PERSPECTIVES OF TREATING SWINE MANURE BIODIGESTORS IN PROJECTS OF CARBON CAPTURE IN BRAZIL.

PERSPECTIVAS DE TRATAMENTO DE DEJETOS SUÍNOS EM BIODIGESTORES EM PROJETOS DE CAPTURA DE CARBONO NO BRASIL.

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ABSTRACT

The Clean Development Mechanism (CDM) projects proposed in the Kyoto Protocol constitute an interesting way of protecting the environment and at the same time promoting sustainable economic development in emerging economy countries. Possible CDM projects include the treatment of swine manure using biodigestion, which would provide an opportunity for Brazil to actively participate in the carbon credits market. Brazil is currently the world's third leading swine producer (36 million animals). This study aims to demonstrate that the treatment of swine manure using bio digestion can minimize environmental impact and also contribute to reducing carbon dioxide emissions into the atmosphere by approximately 19 million tons per year, generating around US$ 78 million in carbon credits for Brazil annually.

Key words: Swine culture, carbon market, greenhouse, bio digestion, CDM.

INTRODUCTION

The increase in emission of gases in the atmosphere, mainly carbon dioxide (CO_2) and methane (CH_4), which contribute to the growth of the greenhouse effect, has caused great concern and discussion due to its consequences for the world´s climate. The Kyoto Protocol, created with the objective of contributing to the reduction in atmospheric emissions of gases of the greenhouse effect (GEE), was crafted in 1997 and entered into force from February 2005. It states that the 39 industrialised countries (named Annex I countries), which are the biggest emitters, commit to reduce by 5,2% the emissions of GEE, from 2008 to 2012, based on global levels registered in 1990.

These countries will be able to meet their targets of reduction by what is called the Clean Development Mechanism (CDM). This arrangement, defined in article 12 of the Kyoto Protocol, allows the Annex I countries to reach their goals by financing and developing projects

of reduction of emissions which focus on the sustainable development of the developing countries. Brazil, given its natural conditions, is a strong candidate to host a significant part of the CDM projects, benefiting from access to more advanced technologies, receiving investments and consequently, improving its environmental conditions. Jotzo and Michaelowa (2005) estimate that CDM will be able to absorb about 32% of the world market demand for carbon credits. This volume would correspond to 300 million tCO_2eq annually or 1,5 billion tCO_2eq (metric ton of carbon dioxide equivalent) for the duration of the agreement of the Kyoto Protocol. Taking into account amounts estimated by various specialists, the price of the ton of CO_2eq varying between US$ 8 and US$ 32 (Carbono Brasil, 2010), the global demand for credit of carbon emission of CDM may reach US$ 10 billion a year in 2010, and Brazil may play an important role (Mathews, 2008).

Projects of treating swine manure, which capture the methane gas (CH_4) before it reaches the atmosphere, are perfect examples of the CDM category. In Brazil, there are initiatives which make use of the biodigestor technology. Through deposition of swine manure anaerobically and its further energy use, will reduce the emission of GEE, not only reducing CH_4 but also replacing fossil fuels.

CDM APPLIED TO SWINE BREEDING IN BRAZIL

Brazil is considered to be the third biggest country for swine breeding in the world, with a breeding stock of 36,09 million of swine according to 2006 data (Embrapa, 2007) with 51% of this stock concentrated in the southern region of the country. The production of pork meat in 2006 was 2,87 million of tons, 22% for export (Abipecs, 2007).

The Kyoto Protocol can be considered the root of the current carbon market, as it introduces instruments to the market which allow the negotiation of emissions among countries which have higher capacity to reduce the emissions and those which may not meet their own targets of reduction.

This protocol shows two basic categories of signatories. The industrialised countries in Annex I agree to reduce, by 2012, the emission of polluting gases by 5,2% lower than 1990 levels. In the “Non-Annex I”, the developing countries are listed, not with the same mission, but with the advice to help the first group in their reduction targets.

The Kyoto Protocol establishes some strategies to enable the industrialized countries to meet their targets of reduction of greenhouse gas. It is of great interest to Brazil as the clean development mechanism which allows Annex I countries to meet their targets by financing and developing projects for reduction of emissions which focus on sustainable development in developing countries.

