

**BARRIERS AND CONSTRAINTS TO IMPLEMENTATION OF ANAEROBIC DIGESTION
SYSTEMS IN SWINE FARMS IN THE PHILIPPINES**

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by

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EXECUTIVE SUMMARY

A resource assessment¹ (RA) for the livestock and food waste sector developed by the Global Methane Initiative² (GMI) in July 2009 found that significant methane emission reductions can be achieved in the Philippine swine sector as this source accounts for over 50% of the estimated emissions.

While the methane reduction potential is significant, the deployment rate of methane reducing technology, primarily anaerobic digestion (AD), appears to be severely constrained as there are a very limited number (28) of ADs in operation even though the projects appear financially justified. This condition suggests that a series of barriers exist which prevent achieving the full market potential. Worldwide, barriers constraining the development of methane reducing technologies in the livestock and food waste sectors are common in many countries.

This document presents the findings from an assessment conducted by the GMI to better understand the barriers and constraints faced by household and commercial scale pork production in the Philippines. The assessment approach included a mix of stakeholder interviews, desktop review of resource data, and telephone/e-mail communications with key experts, farm owners, and resource persons.

The assessment looked at the range of scales for AD applications (micro to large scale) and discusses the specific barriers that prevent project implementation and replication across scales. Findings of the assessment are listed below and have significantly impacted the deployment rate of AD in the Philippines.

- Lack of technical capacity, experience, equipment reliability, and locally available materials (mostly imported).
- Lack of access to financing mechanism options. Currently only Build- Operate- Transfer (BOT) finance mechanism is available, the use of this mechanism by farm owners is also diminishing due to dissatisfaction with the contract arrangement.
- Perceived high risk of AD by banks, investors, and farm owners.
- High costs.
- Lack of, or delays, implementing supporting policies which creates an uncertain environment for investment.
- Lower cost technologies that achieve regulatory compliance and compete with AD. These lower cost technologies also emit high levels of methane.

¹ Resource Assessment for Livestock and Agro-Industrial Wastes – Philippines; U.S. Environmental Protections Agency, July 2009.

² The GMI was formerly the Methane to Markets Partnership Program which is administered by the U.S. Environmental Protection Agency; Climate Change Division. The GMI is designed to reduce methane emissions from countries that wish to participate in the initiative. There are currently greater than 70% of all countries participating in the GMI.

- Competitive price of other energy resources such as woody biomass as a cook fuel.

As a next step the findings of this report will be used to identify the role(s) of GMI in the design, implementation, and reporting requirements in support of The World Bank *Program of Activities* (PoA) under development in the Philippines. The PoA is administrated by the *Land Bank of the Philippines* (LBP) and will also assist the Philippines in executing their *GMI Implementation Plan* (IP) by *The Department of Science and Technology* (DOST), the designated delegate to the GMI.

1. Purpose

A resource assessment³ (RA) for the livestock and food waste sector developed by the Global Methane Initiative⁴ (GMI) in July 2009 found that significant methane emission reductions can be achieved in the Philippine livestock sector. While the methane reduction potential is significant, the deployment rate of methane reducing technology, primarily anaerobic digestion (AD) appears to be severely constrained as there are a very limited number (28) of ADs in operation even though the projects appear financially justified. This condition suggests that a series of barriers exist which prevent achieving the full market potential. Worldwide, barriers constraining the development of methane reducing technologies in the livestock and food waste sectors are common in many countries.

This document presents the findings from an assessment conducted by GMI to better understand the barriers and constraints faced by household and commercial scale pork production in the Philippines. The assessment is comprehensive as it includes all farm scales for AD applications (micro to large scale) and discusses the specific barriers that prevent project implementation and replication across scales.

As a next step the findings of this report will identify the role(s) of GMI⁵ in the design, implementation, and reporting requirements of The World Bank *Programme of Activities* (PoA) under development in the Philippines. The PoA is administrated by the Land Bank of the Philippines (LBP). The PoA will also assist, in part, the Philippines execution of their GMI *Implementation Plan* (IP) by The Department of Science and Technology (DOST), the designated delegate to the GMI.

2. Methodology

The team conducted a mix of stakeholder interviews, surveys, and desktop review of resource data to develop this assessment. The team also conducted telephone and e-mail communications with key experts, farm owners and managers, and resource persons. The team also conducted a literature review to help ground the information collected during the assessment period.

A total of 23 in country interviews were conducted over a two-week period. These included:

- Eight commercial pig farms, to learn about their first-hand experience with AD projects.
- Seven banks, to learn about what processes and procedures are required to apply for loans (such as collateral, complexity of the application, and turnaround time).

³ Resource Assessment for Livestock and Agro-Industrial Wastes – Philippines; U.S. Environmental Protections Agency, July 2009.

⁴ The GMI was formerly the Methane to Markets Partnership Program which is administered by the U.S. Environmental Protection Agency; Climate Change Division. The GMI is designed to reduce methane emissions from countries that wish to participate in the initiative. There are currently greater than 70% of all countries participating in the GMI.

