

Carbon Credits

for Methane Collection and Combustion

Introduction

Methane (CH₄) is one of the primary greenhouse gases (GHG) associated with global warming. The GHGs trap heat much like glass or a plastic cover in a greenhouse traps long-wave radiation emitted from the earth instead of releasing it to the outer atmosphere. Estimates of the impact on the earth's climate from human-driven changes in atmospheric GHG concentrations vary, but nearly all estimates predict some climate change. Methane is produced during anaerobic (without oxygen) digestion of organic material, such as digestion of animal waste in an anaerobic lagoon. The biogas released from an anaerobic lagoon is typically about 60 to 70 percent methane, with the remainder being mainly carbon dioxide (CO₂), which is also a GHG.

Projects that reduce methane emissions are eligible to earn marketable assets, generically called carbon credits, which represent the reduction in GHG emissions. Carbon credits are assets defined by a variety of voluntary specifications, as well as by national and international regulations. The carbon market comprises all carbon credits, and there are a variety of accounting registries that track the GHG assets. Trading occurs on several exchange platforms, including Chicago Climate Exchange and NYMEX Green Exchange.

One carbon credit usually represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases such as methane and nitrous oxide. Methane and nitrous oxide have approximately 21 times and 310 times, respectively, the heat-trapping capacity of carbon dioxide. Reducing methane by one ton is equivalent to reducing carbon dioxide by 21 tons. Concentrated animal feeding operations (CAFOs) offer good potential with current technology for capturing methane, and also combustion and energy use. Several factors should be considered in methane collection and utilization. (For example, see Biogas Anaerobic Digester Considerations for Swine Farms in North Carolina, N.C. Cooperative Extension AG-707).

Markets for Carbon Credits

The two types of markets for carbon credits are (1) compliance and (2) voluntary. Compliance markets have set a "cap and trade" system whereby the total annual emissions for an industry or country are capped by law or agreement, and carbon credits can be traded between businesses or sold in trading markets. Those producers who exceed their emission reductions can trade their credits to others in the marketplace who have not reached their emission goals. Voluntary markets exist for businesses or individuals to lower their "carbon footprint" by voluntarily purchasing carbon credits from an investment fund or company that has aggregated credits from individual projects that reduce emissions.

The compliance markets are mainly a result of the Kyoto Protocol, a cap and trade system that resulted from the international Framework Convention on Climate Change. The protocol was adopted at the 3rd Conference of the Parties in Kyoto, Japan, on December 11, 1997. The treaty required ratification by no less than 55 countries and enough industrialized countries to represent at least 55 percent of the total carbon dioxide emissions. Fifty-five countries agreed by May 23, 2002, but the 55 percent requirement was not met until Russia agreed on November 18, 2004. The treaty came into force 90 days later on February 15, 2005. As of May 2008, 182 countries had ratified the protocol.

Of these 182 countries, 36 developed countries (plus the European Union) are required to reduce greenhouse gas emissions to the levels specified in the treaty. The U.S. has not ratified the Kyoto Protocol. Brazil, China, India, and 134 other developing countries have ratified the protocol, but have no obligation beyond monitoring and reporting emissions. The Kyoto Protocol created specific rules for registering and certifying carbon credits. Carbon credit markets have been developing for several years, especially in Europe.

The number of voluntary markets has been increasing. In the United States, some of the companies involved in carbon credit trading are the Chicago Climate Exchange, AgraGate, and the Environmental Credit Corporation. Trading prices have been variable. For the Chicago Climate Exchange, the price per metric ton of CO₂ in 2008 went from \$2 in early 2008 to \$7 in mid-summer, and back to \$2 in the fall. The price rose dramatically during mid-2008 in anticipation of legislation, but dropped just as dramatically when legislation stalled.

In 2008 in North Carolina, NC Green Power (<http://www.ncgreenpower.org/>) initiated a program for selling carbon offsets (http://www.ncgreenpower.org/signup/carbon_offset_rfp.html). The initial price was \$4 per 500 pounds of carbon dioxide equivalent offset. Under the program, certain participating utilities offer their customers the option to subscribe to available tariffs to support carbon offsets. These tariffs allow customers to subsidize the mitigation of greenhouse gases (carbon dioxide equivalents). These carbon offsets will be offered on a monthly basis for a premium. Each block of carbon offset subsidized by a consumer or business will allow the NC GreenPower carbon offset program administrator to buy an equivalent block of carbon dioxide equivalents mitigated by an emission reduction project and sourced directly from the project or from the voluntary carbon offset market. Some of the requirements for the emission reduction projects are that there be no renewable energy credits, the reduction must be permanent, and the project must have “additionality” (cannot be mandated by law and would not have occurred for any reason besides concern for mitigation of climate change, or in other words, must be beyond business as usual).

There are efforts by local governments in the U.S. to reduce GHG emissions, and these legally binding agreements and registries can create additional markets to sell methane destruction credits. There is a state level cap and trade program for nine northeastern states in the Regional Greenhouse Gas Initiative (RGGI), started in January 2007. In 2006, California signed into law the Global Warming Solutions Act requiring reduction of GHG emissions by 25 percent by 2020.

Interest in reducing GHG emissions is increasing worldwide, and this has led to attempts to create new markets for carbon credits. The potential for having cap and trade programs in various states or potentially for the entire United States under an agreement such as the Kyoto Protocol

leads to speculation that the price of carbon credits could increase substantially.