The main focus in the approach of swine manure has been actions involving the generation and consumption of biogas. This gas contains mostly methane (CH_4) which has greenhouse capacity 21 times (Ipcc, 2007) higher than carbon dioxide (CO_2). Therefore, projects which reduce the emission and consumption of this gas to generate energy can be considered for the CDM. The proposal is that swine breeders have biodigestors in their facilities, as the biodigestor is a piece of equipment approved by law (NAE, 2005).

BIODIGESTORS AND SWINE BREEDING

Biodigestors are sealed tanks used for the anaerobic fermentation of swine manure, where the gas formed in the process (CH_4) is recovered and later burned consequently avoiding its emission into the atmosphere. The gas produced in the biodigestor is cleaned by removing humidity and sulphur be-

fore being drawn into the diesel engine (Nae, 2005). The swine manure turn into fertilizers.

Anaerobic biodigestion is a process that has been known for a long time and its use for the production of biogas for the conversion of energy for cooking and lighting and also as biofertilizer is very popular in Asian countries. At the beginning of the 20th century, the development of biodigestors for the production of methane gas from animal manure, especially bovine, started in India and China (Cenbio, 2005).

According to Dechezleprêtre et. al (2008) the biodigestion systems in breeding farms are very popular in countries like Brazil and China. In the Brazilian case, there are 20 projects that generate energy, produce biofertilizer and recover 1477 ktCO_2eq each year, helping on the reduction of environmental impacts. Due to the mentionated value, the project can be also used as a way to generate carbon credits to be sold.

After about 30 years, biodigestors have reappeared as an alternative to the producer, thanks to the availability of new materials for the construction of biodigestors and, evidently, the higher dependency of energy due to the increase in production scales, the automation in the production process and the increase in costs of traditional energy (electrical, wood and petroleum). What is news is that, besides the production of biogas and biofertilizer, products which are inherent to anaerobic biodigestion, there is the possibility of selling carbon credits, which would add more value to the process of treating swine manure.

This kind of project means technology transfers to a country. Brazil and Mexico have attracted finantial investments to develop breeding farms from foreign partners. According to Dechezleprêtre et. al (2008), a strong capability of development of the technologies comes from foreign countries, but the domestic technology and needs rule the development of new methods for old stuff.

CDM projects through the implementation of biodigestors on farms minimize its environmental impact, managing the solid and liquid residuals generated in a sustainable way. The use of biodigestors in treating swine manure contributes in a significant way by reducing organic volume which compromises the quality of water and enables the proliferation of pathogenic organisms and other carriers of infectious diseases. The biodigestors also fulfil the role of reducing odorous substances which may cause discomfort to the neighbouring population and to farm workers.

The Brazilian swine breeding chain can participate actively of CDM. Initiatives in advanced stage of implementation of biodigestor projects are being promoted in the Brazilian market, such as the Faxinais dos Guedes e Toledo and the company Sadia and other producers.

The energy capacity of swine manure: 1 m^3 of manure produces around 0,5 m^3 of biogas (Konzen, 1983) and 1 m^3 of biogas is the energy equivalent to 0,66 litres of diesel or 0,7 litres of gasoline (Pompermayer, 2000).

METHODOLOGY

In this study, the focus was on projecting the potential of capturing CO_2 originating from swine breeding in Brazil. In this sense, firstly, the annual average amount of tons of carbon dioxide in equivalent (tCO_2eq) generated by a swine was estimated. To do that, data from the Project of Capture and Combustion of Gases of the Greenhouse Effect of the System of Managing Manure in Faxinal dos Guedes in Santa Catarina and São Sebastião and Luiz Marina in the region of Toledo in Paraná was used. This project consists of the implementation of an anaerobic digestor to treat the swine manure and capture and incinerate the methane generated

by this process. Before the implementation of this project, the swine manure was treated in anaerobic lagoons; the methane gas was released in the atmosphere ("baseline"). The aim of this project is to avoid the emission of methane gas from the systems of managing manure on these farms.

After that, considering the annual swine breeding stock in Brazil of 36,09 million, the annual potential of generating tCO_2eq from all swine breeding activity was calculated. In sequence, based on the estimated price of tCO_2eq, the size of the market on carbon credit per year was projected in monetary (US$ 8 and US$ 32, Carbono Brasil, 2010). A sensitivity analysis was also prepared considering the practice of different prices of tCO_2eq, associated with the perspective of growth in the production of pork meat in Brazil.