⁵ GMI typically supports partner countries to build the necessary market, technical, and educational capacity to provide and service reliable low risk AD technologies by national entities. Based on this approach success has been demonstrated in Vietnam, Mexico, Thailand, Argentina, and China.

- Five trainers from the Philippine Department of Science and Technology (DOST), to learn about their experiences in conducting training programs to develop small household and backyard AD systems; and
- Three AD technology and service providers, to learn about their market experience.

In particular the interviews with the banks and service/technology providers aimed at understanding the requirements for large commercial and smaller scale backyard pig farm owners to access capital for farm scale AD project development. The team looked at the processes and accessibility of credit from banks (commercial, government, & rural banks) and service providers offering Build-Operate-Transfer (BOT) types of financing mechanisms.

Where appropriate, the team included questions on Clean Development Mechanism (CDM) awareness, CDM portfolio, and successes or challenges in developing and registering CDM projects. A summary of interviewees is listed below:

Stakeholder	Interviewees
Commercial Pig Farmers (8)	Confidential
Banks - Government, Commercial & Rural (7)	Philippines National Bank- Commercial Bank Bank of the Philippine Islands- Commercial Bank Land Bank Philippines- Government Bank Development Bank of the Philippines- Government Bank Imus Rural Bank (Cavite)- Rural Bank
Department of Science & Technology (5)	Vic Taylan Orly Anselmo Jesse Pine Fer Ablaza Gil Marasigan
Technology & Service Providers (3)	Solutions Using Renewable Energy, Inc.(SURE) Philippine Bio-Sciences, Inc. (PhilBIO) Technical Advisors/ Carbon Finance Solutions (TA/CAFIS)

3. Background

In 1999, the Philippines reported to the United Nations Framework Convention on Climate Change (UNFCCC) that its agricultural and waste sectors accounted for a combined 40 percent of the country’s greenhouse gas (GHG) emissions, which were estimated to be 7.9 million metric tons (MMT) of carbon dioxide equivalent (CO₂e) per year. A more recent 2009 report, the Philippine RA, developed by the GMI estimates that 2.5 MMT CO₂e per year are emitted by the livestock and food waste sectors, where the swine sub-sector accounted for over 50% of the total emissions. This estimate is based on a detailed evaluation where a random set of livestock and food processing facilities were selected and visited to verify waste handling and management practices across all scales of production in the Philippines.

World wide, capturing and flaring methane with anaerobic digestion technologies (AD) is a proven and effective greenhouse gas (GHG) reduction technology. As an alternative, methane can also be used as a renewable energy source when methane is captured and combusted in a reciprocating engine (genset), boiler, or used as a source of cook fuel and light. When methane is used as an energy

source the financial returns on the investment can improve depending on energy pricing and electric utility policies as related to renewable energy and grid inter-connection.

For example, in many cases utilities do not provide energy (kWh) rates that can justify the investment even when energy prices are high, or add additional costs by requiring expensive inter-connection and metering equipment. Country efforts to improve the financial performance of AD and other renewable energy sources include GHG reducing policies and energy policies that offer financial support to off-set low energy rates and other costs often associated with electric power generation and grid interconnection to provide a favorable investment environment. Countries also require public and private sector capacity to supply and service these technologies as well as access to capital through appropriate finance mechanisms. In the absence of these elements, deployment of commercial scale AD is impeded.

4. The Swine Sector in the Philippines

Swine farming is a major sub-sector in the agricultural livestock industry. As of January 2008, the Philippines had 13.7 million pigs. The pig population can be divided between commercial and backyard farms according to the number of pigs and the types of operations where the commercial farms account for 29% of the pig population and the backyard farms account for 71%⁶. A farm is considered a backyard farm when it has 50 pigs or fewer.

The majority of the swine population is found in Central Luzon (Region III and Region IV-A Calamba Laguna Batangas Rizal and Quezon), where large commercial farms are located, although large commercial farms have also been established in provinces near Metro Manila to meet the area's growing demand. Another major production region is the Western Visayas (Region VI), where pig production is mostly concentrated in backyard farms.

The swine sector generates wastewaters with high organic loadings that, depending on the type of operation, are usually discharged to lagoons, tanks or impoundments. As of 2003, up to 65% of the medium to large commercial farms used lagoon systems; for small commercial farms, 49% used lagoon systems, and 47% used settling ponds.⁷ The smaller household and backyard farms typically discharge to surface waters or collect and dispose of waste material in an open pit to decompose.

5. General Findings of the Assessment

While backyard and commercial farms share many of the barriers to AD development, they also have a unique set of barriers specifically related to the scale and type of operation. Therefore, findings will be discussed for each size range separately.

