The Status and Future of Methane Destruction Projects in Mexico

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ABSTRACT

Of the Clean Development Mechanism projects that exist in Mexico, methane destruction projects from hog farms dominate the landscape with 56% of the projects developed and 49% of the Certified Emission Reductions (CERs) that will be generated within the country by 2012. These biodigesters, however, have experienced many technical difficulties that place their future viability and continued development in question. Because of these challenges, future methane capture in the country may focus around other agro industries or landfills.

Keywords: methane capture and destruction, Clean Development Mechanism, Kyoto Protocol, Mexico, Certified Emission Reductions

1 INTRODUCTION

Mexico has a well-developed hog industry with five million farms and over 18 million pigs that has been able to capitalize on the revenues from the Kyoto Protocol's Clean Development Mechanism[1]. This Mechanism allows developed, Annex I countries who have signed the Protocol to make emission reductions through having an equity stake in or purchasing emissions reductions from projects in developing countries. The emissions reductions derived from these projects have to be considered additional to what would have occurred in a business-as-usual situation.

Hog farms in Mexico were an area ripe for development because none had advanced wastewater treatment for the pig excrement. Some farms simply let the waste spill directly into waterways. Others allow it to pool in lagoons where methane from the excrement to off-gasses into the environment before it was discharged into a local waterway, evaporated, or sprayed on crops. These lagoons were a rudimentary way of preventing water contamination. Only the hog farms with lagoons that produced methane are eligible for CERs since preventing the release of this methane presented an opportunity for CDM project development. Farms that did not have these lagoons and simply released the excrement immediately into the local waterway were not eligible for project development since there was no methane being produced onsite as the excrement entered a moving waterway and was oxygenated [2].

These projects are not only considered desirable from a financial perspective, but they also provide local farmers with a solution to the odor and water contamination problems that had begun to create tense relationships with neighbors. Those farmers without biodigesters occasionally have to pay fines for the polluted water they discharged from the waste lagoons, which must be 90% free of solid organic matter [2].

Of all of the Clean Development Mechanism projects in Mexico, 56% are methane capture from hog farms and these projects constitute 49% of the Certified Emission Reductions (CERs) that will be generated within the country by 2012. Mexico has also benefited from more biogas capture projects than any other country in the region, with a predicted 11,000 more CERs that will be derived from their closest competitor, Brazil, by 2012 [3]. Mexico has enjoyed such success for several reasons. Mexico, unlike its neighbors to the South, has hog farms with critical mass of animals that is enough to make a digester viable. Also, most hog farms belong to group of farms all pertaining to the same owner like GCM and Soccoro Romera Sanchez. Multiple farm sites that belong to the same owner are easier to bundle together in order to take advantage of the small-scale methodology. It is less risky to bundle several biodigesters with the same owner because compliance and communication with farm doctors and operators is simplified. Projects that emit a total of less than 60,000 tons of carbon dioxide destroyed annually can be combined for the sake of lowering project costs by creating only one Project Design Document and being evaluated by one validator and verifier [4].

These farms have also been successful in Mexico because Ag Cert, the self-proclaimed "worldwide leader in agriculturally derived emission reductions," set up operations in the country and aggressively pursued projects there with more than 120 staff serving the country [5]. As some farmers began to take advantage of the opportunity to earn money from their hog waste, word spread, and more farms became interested.

Despite Mexico's important role in the market, technical problems with the operation of these farms have placed their future in jeopardy. Future methane capture opportunities in the country could be focused on other types of agro industries or landfills.

2 DIGESTOR FUNCTIONING

To understand the technical barriers facing biodigesters in Mexico, one must first have an idea of how a digester operates. Excrement or blood from a slaughterhouse falls or is swept into pits that are sent by gravity or a pump to a large container. Here the excrement is collected and allowed to sit for approximately thirty days in a plastic-lined and capped container. Depending on the density of the excrement, plastic walls are sometimes placed inside the digester to slow the movement of the excrement through the process so that it produces sufficient methane. In Mexico, positive pressure systems are usually used to trap the methane. In these systems a bubble of methane forms on top of the container. In negative pressure digesters, which are more commonly used in Brazil, the plastic is flush with the excrement [6].

After methane is produced, it runs through pipes and a meter to a flare where it is burnt to produce carbon dioxide, a greenhouse gas that is 21 times less potent when considered in a one hundred year time scale [7]. Sometimes, fans that blow the methane from the digester to the flare must be turned on to ensure that too much methane does not accumulate under the plastic cover. This seemingly simple system is a relatively new technology that has been implemented in several places throughout the world from India to the United States. However, each digester is different because of the animals that contribute to its contents and its location; therefore, each system must be considered individually in order to ensure proper functioning [8].