RESULTS

The results of this study show that the potential for Brazilian swine breeding in capturing carbon through the use of biodigestors in the treatment of swine manure, appears to be highly favourable, as shown in Tables 1 and 2.

Table 1. Average Generation of tCO2 / Swine

Item	Faxinal dos Guedes	Toledo Luiz Marina	Toledo São Sebastião	Total
Reduction of tCO_2eq / year	19.916	2.839	1.522	24.277
Head of swine	36.911	4.721	3.218	44.850
tCO2eq / swine/year	0,54	0,60	0,47	0,54

Source: Clean Development Mechanism – Project Design Document Form (CDM – PDD) – Faxinal dos Guedes, Toledo Luiz Marina and Toledo São Sebastião.

Table 2. Projection of Reduction in Emission of tCO_2eq

Item	2006	2016
Total swine / year (million) (1)	36,09	36,09
tCO_2 / swine/year (2)	0,54	0,54
Reduction in tCO_2eq / year (million)	19,49	19,49
tCO_2eq rate	4,00	7,00
Carbon Credits US$ million	77,95	136,42

Source: (1) EMBRAPA, 2007 Source: (2) Clean Development Mechanism – Project Design Document Form (CDM-PDD) – Faxinal dos Guedes, Toledo Luiz Marina and Toledo São Sebastião

Table 1 shows that a swine can generate on average 0,54 tCO_2eq a year. According to Table 2, the value of carbon credits generated by the Brazilian swine breeding activity, depending on the tCO_2eq rate, can vary from 77 to 130 million American dollars approximately.

It is worth mentioning that the commercialization of carbon credits, the way is outlined, would not be easily available for small and medium swine breeding businesses, but only to large sized farms, which have the quantity of manure economically viable to make the necessary investment focusing on the future sale of carbon credits.

CONCLUSIONS

It is no wonder that there is a growing commitment from Brazil to solve global issues generated by the greenhouse effect, replacing technologies which are great generators of harmful gases for the atmosphere by treatment systems which are environmentally sustainable.

The CDM projects on treating swine manure, through biodigestion, contribute not only to the elimination of GEE, but also to reduce the environmental degradation caused by an activity such as swine breeding considered to be of great polluting potential. Besides, they contribute to the goal of economical sustainability as it guarantees the continuous creation of jobs in the swine breeding chain and maintains a stable rural population.

The results of this study show that the potential for the Brazilian swine breeding sector in capturing carbon through the use of biodigestors in treating swine manure is highly favourable. Considered the third biggest producer of swine in the world, with a breeding stock of 36,09 million animals, Brazil can contribute to the elimination of emissions of around 19 million tons a year of carbon dioxide equivalent in the atmosphere and, consequently, generate about US$ 78 million annually in carbon credits.

After 2012, the future of the carbon market seems uncertain, increasing the risk of implementation of CDM projects at the moment. In this sense, the projects on treating swine manure through biodigestion are attractive to investors, as its implementation is fast and has relative low cost when compared to other CDM projects.

The CDM projects won't be able to decrease emissions and promote sustainable development, but is a good idea for promoting clean carbon-free energy for developing countries and a modified CDM could deliver a reasonable quantity of cost-effective emission reductions and make the flow of technologies rise. Several key barriers need to be overcome so the CDM can be appreciated on its full potential (Lloyd, 2008).

The international market, mainly Europe, is very demanding with regards to the environment. The use of biodigestors to treat swine manure and generate carbon credits can become a differential for the export of Brazilian pork meat, contributing to the increase in external sales and add value to the exported pork meat.

In the meantime, the use of biodigestors in generating carbon credits is restricted to large swine producers or big companies. The insertion of small and medium swine breeders into this market would be viable if they centralized the treatment of manure by biodigestion, where not only the volume of credits generated but also the necessary investments would tend to be economically viable.

The decrease in environmental impacts caused by swine breeding demands more complex actions and not only the commercialization of carbon credit to become viable. This should be considered an important available tool to reduce the environmental problems of this activity.

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