⁶ Bureau of Agricultural Statistics, Philippines 2009

⁷ International Institute for Energy Conservation, 2009, "Resource Assessment for Livestock and Agro-industrial Wastes – Philippines"

5.1 Household and Backyard Farms (Micro to Small Scale)

The team relied mostly on DOST data and practical experience from DOST trainers with household and backyard farm owners. In 1970 the Philippines began developing AD technology at Maya Farms and other public agencies have continued development at the household and backyard scale. DOST also is currently involved in biogas promotion at the household and backyard scale through its various attached agencies and councils such as the Philippine Council for Industry and Energy Research and Development (PCIERD) and the Industrial Technology Development Institute (ITDI), which are involved in research, development and demonstration of micro and small scale AD systems around the country. DOST has provided various types of support for AD development at these scales and include design services, operational training, and workshops on the benefits of ADs. When interviewed, DOST trainer's identified financial constraints, lack of awareness, lack of technical information, and human resource constraints as the main barriers faced by household and backyard farm owners.

The findings also include the results of a recent study by SNV Netherlands Development Organization, and Winrock International⁸ on the domestic biogas market potential in the Philippines and issues faced by the rural backyard farms when trying to adopt AD technologies. The main barriers identified in these reports are shown below, and are consistent with the findings of this assessment. These findings are summarized in Figure 1.

5.1.1 Investment Barriers

- All respondents agreed that cost is the greatest barrier encountered at small farm scales. On average, building an AD system in the Philippines will cost about Php 10,000 (between \$220-\$230) per cubic meter capacity for a Chinese fixed-dome digester.
- Banks and technology companies providing Build-Operate-Transfer (BOT) financing mechanisms have indicated that these farm scales are not an attractive client. Furthermore, banks do not desire chattel (machines, equipment, etc.) as collateral, rather banks desire land as collateral to secure the farm owners loan. Moreover, banks do not have the resources to carry

Figure 1: Factors limiting adoption of AD systems by backyard farms - response summarizing a survey of DOST Trainers

1. Financing the anaerobic digester
 - a. Lack of capital/operating funds to build, operate and maintain the digester.
 - b. Limited access to financing schemes and bank credit.
2. Lack of awareness on
 - a. Technology & technical design
 - b. Benefits of anaerobic digesters and biogas.
 - c. Availability of anaerobic digester technology.
3. Ready availability of other energy options, such as fuel wood, LPG, and grid electricity
4. Lack of technical capacity
 - a. Farm hands must be trained and educated in the construction, operations, and maintenance of the anaerobic digester.
 - b. Limited number of anaerobic digester experts.
5. Land and livestock requirements
 - a. Farm plot too small to install a micro-scale anaerobic digester.
 - b. Number of animals insufficient to produce enough manure to operate a micro-scale anaerobic digester.
6. Lack of coordination and support from different government agencies that are involved in biogas promotion.

⁸ SNV Netherlands Development Organization and Winrock International. 2010. "Feasibility Study Of a National Biogas Program on Domestic Biogas in the Philippines."

out on-farm repayment collections, which would be required for very small loans at small farm scales.

5.1.2 Technological Barriers

- Access to AD industry companies and proven technologies is difficult as the profit margin for these companies from small farm customers is extremely low and would require large numbers of installations to justify entering this market. As such the private sector capacity to service smaller farm scales are virtually unavailable and provided through government services as illustrated by the DOST program, which can be constrained by annual budget cycles and staff work loads. Nongovernmental organizations (NGOs) that, on an “off and on” basis, have been active at this scale may also experience the same constraints.
- Informational access for low-cost AD technologies is difficult, and can only be effectively provided through farm owner training in the design construction, operation, and maintenance of these technologies. Unfortunately technical trainings result in varying degrees of trainee ability and skill, which can lead to installations that are poorly constructed, operated and maintained and often times are abandoned due to breakdowns, design, and equipment failures.

Smaller scale farms are also constrained by very small land holdings where available land is used for the production of pork. As such farm owners are reluctant to commit available land to even AD systems with small foot prints and are likely to continue disposing waste into surface waters or invest in minimal waste management systems such as an open pit. The trainers from DOST suggested that building a pig house on top of an AD may be the best option to address land constraints, but that the technological know-how to design these types of systems is limited.

5.1.3 Barriers Due to Prevailing Practice

- Convenient availability of other sources of energy, such as fuel wood, reduces incentives for farmer households to invest in alternative and capital-intensive energy sources like biogas⁹.
- It is easier to dispose of wastes in small impoundments or to nearby surface waters where there is no consequence to the disposer.

5.1.4 Other Barriers

- The common backyard farm in rural Philippines has too few standing animals to operate an anaerobic digester.¹⁰
- The DOST trainers also felt that stakeholders, such as technology and service providers, government agencies promoting biogas, and local governments, need to be more coordinated when reaching out to backyard farmers. For example, technology providers should make sure to assist in maintenance of technology.

⁹ SNV Netherlands Development Organization and Winrock International. 2010. “Feasibility Study Of a National Biogas Program on Domestic Biogas in the Philippines.”

