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Production Assistant
Janice Storebo

Formatting
Tina Smith

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David Brown

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Ruth Cronje, and Jan Swanson;
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Pork's carbon footprint: Hot air, hot opportunity or both?

Garth W. Boyd
Senior Vice President, Agriculture, Camco Global

About 10 years ago, while director of environmental affairs at Murphy Farms (read, lagoon guy) I remember getting a call from a gentleman at Cantor Fitzgerald atop the World Trade Center in New York City. He told me about the notion of a carbon market, yet to be established but on the horizon, in theory what a carbon credit is and why carbon may have value. He expressed interest in securing the rights to the potential carbon credits that could be created by capturing and destroying the methane emissions from our hog lagoons. I wish I could say that I embraced his vision of the future opportunity. I did not. I was extremely skeptical and rather dismissive of what I considered to be "blue sky or hot air" thinking.

Fast forward to now and I am obviously betting my career path on the reality of a hot opportunity for animal agriculture to mostly benefit from the emerging carbon conscious consumer and economy. History will prove that this gentleman from Cantor Fitzgerald was probably right.

First, the lay of the land:
Long-running trends in global animal agriculture have been responsible for achieving enormous gains in efficiently producing animal food products. These trends include: greatly expanded pork, beef, milk, chicken and turkey production; increased per capita consumption of meat; fewer and larger animal operations, resulting in greater efficiencies; specialized farms spawned by new technologies and best management practices; dramatic growth of contract farming; and increased concern about the environmental impact of concentrated production.

While these trends in animal agriculture have greatly improved production of affordable food products, they also have brought about numerous challenges in manure management and no industry has been more critiqued or proactive than the pork industry. At the same time, there are emerging opportunities for realizing value from the conversion of manure into energy (electricity and renewable fuels) and marketable environmental attributes such as carbon credits.

Conventional manure management

As most types of livestock farms (except for beef) moved to indoor production, manure capture and treatment systems have evolved from letting the manure run into the creek, aided by storm water runoff, to complete storage or storage and treatment systems, especially for wet manure systems.

Land application of manure is still the norm where the primary nutrients found in manure (nitrogen and phosphorus) are used as an organic fertilizer for row crops and hay. Continual advances have been made in best management practices and tools for land application of manure. While the vast majority of systems are properly designed, constructed and managed, mismanagement can lead to environmental mishaps such as overflowing or burst lagoons and basins or runoff from over-application. These isolated incidents have driven pubic outcry, media coverage and legislation in many animal ag intensive states. In fact, in 1997 the state of North Carolina issued an ongoing moratorium on any new hog farms that use the lagoon and sprayfield system to treat manure. Obtaining permits for building new facilities has proven to be very controversial in most of the US. The threat of lawsuits and increased costs has made new hog facilities nearly impossible in many cases.

In addition to water-quality concerns, animal production practices in the US affect local, regional and global air quality through the emission of nitrogen (ammonia), sulfur, volatile organic compounds, particulate matter and odors. Each year in the US manure management contributes almost 2 million metric tons of methane to the atmosphere, which has a global warming potential equivalent to 40 million metric tons of carbon dioxide (US Environmental Protection Agency, 2006). Over 80% of these greenhouse gas (GHG) emissions come from dairy and swine lagoons.

The pork, poultry, layer, turkey and dairy industries have entered into a Consent Agreement with the EPA to monitor air emissions from sample farms for a two-year period which began in 2007. The purpose is to accurately determine emissions and formulate emission factors so that operations can determine whether they are in compliance with US Clean Air Act emission limits. Several tack on studies to the Consent Agreement are measuring greenhouse gas emissions from animal production operations.

Environmentally superior technologies

Because of concerns with conventional manure management systems, especially in the pork industry, over the last

ten years there has been considerable public and private research and development dollars and effort devoted to developing what is commonly referred to as environmentally superior technologies (EST) to replace the traditional means of storing and treating liquid manure.

Many technologies attempt to reduce or eliminate odor, ammonia (nitrogen), phosphorus and pathogens present in manure using biological, chemical and/or mechanical processes. To date, most systems that have been developed are extremely expensive and uneconomical and, in most cases, quite complicated to operate. Therefore the very limited implementation on farms to date has most often involved grant money available for demonstrations.