3 PREREQUISITES

There are certain prerequisites for health digester functioning that must be fulfilled in order for CERs to be created. The site of the digester is perhaps the most important parameter since digesters that are located at high altitudes or in cool weather have a hard time maintaining the 25-30 degree Celsius temperatures needed. Hog farms in the state of Puebla near the town of Perote have had difficulty maintaining a constant temperature. To remediate this problem, operators of Granjas Carroll Mexico (GCM) farms in Perote are considering heating the contents of the biodigester with the excess heat from a microturbine that would burn methane from the digester [9]. Also, if located in a site with frequent rain, the digester can remain too cool as pools of water gather on the surface, deflating the methane bubble and lowering the temperature of the excrement. If the project has no full-time grounds keeper and, like AgCert farms, relies on weekly visits from an engineer that lives remotely, then there is sometimes not a pump onsite to move the water off the top of the digester surface. And, even if the local farmer has a pump, he does not always cooperate and use it in a timely fashion [2].

The diet of the pigs can cause fluctuations in the pH, which needs to remain close to 7. Adding ingredients to the excrement to make it more acidic or alkaline can cause large pH swings that over compensates. However, GCM has found that their excrement is too alkaline at an average of 7.9. They are planning on adding buffer tanks that will neutralize the excrement before it enters the main repository [9].

If the animals suffer from a disease and are prescribed antibiotics or given vaccinations, the medicine can harm the bacteria living in the digester. A close relationship with the farm doctor can help prevent the over prescription of antibiotics and use of medicine on a rotating group of animals to decrease the impact of machine on the digester. Likewise, non-biodegradable chemicals used to clean animal stalls can also limit the productivity of the digester by killing the microorganisms that anaerobically decompose the excrement [10]. Empacador Toledo hog farms in Guatemala found that using too much water to clean stalls made the waste too dilute. They cut back on their water use from 20 liters per pound of excrement to 5 by manually sweeping waste into pits instead of hosing it and resolved digester problems [11].

The most essential part of the system for carbon credits is the actual burning of methane from a flare after it has been captured. Often the pilot light that lights the methane will get blown out by the wind, rain, or a piece of the flare that falls on top of it. Many flares have begun to install a solar-powered backup pilot light since failure is so common [9]. However, four of the ten digesters the author visited had not properly insulated the cables from the solar pilot light to the flare. The cables were therefore burnt.

If the methane does not burn clearly, there is a problem with the gas content. Often an orange flame is indicative of too much carbon dioxide in the digester. Lime is mixed in to reduce the CO2 content. If there is too much hydro sulfuric acid in the gas, it can damage the flare over time. To reduce the amount of hydro sulfuric acid in the gas, it is sometimes passed through a pipe with a piece of iron that attracts the harmful gas. Water is also condensed out of the gas in another filter [2].

4 COMMUNICATION BREAKDOWN

Communication between the farmer and the engineer is a critical component to the success of digester projects. If the farmer or grounds keeper cannot pass messages directly to the engineer, critical components of the system like fans, pumps, and pipes cannot be repaired in a timely fashion. Often parts for systems have to be transported from the capital or even ordered from abroad. The Ag Cert model of relying on a remotely located engineer to service a region of farms proves problematic since the company engineer cannot receive phone calls on this cellular telephone from anyone but the Ag Cert office. Farmers who leave messages at the office do not always have success passing it on to the engineer [2].

Contacting a project developer that is located abroad is even more complicated if the company does not have permanent operations and staff in the host country. GCM had the experience of paying high project costs for UEM Group Berhad, a Kuala Lumpur-based company, to develop a project that used sophisticated technology that replicated a design used on dairy cows. The tubes used have a diameter that is larger than needed and better suited for cows instead of pigs. The mechanical devices used to tighten the plastic cover are susceptible to tear. The open flare for the system worked for 24 hours before it burnt the pilot light cables and threatened power lines that were sited too close to the flare. Since UEM is based abroad, they did not have an engineer that could frequent the project and offer technical assistance [9]. As a result of this experience, GCM hired the locally-based and more economical Geosistemas to handle the rest of their digester development [12].

There is sometimes a communication failure between the farmer and the consultant with regards to the CDM negotiations. The general director of Socorro Romero Sanchez hog farms, which has 29 projects with Ag Cert, is under the impression that after the first 10 years of the contract, the company will keep the carbon credits [13]. However, if a 10-year crediting period was chosen, then it cannot be renewed for additional carbon credits since a new baseline that includes the functioning digesters would be used in a new PDD an no emission reductions would be calculated [14].