¹⁰ SNV Netherlands Development Organization and Winrock International. 2010. “Feasibility Study Of a National Biogas Program on Domestic Biogas in the Philippines.”

5.2 Commercial Farms (Medium to Large Scale)

The team relied on interviews with banks, commercial pig farm owners, and technology and service providers to identify the barriers to AD deployment in commercial farms.

The team interviewed 8 commercial pig farm owners to gather their insight into opportunities and constraints in installing AD systems on their farms, as well as their experience with the CDM process.

While commercial farms make up a much smaller proportion of the national swine industry than backyard farms, their larger operations make these farm owners a group that is interested in, and enthusiastic about AD technology. The team identified the main reasons for their interest in AD systems as follows:

1. Compliance with environmental regulations: Farm owners felt that it was important to invest in technologies such as AD technology and other technologies that will ensure that the quality of the farm operations remains constant and that the business is not forced to shut down due to non-compliance with government regulations. Waste management has also become a necessity to ensure hygienic operations and biosecurity on larger farms. In addition, offensive farm odors need to be controlled as farms located in rapidly urbanizing areas such as Bulacaan, Laguna and Tagaytay are particularly sensitive to this aspect as they are surrounded by residential and commercial properties.
2. Reduction of farm operational costs: An AD system would reduce the operational costs of the farm through lower electricity bills where adequate price support is available and reduced purchases of fertilizer if crops are grown. For farms that rely on waste transport, it is desirable to reduce waste volume to reduce the fees for collection and disposal at a landfill site.
3. Other incentives: Farm owners identified the following incentives/benefits resulting from investments in AD systems:
 - Excess by-products from the AD system could be sold as fertilizer, particularly if the digester produces more than the farm can consume.
 - Certified Emission Reductions (CERs) could result in justifying the investment as the financial performance would be improved and offer a potential revenue stream for the farm.
 - Higher prices per head of pig based on environmental compliance. Some farm owners mentioned that clients such as San Miguel Corporation are offering financial incentives for their breeder farms and suppliers to get Environmental Compliance Certificates (PhP 18.95 extra per head of pig) and build an AD system on their farms (PhP 54.00 extra per head of pig). However, the farm owner would have to fund these initiatives themselves and the certification has only been used for companies that produce pork for export. As such these certificates have limited application recognizing that most farms do not produce export quality pork.
 - Net-metering for renewable energy (NMRE) would allow end-users to generate their own power and sell it to the grid and is under discussion. The NMRE, if implemented would

guarantee a fixed price for at least 12 years for electricity produced from wind, solar, ocean, run-of-river hydro and biogas. However, the specific feed-in-tariff rates are still being formulated by the National Renewable Energy Board, and will likely vary depending on the renewable energy source. This potential incentive however seems very uncertain and is not helpful in ensuring access to credit and finance.

- The Renewable Energy (RE) Act proposed the following tax breaks for RE producers and consumers¹¹: a) income tax holiday for 7 years; b) duty-free importation of RE machinery, equipment and materials within the first 10 years; c) special realty tax rates; d) net operating loss carry-over (to be carried for the next 7 consecutive years); e) 10% corporate tax rate; e) tax exemption on sale of CERS; f) tax credit on domestic capital equipment and Services; g) zero percent VAT on sale of fuel generated from RE. However, most of these tax breaks are realized at the installation stage, or within the first seven years of operation. Moreover recognizing that most AD projects in the Philippines have been solely financed through BOT mechanisms, the farmer owner's would not be able to benefit from these tax incentives.

While the benefits of AD are evident to commercial farm owners, there are significant barriers that hinder the adoption of AD systems on their farms. The barriers encountered are also consistent with many other countries desiring to advance deployment of AD technologies. Commercial farm owners unanimously highlighted cost and access to favorable credit terms as the most prohibitive barrier. A summary of the barriers identified are shown below, and summarized in Figure 2. Annex 3 presents a summary of the interviewed banks lending process.

5.2.1 Investment Barriers

- Installation of AD systems is capital intensive. The cost of the construction, equipment, and operation and maintenance can be high and will vary based on the quality of the factors mentioned above. Farmers mentioned estimates that started at Php 6 million (US\$ 135,000 - \$ 140,000) for an AD with a low quality, locally reconfigured 100 kW medium BTU fuelled (biogas) automotive engine generator, to estimates that went up to Php 70 million (\$ 1,550,000 to 1,560,000) for an AD with an imported 1MW biogas fuelled engine generator.
- While banks, such as LBP provide loans to larger commercial farms and provide information and resources as they need them, it is still difficult to access the level of funds required to install an AD system as the farm owners are not able to meet the level of collateral required to secure the

Figure 2: Factors limiting adoption of AD systems by commercial pig farms – Summary of responses from interviews

1. Financial Barriers
 - a. Cost of anaerobic digester.
 - b. Access to credit.
 - c. BOT schemes are not attractive as they provide very little benefit to the farm.
 - d. CDM transaction costs are too high.
2. Technical Barriers
 - a. Human resource constraints.
 - b. Access to proven technology.
 - c. Access to low cost technology as most is imported.
 - d. Lack of local equipment such as engine generators, flares and gas handling.
3. Access to Technical Assistance
4. Institutional and Policy Barriers
 - a. Lack of sound fiscal policy to provide incentive (taxation, capital allowance) to attract investment in biogas technology.