Some EST systems have focused on converting manure into energy using energy recovery systems such as ambient temperature or heated digesters. Lagoon covers, though, have the advantage of being a simple, well-understood and relatively low-cost technology that takes advantage of extensive existing investment in manure treatment and storage infrastructure. In this system, lagoon emissions are captured and collected under an impermeable cover, conveyed through a gas handling system, and destroyed through combustion in a flare, boiler or electrical generator commonly known as a genset. However, lagoon covers by themselves have traditionally provided no opportunity for economic return and, as a result, their cost made them impractical.

Up until now, using ESTs on a commercial scale has been both high-risk and high-cost, with many more failures than successes. But that is slowly changing due to more favorable economics associated with the value of electricity in some states, the overall high cost of energy and the increasing value of carbon credits.

Carbon credits

A carbon credit is a metric ton of carbon dioxide equivalent that, to be tradable, must be a quantified, verified and certified emission reduction of a greenhouse gas. The market for trading of carbon credits is the result of growing concern over global climate change; specifically, the warming of Earth's surface and the overall negative consequences that global warming can have for mankind. This is usually referred to as the greenhouse effect.

When sunlight reaches the surface of Earth, some of it is absorbed and warms the Earth. Because the Earth's surface is much cooler than the sun, it radiates energy at much longer wavelengths than the sun. Some energy in these longer wavelengths is absorbed by greenhouse gases in the atmosphere before it can be lost to space. The absorption of this energy warms the atmosphere. Greenhouse gases also emit energy both upward to space and downward to the surface. The downward part of this radiation emitted by the atmosphere is the "greenhouse effect.",

Greenhouse gases are components of the atmosphere that contribute to the greenhouse effect. Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Certain human activities such as industry, transportation and agriculture, however, add to the levels of most of these naturally occurring gases. The increased levels are thought to be responsible for the warming of the Earth.

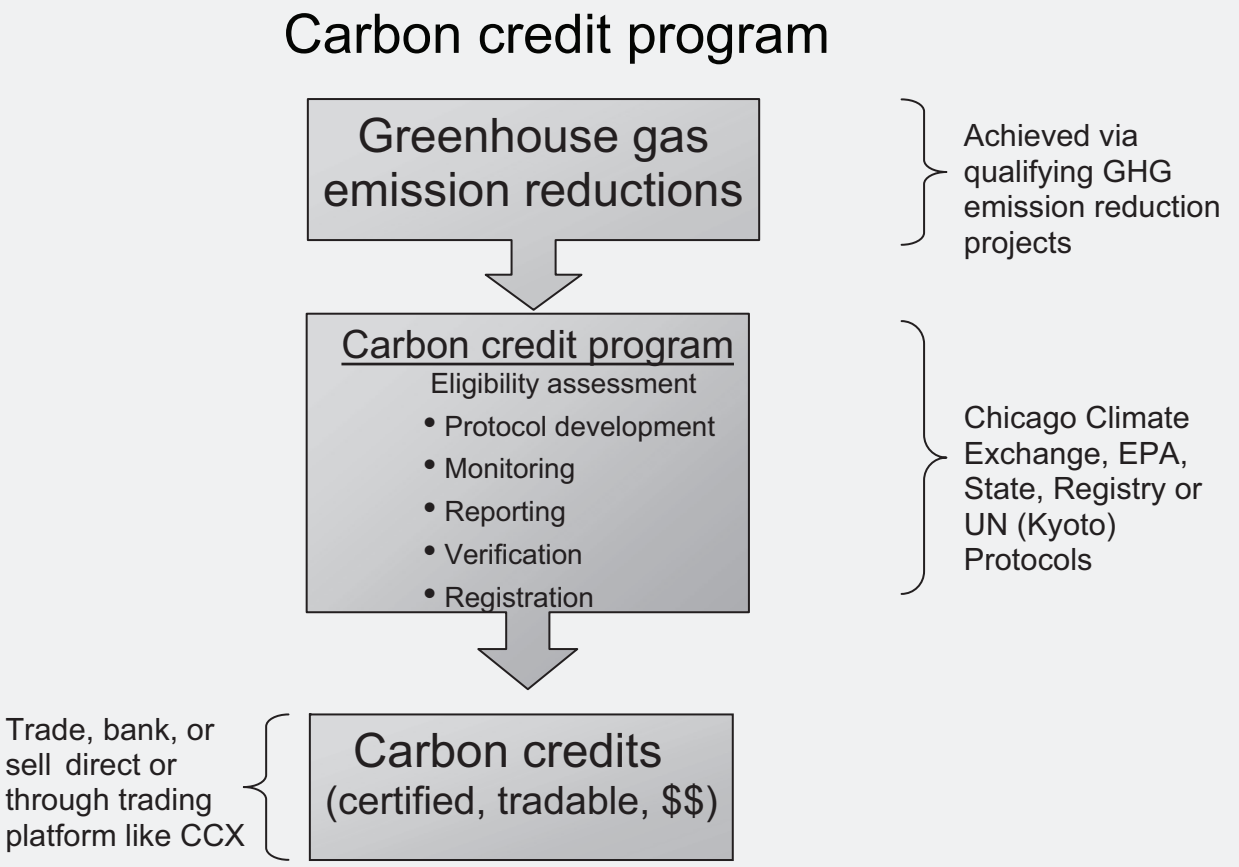
Carbon dioxide, methane, nitrous oxide and three groups of fluorinated gases are the subject of the Kyoto Protocol which went into effect in 2005. The Kyoto Protocol is an agreement made under the United Nations Framework Convention on Climate Change (UNFCCC). Countries that ratify this protocol commit to reduce their emissions of carbon dioxide and five other greenhouse gases 6% by 2012 from a 1990 baseline level. The Kyoto Protocol now covers more than 160 countries globally and over 55% of global GHG emissions. The United States is not a signatory nation due to concerns about the impact the emissions reductions would have on economic activity. However in the absence of federal regulations there are both state and regional regulatory programs like California's Assembly Bill 32, the Western Climate Initiative and the Regional Greenhouse Gas Initiative (RGGI) covering GHG emissions from utilities in northeastern states. In addition, there are voluntary programs in the US such as the Chicago Climate Exchange (CCX). There is increasing public pressure for a cap and trade system with both presidential candidates in favor of a cap and trade system of federal regulations to cut GHG emissions. Legislation (Lieberman-Warner Act) was introduced in the Senate in 2008 and while it did not pass, proposed legislation will surely be high on the agenda of the next Congress and most DC insiders predict passage of federal regulations curbing GHG emissions for the major emitting sectors of the economy.

