

Costs	IDR	Remarks
Investment costs	8,000,000	
Annual maintenance costs	160,000	2% of investment costs
Subsidy	2,000,000	
Net costs	6,000,000	
Down payment	800,000	10% of investment costs
Loan amount	5,200,000	
Annual loan payment	2,353,000	17% interest, 4 years term

Annual savings	Unit	IDR/unit	Total IDR
Biomass (kg)	2,600	600	1,560,000
Kerosene (litre)	550	3,500	1,925,000

Annex 8: Basic data for the economic analysis of biogas plant of 6 m3

The data in this Annex presents the information on the economic costs and benefits associated with a biogas plant of 6 m3. The financial data are based on the costs estimates of a fixed dome plant as presented in Annex 6.

Cost/Benefit Breakdown	Financial	Economic factor or Shadow value	Economic
Costs:	(IDR)		(IDR)
Cement	4,200	0.60	702,000
Materials	8,445	0.75	1,882,875
Labour	5,550	0.75	915,000
Appliances	2,595	0.90	2,506,500
Fees & charges	4,210	1.00	314,500
Total investment costs	8,000,000		6,320,875
Annual maintenance costs (2%)	160,000		126,418
Benefits:			
Firewood savings	1,560,000	1.00	1,560,000
Nutrient savings	0	(1.00)	250,000
Domestic labour savings	91,250	(0.75)	68,438
Reduced CO2-eq	0	(1.00)	237,500
Toilet attachment	0		0
Indoor smoke reduction	0	(1.00)	60,000
Employment generation	0		0
Total annual benefits	1,651,250		2,175,938

Summary of the EIRR:

EIRR for benefits from just biomass = 28%
EIRR with the value of saved domestic labour added = 30%
EIRR with the value of nutrients saved added to all of the above = 38%
EIRR with the value of smoke reduction added to all of the above = 40%
EIRR with the value of reduced carbon added to all of the above = 48%

Annex 9: Study request of Directorate General for Electricity and Energy Utilisation (GoI)

INTEGRATED BIOGAS DEVELOPMENT PROGRAM

CURRENT STATUS

The GOI's primary intention of developing biogas and other renewable energy (RE) resources is for these to help in achieving its socio-economic development objectives. Rural electrification using these technologies does not automatically create development benefits that are commensurate to the investment involved unless they are applied also to productive uses (i.e. not only for residential lighting). Availability of energy should bring about a big difference in people's productivity and incomes, and that energy services provision facilitates and sustains productive activities. In addition to increased productivity and higher incomes, the RE technologies simply reduce the drudgery of many people in rural areas.

As an effect of rising oil price, provision of basic energy need for rural household especially for cooking and lighting has become a critical energy issue. A significant amount of rural energy needs is still fulfilled using fuel wood, agricultural waste or other locally available energy sources. Biogas is one of renewable energy sources which can be found from sewage, liquid manure of hens, cattle, pigs, organic waste from market and agricultural and food industry. Currently, around 13 million cattle are breeded potentially available for biogas development. It is predicted that Indonesia has potential of biogas energy of 684.8 MW with installed capacity of 0.06 MW or only 0.008%. Biogas production has several benefits, such as (a) eliminating GHG, (b) reduction of odor, (c) betterment of fertilizer, (d) production of heat and power.

Presently, capacity building for community development focusing on biogas power application is limited to specific projects only. Usually biogas projects, which are mainly rural-based, do not include thorough preparation of the host community before the start of the project, or if at all, they are not deliberately done in an integrated and sustained manner. Currently, biogas technology delivery and financing mechanism development and promotion are limited only to the specific requirements of various biogas projects, resulting to less than desired participation from rural people. There is a need to define performance targets for improving private sector and community acceptance through planned biogas demonstration, adoption of best practices and application of lessons learned.

Some constrains related to develop biogas are its availability, ease of handling and use, external factors such as technology and legislation. So far, there is lack of a national professional institution which develop a national development and application program. To date, there are still no specific policies and localized implementing regulations for biogas applications to fit in local development plans and attract investments in a faster mode. The Government of Indonesia (GOI) sees the desirability of tapping the large biogas potential. However, the GOI needs to create a conducive business environment and adopt an integrated approach in augmenting present and planned government initiatives and varied donor assistance projects in biogas development. Considering the potential of biogas and its utilization in both rural and urban area, Directorate General of Energy and Energy

Utilization of MEMR request the Government of Netherlands to support implementation of Biogas Program.

PROJECT GOAL, OBJECTIVE, OUTCOMES, AND OUTPUTS/ACTIVITIES

The overall goal of the proposed BIOGAS Project is the improvement of modern energy access of people from biogas.

BIOGAS Project will address the barriers to widespread application of biogas technology, which exist despite the various government programs/activities in the past. The barriers would be identified through several rounds of consultations with government and stakeholder entities involved in the biogas industry. The project is designed to build on the present capacity and biogas programs of the government and initiatives by other sectors. There are outputs and lessons learned from the implementation of previous and ongoing biogas projects. BIOGAS will also identify and mobilize parallel activities and projects of the GOI through DGEEU, other government agencies and the private sector. They will together co-finance the various requirements of the whole program.

The main outcomes of the project, corresponding to the proposed project components are: (a) Enhanced interest of the private sector in the biogas business; (b) Increased number of community-based biogas projects as a result of effective institutional capacity building; (c) Improved availability, and local knowledge, of biogas technology applications in potential areas of biogas development; and, (d) Private sector and rural communities implement biogas projects for electricity and productive use purposes. The goal and purpose of the BIOGAS will be achieved through the implementation of four (4) sets of integrated project activities or components.

COMPONENT 1: BIOGAS POLICY AND FINANCING PROGRAM - This will involve the establishment of a functioning mechanism for sustained periodic review/updating and enforcement of policies, standards, guidelines and programs on biogas project development and financing of biogas projects for energy generation and productive application.

COMPONENT 2: COMMUNITY-BASED BIOGAS DEVELOPMENT & INSTITUTIONAL CAPACITY BUILDING PROGRAM - This component will involve activities that will strengthen capacity of the relevant institutions in the national, provincial and community levels on the development and implementation of biogas projects both for fuel or electricity purposes.

COMPONENT 3: BIOGAS TECHNOLOGY SUPPORT PROGRAM - This component will involve activities that will build capacity and assist local governments and communities, as well as the local biogas industry in the technical design, sustainable operation, repair and maintenance of biogas facilities.

COMPONENT 4: BIOGAS APPLICATION PROGRAM - This component will showcase the "business angle" of biogas technology applications, and will involve the implementation of specific activities demonstrating the conceptualization, design & development, implementation, financing, sustainable commercial operation, and repair & maintenance of biogas facilities both for power and productive use applications.

SUPPORTS FROM THE NETHERLANDS

The BIOGAS PROGRAM seeks supports from the Netherlands to conduct whole program. Support components of the project comprise training measures in the sustainable planning, material and equipment inputs and advice by long-term and short-term experts.

MEMR 25.01.2008