¹¹ Perez, Vincent. 2009. "Status of Renewable Energy Policy in the Philippines." Presentation. World-Wildlife Fund for Nature. [URL: <http://www.cleanenergyasia.net/library/status-renewable-energy-policy-philippines/>]

loan. In general, Philippine banks also do not get involved in chattel mortgages and prefer accepting land as collateral. Furthermore, it is difficult to access credit within a reasonable time period when the loan is secured as banks can take 6 months to 1 year to release the loan amount.

- The lack of bundling of small emission reduction projects results in a large burden of administrative costs. To date, there are 28 manure management projects in the Philippines registered with the CDM Executive Board (developed mainly by PhilBIO). With the exception of one project that uses manure from two nearby facilities at the same farm, each project is for an individual farm. This project-by-project approach does not take advantage of potential administrative savings by bundling several projects under the same methodology as this option has not until recently been available to Philippine farms under the PoA. It is also important to note that there has been very limited CDM payment or none to the registered AD projects to date after a few years of operation.
- Most of the 28 large scale Philippine AD projects have been financed by BOT mechanisms. While initially an attractive finance mechanism, the attractiveness of this mechanism is rapidly diminishing as the farm owners have realized that they receive a very small portion of the benefits, a reduced energy price paid to the third party operator and financier. The AD system is also transferred to the farm owner at around the time the equipment and materials begin to experience problems and require major repairs.
- The sizing of many BOT projects are also too small due in part to the desired profit margins and do not meet the original methane reduction and energy generation estimates. The Philippine trend in diminishing BOT interest has also been experienced in other countries such as Mexico. These energy payments and other financial gains made by the technology provider and BOT financier are also mostly transferred out of the country greatly limiting the opportunities to support rural economic development through AD deployment.
- The Agricultural Credit Policy Council (ACPC) notes that lending by banks in the Philippines to the agriculture sector has steadily increased over the last few years. However, farm improvement loans are targeted at investments that increase the production side of the pork industry such as loans for building construction, insulation, fans, feed equipment, among others, and not for loans related to waste management and environmental quality.
- The interest rates for these types of loans are also quite high for the agricultural sector and are more or less similar across all banks. Farm owners in general quoted estimates of 10- 12% interest rates for agricultural production loans. However, these loans are seen as a low risk investment as the production improvement this equipment provides are proven to increase revenues by increasing the amount of pork produced. The loan interest rates are not designed to finance waste management projects as the risk is perceived to be high and the revenue generation and payback period is uncertain. For example, to date there has not been a carbon reduction payment issued to a manure management project that can be used to justify an AD loan. This is then perceived as an increase in risk by the lending institution and may increase these already high interest rates. High rates also demand higher collateral, making the requirement difficult and/or unacceptable to farm owners and further reduce the financial return on investment.

5.2.2 Technological Barriers

- Some farm owners noted that access to information on affordable renewable energy technology is limited. This was confirmed by Sure, Inc. a service provider that stated that some technology providers lack knowledge and experience and end up over-projecting the methane capture potential.
- To keep costs low, some technology providers are also installing low-quality engine generators. This approach results in being more costly since the expected performance is not achieved, resulting in the farm owner's dissatisfaction and a poor image for the project.
- Lack of local capacity to conduct operation and maintenance (O&M) services for AD systems and generators is a significant issue in the Philippines as well as other countries. Long term sustainability of AD systems is compromised when O&M is not performed correctly and the unit operations begin to prematurely fail. Currently, there are no specific provisions or training from available service and technology providers to address O&M issues.

5.2.3 Barriers Due to Prevailing Practice

- The highest priority for commercial farms is the management of their waste discharges to simply maintain compliance with local regulation. From the farm owner's perspective, the existing lagoon system is an adequate and inexpensive way to meet these requirements.

5.2.4 Other Barriers

- During interviews with the commercial pig farmers, several of them referred to the government's Renewable Energy Act. It was evident that the potential incentives outlined in the act are attractive to farmers. However, the unresolved feed-in-tariffs and the lack of governmental programs, and limited private sector support to address the financial and technical barriers discussed above, make potential private sector financing wary of focusing investment in AD related RE applications.
- Another important barrier is the perceived high risk of AD systems caused by the lack of emission reduction payments to AD projects under CDM to date.
- Technology companies offer BOT AD financing mechanisms, however, they only offer this finance mechanism to farms having a minimum standing sow population. This minimum is based on the need to meet the desired profit requirements of the developer through the revenues generated by projected CDM, and energy payments. For example Solutions Using Renewable Energy (Sure, Inc) requires that a farm (or group of farms) have at least 1,000 sows.¹² Philippine Bio-Sciences, Inc. (PhilBIO) will venture into BOT financing with farms (or a group of farms) that have at least 2,000 sows.¹³ These requirements prohibit smaller farms and new farms, with plans to eventually expand to participate in the BOT mechanism assuming they find it an attractive finance mechanism to develop an AD project.