Markets for trading of carbon credits came about so that industrial emitters and governments can efficiently (at a lower cost than implementing control technology) satisfy a portion of their Kyoto Protocol requirements (cap) or meet voluntary reductions, as in the US Credits are generated in many ways but, as it pertains to animal agriculture, are produced through the capture and combustion of biogas (methane) emitted from animal manure management systems in developing countries (for Kyoto Protocol) or in the US (for voluntary programs). Greenhouse gases such as methane are converted into CO^2 equivalents for trading purposes. Methane has 21 times the global warming potential of CO^2.

Only recently in the US, with the emergence of legislative initiatives such as "renewable portfolio standards" and new environmental markets have producers been able to: 1) receive a premium for electricity created from methane combustion and 2) quantify and place a monetary value on emission reductions created by changes in manure management practices.

Both the United Nations Clean Development Mechanism ("CDM") abroad and the CCX in the US have developed

Figure 1



protocols to register and issue tradable carbon credits to projects employing anaerobic digesters, including simple lagoon covers.

This growing market represents a new and reliable source of revenue and environmental benefits for farmers and agricultural landowners. In 2007 approximately 832 million metric tons of CO^2 equivalents, with a dollar value of more than $13.4 billion, were traded in international markets (PointCarbon, 2008). The average wholesale price for a carbon credit in the compliance market was approximately $16.

In the voluntary market, 65 million metric tons of CO^2 equivalents were traded in 2007, worth about $265 million (Point Carbon, 2008). The average wholesale price of a carbon credit was about $6. This is a tripling of volume and value from 2006. The market is forecast to grow dramatically as the US transitions to a compliance market and is estimated to be a trillion dollar market in the US alone by 2020, thus the price of carbon is expected to increase significantly as demand increases.

The rough rule of thumb is that the capture and destruction of methane from a hog lagoon generates about 0.4 metric tons of CO2 equivalent per finishing hog space per year. Current prices for carbon are not driving technology onto the hog farm. As carbon prices increase, the likelihood of using technologies that capture and destroy methane also increase.

While the potential for capturing value from manure by generating energy and carbon credits is significant, emerging carbon markets and standards are new in the US and not yet well understood by farmers, technology providers and the agricultural financial community. Several barriers, including uncertain transaction costs, small quantities of benefits for some farms, performance risks and liability, new and uncertain markets, and poor information, may reduce the impact of these incentives and slow the adoption of technologies that may otherwise benefit from environmental markets. But as long as lagoon covers and digesters are not required by law and animal agriculture remains exempt from GHG regulations, implementation of these technologies should benefit from the sale of carbon credits.