The Potential for Methane Collection and Combustion

Over 2,000 anaerobic lagoons are active in North Carolina, mostly on pig farms, but some on poultry and dairy farms. Anaerobic lagoons emit biogas that consists mainly of methane (about 2/3) and carbon dioxide (roughly 1/3), and small amounts of other gases such as ammonia, hydrogen sulfide, and water vapor. If a lagoon is covered and the gases are collected and combusted, then the methane is converted to carbon dioxide, and water vapor during combustion and methane emissions is reduced compared to an uncovered lagoon. Although carbon dioxide emissions result from combusting the biogas, the overall equivalent carbon emission is reduced, because methane has about 21 times the heat-trapping or global-warming potential as carbon dioxide. Methane collection and combustion can help reduce the carbon footprint of animal operations and offers potential revenues from carbon credits or energy.

Markets established to buy and sell carbon credits, such as the Chicago Climate Exchange, use specific methods to calculate the carbon offset or carbon credits obtained by collecting and combusting the methane. An example of specifications and guidelines for methane emission offset projects and their verification is available at the Web site of the Chicago Climate Exchange (CCX). Its specifications for agricultural methane emission offset projects can be found at <http://www.chicagoclimatex.com/content.jsf?id=103>. For CCX, methane collection or combustion projects activated on or after January 1, 1999, may qualify.

Guidelines for the CCX agricultural methane gas project can be found at http://www.chicagoclimatex.com/docs/offsets/Agriculture_Methane_Protocol.pdf.

These guidelines include the overall approach for crediting methane reductions from anaerobic digestion of animal manure as emission offsets, the protocol for calculating methane generation, and the protocol for measuring, recording, and verifying anaerobic digester methane recovery rates based on biogas flow and methane measurements. The guidelines include tables of methane emission factors by state for animal type and by baseline manure management system. The emissions baseline is the amount of methane that would be emitted to the atmosphere during the crediting period in the absence of the anaerobic digester project.

Table 1. Baseline annual GHG emissions for anaerobic lagoon manure management in North Carolina assuming Global Warming Potential of methane = 21 and no solids separation. (metric tons CO_{2e} per head per year)

Dairy Cow	Dairy Heifer	Market swine < 60 lbs	Market swine 60-119 lbs	Market swine 120-179 lbs	Market Swine > 180 lbs	Breeding Swine
4.70	2.11	0.26	0.41	0.68	0.90	0.95

Extracted from Table B.7 of CCX Agricultural Methane Gas Project Guidelines
http://www.chicagoclimatex.com/docs/offsets/Agriculture_Methane_Protocol.pdf

For example, the CCX baseline GHG emissions for anaerobic lagoons in North Carolina, assuming no solids separation before the lagoon and considering that the global warming potential for methane is 21 times that of CO₂, is 0.68 metric tons CO_{2e}/head per year for a 120- to 179-pound finishing pig (Table 1). The farmer arranges the technical GHG reduction activity in partnership with the buyer organization (such as a broker or aggregator), installation occurs, and a third-party verifier audits the installation and submits a report. If accepted into market, annual emissions are verified. Initially, the project's eligibility and calculations of methane emission reductions must be approved by a third-party, CCX-approved Verifier. At least once per year, biogas flow measurements, records, and procedures should be verified as acceptable per the CCX protocol. A list of CCX-approved offset verifiers can be found at: <http://www.chicagoclimatex.com/content.jsf?id=102>.

Environmental Credit Corporation (ECC) (<http://www.envcc.com/>) is a carbon broker that obtained a USDA-NRCS Conservation Innovation Grant to assist in covering four swine lagoons in North Carolina in 2008. The cost of covering a lagoon is typically about \$1 to \$3 per square foot. Their business plan is to pay the expenses of covering the lagoon and pay the farmer some of the income obtained from carbon credits as traded on the Chicago Climate Exchange. Their destruction technique is to flare the gas, but some systems may enable energy or heat production opportunities for the farm. Covered lagoons or other anaerobic digesters have the potential to produce renewable energy by using the biogas in an engine generator or boiler.

There are other potential programs and grants for renewable energy. Selling carbon credits may not be allowed if the project also includes renewable energy credits or benefits, and most established programs require registration to avoid such

“double counting.” Generally, electricity projects that use biogas can earn carbon credits for destroying methane (whether it is in the electricity-generating equipment or a flare), but not for the offset of fossil-fuel combustion if they will earn Renewable Energy Credits for the electricity. Using the biogas in an engine generator for electricity requires significant investment and also significant labor and operating costs. Economies of scale, price offered for electricity by utility companies, and potential energy use on the farm are important factors in considering whether to use the biogas to generate electricity.

Summary

The carbon credit business is a rapidly changing business, and people should be aware that market rates, protocols, and registration programs can change quickly. There are many companies involved in carbon credit trading, and a few have been active in brokering credits for agricultural projects. For example, two of the aggregators or brokers in the U.S. that can handle on-farm methane projects are AgraGate Climate Credit Corporation, which was created to expand the Iowa Farm Bureau Federation (IFBF) Carbon Credit Aggregation Program that began in 2003, and Environmental Credit Corporation, which started a pilot program in North Carolina in 2008 for covering lagoons for carbon credits.

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