¹²September 29, 2010. Interview with Bernal, Edgardo G., Vice President for Operation, Sure Inc.

¹³ Interview with Farm 7- See Annex 1 table.

The main BOT issues that resulted from these interviews and provided the basis for the above barrier discussion were:

- The farm owner receives very little payment, usually in the form of a reduced energy payment to the service provider offering the BOT financing.
- The farm owner does not have much say in the construction and installation of the anaerobic digester (cost control, design, and type of equipment).
- Farm staff is not necessarily trained adequately by the technology provider on the operation and maintenance of the equipment during the transfer process. For example, farmers involved with some technology providers in BOT financing have reported that the quality of gensets installed are of poor quality and therefore break down often, although they acknowledge that lack of proper maintenance exacerbates the problem. However farm owners stressed that staff are also not trained properly.
- When the gensets fail, it can take a few months to repair the generators where the importation of parts and repair skills contribute to delay among others. During this time, the farm needs to revert back to the local electricity supplier and forgo energy payments until repair is complete. This results in reducing energy revenues.
- Finally, after the AD is transferred to the farm owner (approximately 7 years), farm owners felt that most of the government's tax incentives provided to companies involved in renewable energy programs (such as the 7 year income tax holiday) would no longer be applicable. Also after this amount of time other components and materials will also show signs of wear and require repair at an accelerated rate.

6. Conclusions

The assessment findings show a significant number of barriers that seriously impede AD deployment in the swine sector across all scales of production in the Philippines. The barriers identified are supported by the barriers found in most biogas PDDs for the Philippines, and reported by the SNV Netherlands Development Organization, and Winrock International. The Institute for Global Environmental Strategies¹⁴ also has similar findings. These findings include:

- Lack of knowledge and experience with the biological treatment of animal wastewater technology prevents investment in these projects.
- The predominant technology for piggery wastewater treatment in the Philippines is a lagoon-based system. This system represents the lowest cost option, with the only cost being the opportunity cost of alternative land use.
- Biological treatment technology of animal wastewater is a new and relatively unknown technology in the Philippines.

¹⁴ IGES and DENR. 2010. "CDM Country Factsheet: Philippines."

- Anaerobic digestion systems are perceived as high risk, based upon a biological system that is neither 100% characterized, nor performance guaranteed.

The Resource Assessment conducted by the GMI for livestock and food waste in the Philippines indicates that significant methane emission reductions can be achieved in the Philippine livestock sector when these barriers are addressed. Recognizing this opportunity GMI¹⁵ is developing the national capacity to design, construct and service AD projects to support LBP in the *Programme of Activities* implemented in 2009. This support is expected to foster rural economic development through the retention of capital in the country, develop a national private sector, and increase employment opportunities for Philippine nationals. Areas of support include:

- Developing local capacity to supply and service the livestock AD market. This includes extensive design and engineering based training to public and private sector entities. This approach has demonstrated to be effective with an indirect benefit of increasing local employment opportunities and fostering rural economic development.
- Development of a service provider certification program and National AD Standards to reduce the risk perception associated with AD technology.
- Credibly evaluate and report technology performance based on an *International Protocol* and Methodology developed by GMI partner countries.
- Introduce “corporate social responsibility” by using a portion of CER payments to finance household and backyard farms to provide access to AD technology.
- Educate the livestock sector and other stakeholders on the benefits of AD and the process of developing an AD project.

As a result of these activities the Philippines is in the process of planning the development of a National Program, the Philippine Methane Initiative, focused on the needs of very small household and backyard farms.

¹⁵ GMI typically supports partner countries to build the necessary market, technical, and educational capacity to provide and service reliable low risk AD technologies by national entities. Based on this approach success has been demonstrated in Vietnam, Mexico, Thailand, Argentina, and China.

Annex 1: Data on Pig Farms Interviewed (All Farrow-to-Finish Farms)