5 CHANGING METHODOLOGY

A change in UNFCCC methodology for the destruction of methane has changed the economics of methane capture projects significantly. Prior to November 2006, the UNFCCC methodology allowed developers to assume that 100% of the methane was destroyed by these open flares. However, the UNFCCC's new, revised destruction of methane methodology sets a maximum amount of methane destroyed from these open flares of 50%. In order to prove that more than 50% of the methane is destroyed, farm owners have to have a closed flare with a temperature gauge. The heat of the gas flared determines how efficiently the flare is working and the quantity of gas destroyed [15].

The temperature gauge only costs about $1,200 USD, but the cost of the flares varies widely. Open flares cost only $27,000-$150,000 while closed flares range between $105,000 and $195,000 [16]. A Mexican company called Geosistemas has created a less expensive closed flare that is comparable in price to the open flare. However, this flare is not yet available for purchase [12].

Projects that started under the assumption that they could buy and use open flares, but did not register the project before the change in methodology have had to revise their budgets to incorporate the cost of the closed flares and in some cases have had to return open flares already purchased. Fear that the methodology could change again prompts projects in process to finish in a rush and discourages new project development from companies like Ecosecurities who did the CDM negotiations for GCM and had to change 29 digester plans after the methodology was revised [17].

6 ELECTRICAL GENERATION

The GCM farms hope to eventually generate electricity from the methane and have designed the carbon credit allocations to include displacement of carbon-intensive fuels from the electrical grid. While the use of methane to produce electricity is a proven technology, several concerns about this aspect of the project operations suggest that the first few years of electrical generation could be a period of trial and error. Too much hydrosulfuric acid not only hurts the flare, but can also cause malfunctioning of a generator or microturbine. Doubts about the amount of gas that will be produced and most appropriate form of equipment make it difficult to size the system precisely [9].

Ag Cert has decided not to incorporate electrical generation in their projects because of the high capital costs of the generator and uncertainty about how to use some gas in the generator and then switch the stream to the flare. The generators that will serve the farms are not big enough to all of the biogas produced at most digesters owned by Ag Cert. So, the methane would build up in the covered lagoon until the stream was stitched to the flare. At that point, the pilot light must be ready to fire and the switch must be synchronized well to prevent the release of unburned gas into the atmosphere. According to an Ag Cert engineer, the gas cannot be sent to both devices simultaneously [2]. Despite these doubts about electrical generation, the farmers at many of the Ag Cert farms are planning on buying generators themselves to make use of the methane and eliminate their electricity bills [18].

Excess electricity that is not used by the farm could theoretically be fed into the grid as is being proposed in Empacador Toledo's hog farms in Guatemala by Ecoinvest. However, the structure of the Mexican market is such that it is complicated to sell excess electricity back to the grid. Generators can either earn 85% of the state-run companies' avoided cost or apply to be a self-supplier and structure a power purchase agreement with a large consumer who must own part of the generation project. Under both schemes, the generator must pay high transmission tariffs. Also, the project owner is responsible for setting up electricity lines from the point of generation to the load [19]. Thus far, no hog farms have chosen to invest in a generator that can produce more electricity and feed it into the grid with the hope of earning money from the excess generation. Therefore, electrical generation only serves the farmer's needs and earns carbon credits equal to the emissions that would have been burnt if the farm was served by energy from the national grid.

7 REGULATORY HURDLES

Several upcoming regulations will make it more difficult to demonstrate additionality for biodigester projects in Mexico. Additionality is prerequisite for CDM projects that attempts to ensure that all projects that receive credit would not have occurred in a business-as-usual scenario. If regulations or financial incentives exist that

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mandate or encourage the creation of the project, then it is more difficult to earn CDM revenues.

A new regulation mandates that new hog farms install biodigesters. This law could limit future development to only those currently-existing farms that do not have digesters and use lagoons to process waste [8].

An incentive for farmers to buy generators and use the methane produced from their hogs to produce electricity exists in the state of Puebla. This incentive supposedly pays half of the first cost of a generator. Sorroco Romera Sanchez's farmers have begun taking advantage of this law by benefiting from the government purchasing the first of three generators the company bought [8] and [18]. If the use of this incentive became widespread, then financial additionality would become difficult to prove.

8 CONCLUSION

Given the questionable impact of future regulation that could negate digestor additionality, technical difficulties, and communication barriers, the future of methane capture for hog farms in Mexico is uncertain. The presence of large hog farms with one owner has contributed to the success of these projects thus far, but Mexico's portfolio of projects may be diversified significantly to include other types of CDM projects in the coming years as the challenges of these projects become better known. Or, the period of digester trial and error may be less onerous than expected and push development in new areas of industry like slaughterhouses, dairy farms, coffee farms, palm oil plantations, and landfills.

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