Farm No.	Total Land Size/ Land dedicated to pig farm (hectares)	CDM Involvement	Years of Operation	Current Sow	Target Sow	Does it have an anaerobic digester on site?	Type of Anaerobic Digester	Main Purpose of Methane Capture	Financier for Anaerobic digester/ Financial Scheme	Farm Owner Contribution to Install AD System	Beneficiary of CER Revenue
Farm 1	100,000 hectares/ 25,000 hectares	Pipeline	Under Construction	500	5,000	No- Under Consideration	To be determined	Energy savings (to run farm); Revenue from feed-in tariffs and CERs.	LBP & Self-Financing/ Loan & Savings	Land, Labor, Capital	To be determined
Farm 2	20 hectares/ 8 hectares	Pipeline	2 years	450	800	Yes	3- stage Uncovered Aerobic Lagoon	Energy savings (to run farm); Revenue from feed-in tariffs and CERs.	LBP & Self-Financing/ Loan & Savings	Land, Labor, Capital	Farm Owner
Farm 3	2 hectares/ 2 hectares	Pipeline	10 years	400	600	Yes	Covered Anaerobic Lagoon	Energy savings (to run farm)	LBP & Self-Financing/ Loan & Savings	Land, Labor, Capital	Farm Owner
Farm 4	5 hectares	Pipeline	10 years	350	-	No- Under Consideration	To be determined	Energy savings (to run farm)	To be determined	Land, Labor, Capital	To be determined
Farm 5	Farm Plot 1 11 hectares/ 2 hectares	Ongoing	10 years	100	500	Yes	Covered Anaerobic Lagoon	Energy savings (to run farm)	Technology Provider- Japanese	Land and Labor	Japanese Company- 90%; Farm Owner- 10%
	Farm Plot 2- 2 hectares	None	2 years	250	-	Yes	Solid waste separator filters waste water through a series of 10 lagoons; Drains in close lagoon.	Energy savings (to run cook stoves)	Bank & Self-Financing/ Loan & Savings	Land, Labor, Capital	N/A
Farm 6	50 hectares	Unsuccessful	13 years	10,000	-	Yes	2-stage Covered Anaerobic Lagoon	Energy savings (to run farm); Revenue from feed-in tariffs and CERs.	Bank & Self-Financing/ Loan & Savings	Land and Labor	Carbon Finance Consulting Firm; Farm Owner

Farm 7	72 hectares	Ongoing	N/A	2,400	-	Yes	Covered Anaerobic Lagoon	Energy savings (to run farm)	PhilBIO/ BOT Scheme	Land and Labor	PhilBio
Farm 8	10 hectares		23 years	2,945	-		Concrete tanks, primary digesters, secondary digester	Energy savings (to run farm); CER revenue (CDM Stage- Approval of permits by DOE and DENR for commencement of commercial operation).	Sure, Inc./ BOT Scheme	Land and Labor	

Annex 2: Overview of Banks Interviewed

Seven officers from 5 banks were interviewed to assess bank requirements in securing a farm improvement loan in the Philippines. These five banks comprised 2 commercial banks, 2 government banks, and one rural bank: Philippines National Bank, Bank of the Philippine Islands, Land Bank of the Philippines, Development Bank of the Philippines, and Imus Rural Bank (Cavite). Specific information on each bank is presented below.

Philippine National Bank

The Philippine National Bank (PNB) was established as a government-owned banking institution on July 22, 1916. PNB's primary mandate was to provide financial services to Philippine industry and agriculture and support the government's economic development effort. In 1955, it was authorized to operate as an investment bank with powers to own shares and to issue debentures. In 1963, PNB established the National Investment and Development Corporation to engage primarily in long-term and equity financing of business ventures. The privatization of the Bank started when 30 per cent of its outstanding stocks were offered to the public and its stocks were listed in the stock exchange in 1989. PNB remains as one of the largest banks in the country with a wide array of competitive banking products to answer for the diverse needs of its huge clientele including more than 2 million depositors. PNB is currently a commercial bank and controlled by the Lucio Tan Group.¹⁶

Bank of the Philippine Islands

The Bank of the Philippine Islands (BPI) is the oldest bank in the Philippines. It was founded in 1828 when King Ferdinand VII of Spain issued a decree mandating the establishment of a public bank in the Philippines, at that time colony of Spain. As such, BPI pioneered rural banking in the Philippines, as its countryside banking operations preceded that of many other banks' rural banking operations. Today, it maintains a large rural branch network, with some branches dating bank to the Spanish or American colonial periods. BPI, now a commercial bank, is currently owned by the Ayala Corporation.¹⁷

Development Bank of the Philippines

The Development Bank of the Philippines (DBP) is a government-owned development bank. It has gone through significant changes over the last 75 years. Commencing as the National Loan and Investment Board (NLIB) in 1935, the institution was created to coordinate and manage various government trust funds such as the Postal Savings Fund and the Teacher's Retirement Fund. In 1939, the NLIB was abolished and its functions were transferred to a new body, the Agricultural and Industrial Bank (AIB). AIB continued operations until the outbreak of World War II. After the war, in 1947, the AIB was abolished and the Rehabilitation Finance Corporation (RFC) was formed in its place by. The RFC provided credit facilities for the development of agriculture, commerce and industry and the reconstruction of properties damaged by the war. In 1958, the RFC was reorganized into the modern-day DBP, reflecting that since reconstruction was largely finished, the RFC can venture into other fields. DBP currently provides medium and long-term financing needs of enterprises, with emphasis on small and medium enterprises in the rural areas. Like LBP, DBP has a large rural branch network.

¹⁶ <http://www.pnb.com.ph/content/view/192/332/>

¹⁷ <http://www.bpi.com.ph/>

However, the aim of DBP's rural branch network is to help diversify banking choices whenever an area's banking sector is either dominated by one or a few banks, regardless of status.

Land Bank Philippines

The Land Bank of the Philippines (LBP) was created in 1963 to finance the acquisition and distribution of agricultural estates for division and resale to small landholders as well as the purchase of the landholding by the agricultural lessee. In 1973, the LBP expanded its mandate to include lending to agricultural, industrial, home-building or home-financing projects and other productive enterprises.¹⁸ Currently LBP promotes countryside development and one of its major roles is to provide credit assistance to small farmers, fishermen, micro-enterprises and SMEs, livelihood loans, agriculture projects, and environment projects.¹⁹

Imus Rural Bank, Cavite

A rural bank is a government-sponsored or assisted bank (privately engaged and largely privately-owned) that provides credit facilities on reasonable terms to farmers and merchants, or to cooperatives of farmers and merchants, or in general, to the people of the rural community. They are classified into those with and without authority to accept demand deposits.²⁰ Imus Rural Bank (IRB) is an example of a rural bank lending credit to businesses in the Cavite area.

¹⁸ https://www.landbank.com/about_history.asp

¹⁹ http://www.methanetomarkets.org/documents/ag_cap_philippines.pdf

²⁰ http://dirp.pids.gov.ph/cgi-bin/dd?RURAL_BANKS+eds.dict

Annex 3: Characteristics of the Lending Process and Barriers to Loan Access in the Philippines

There are a lot of similarities and some differences in the procedures and documents required by the five banks interviewed to process loans. All the banks require information on the proprietor, partnership or company applying for the loan. This information includes the business permit, audited financial statements, and tax declarations. The interest rate for their loans is set at the prevailing market value, around 10- 12% per year, and the payment period for loans is 5 years. The amount of loan granted by LBP, DBP, IRB, and PNB was 60% of the appraised value of the collateral. BPI is slightly more conservative, offering only a maximum of 50% of the appraised value of the collateral as loan. However, these loans assume a low risk investment due to increase in revenues based on the activities being financed (e.g., pig houses to increase capacity). These loans are not designed to finance waste management projects; these projects would be financed through higher rates because the uncertainty of payback is perceived as an increase in the risk taken by the lending institution. Higher rates demand higher collateral, making the requirement difficult and/or unacceptable to farmers.

Of all the banks, only DBP specifically states in its application form that it may accept chattel as additional mortgage. Bank officials from the other banks mentioned that chattel mortgages, even if it was just additional to real estate mortgaged, was not encouraged because it increased the bank's burden should the borrower default on the loan payment. The Managing Director of IRB specifically stated that rural banks like IRB do not have enough staff to review and manage the auction of chattel mortgage should the borrower default on the loan. This could be particularly problematic when dealing with small-scale and backyard farmers with very limited assets. Accepting chattel mortgage from small-scale farmers also increases the bank's risk. In general the 2 commercial banks, BPI and PNB have more documentation requirements than DBP, LBP, and IRB to process loans for individual proprietors.

During the interviews, bank officials pointed out the main reasons for unsuccessful loan applications. These included:

- Unqualified collaterals, particularly unclean title (with mortgage), no Transfer Certificate of Title (TCT) with Tax Declaration only, fake TCT or very low market value. Tax Declaration is a form that contains the value of the real estate property which is used as the basis for assessing the amount of yearly real estate taxes.
- Lack of documents, particularly financial documents like Income Tax Returns and Audited Financial Statements.
- Tampered or fake financial documents.
- Unimpressive interview with the borrower.

During the interviews, we learned that there are also human resource constraints within each bank to understand agricultural technology, including AD systems; consequently, the bank loan officers tend to have a difficult time understanding and accepting loan applications. Only LBP staff has received any specific training on the benefits of agricultural technology, such as AD systems; staff at other banks like DBP have not received any training. Even if training was provided to some units at LBP, the loan committee may still not be aware of specific agricultural technology, such as anaerobic digesters, which makes it very difficult for the accounting

departments at the bank to appreciate the challenges and complexities of processing agricultural loans.

Further complicating the issue is the involvement of the banks in the CDM process. Certified Emissions Reductions (CERs) can be used as additional collateral towards loans and assist towards loan repayment. However, while prospect of revenue from the sale of CERs is attractive, greenhouse gases reductions and CERs sales can only be estimated at the beginning, which, in the loan officers view, creates an uncertainty in the process and the farm's capability to re-pay the loan. Also, without a similar existing and successful CDM registered project (that has received CERs revenue) in the market, it is difficult for the loan officers to evaluate their performance and risk, making it challenging to keep the interest of loan committees at banks.

During the interviews with IRB, it was evident that the bank was not aware of anaerobic digester technology, let alone the CDM process. While one interview cannot be used to generalize the awareness of all rural banks, the IRB does provide a representative view to how constrained financial institutions currently are in terms of human resources and capacity to process agricultural and farm improvement loans.