Agriculture

Methane is produced and emitted from the decomposition of livestock and food processing wastes (LFPW) that are stored or treated in systems that promote anaerobic conditions (e.g., liquids or slurries in open lagoons, ponds, tanks, or pits). Reducing methane emissions from LFPW management, however, can yield substantial economic, environmental, and energy benefits. In the agriculture sector, implementing anaerobic digestion (AD) technology can lead to improved air and water quality, odor control, improved nutrient management, reduced GHGs, and the capture and use of biogas—a source of clean, renewable energy.

237 MMTCO$_2$E

estimated LFPW emissions in 2010

In 2010, global methane emissions from LFPW management were estimated to be nearly 237 MMTCO$_2$E, which is almost 4 percent of the total global anthropogenic methane emissions.[11] Over the next decade, methane emissions from LFPW are projected to increase by more than 11 percent, thereby providing significant potential for methane recovery from the LFPW sector.[12]

Through GMI, the United States invested more than $725,000 in 2010 to help advance the recovery and use of methane at agricultural operations internationally. Many of the supported activities will continue to lead to methane emission reductions in future years. Some of these activities are presented in this section.

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[11] U.S. EPA, 2011.

[12] Idem.

Identifying Project Opportunities Through Resource Assessments

The United States has continued to support a strategic approach to reducing methane from the LFPW sector. As a first step, the United States assists in developing country-specific resource assessments (RAs), which help to identify and rank the LFPW sectors and sub-sectors where emission reductions can be achieved. In 2010, EPA finalized RAs for four GMI Partner Countries: Brazil, Ecuador, Mexico, and Vietnam. Based on the RAs performed to date, more than 50 $MMTC0_2E$ could be reduced by implementing AD systems in the LFPW sector (see Table 2).

Table 2: Emission Reduction Potential from AD Implementation

Country	Total Carbon Emission Reductions ($MTCO_2E$/yr)
Argentina	2,274,700
Brazil	20,313,300
Colombia	1,241,700
Ecuador	386,500
India	5,716,100
Mexico	14,785,600
Philippines	2,553,800
Thailand	4,956,000
Vietnam	1,420,300
Total	**53,648,000**

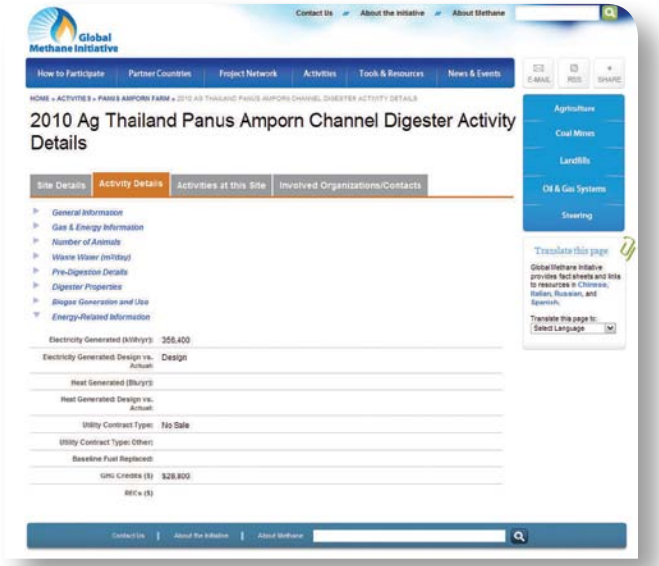
Additionally, EPA supported the development of a report titled *"Barriers and Constraints to Implementation of Anaerobic Digestion Systems in Swine Farms in the Philippines,"* which analyzes methane-reducing project development barriers faced by household- and commercial-scale pork production in the Philippines. The report is based on stakeholder interviews with lending institutions and project developers, data review, and communications with key experts and farm owners. This report is an important step in the development of a sustainable program to increase AD utilization in the Philippine swine sector.

Developing an International AD Database

EPA has begun developing an international database that will provide general information on the types and scale of operating AD systems in GMI Partner Countries. The database will track and report important project-specific information about each digester, such as:

- Agricultural Subsector
- Project Scale
- Digester Type
- Energy Production
- Methane Reduction

In 2010, EPA worked with Partner Countries to create a standardized data collection template that will streamline this process and ensure that the database presents quality information to its users.



Beta version of International AD Database.

Expanding the Agricultural Sector in Thailand

Through the Division of Livestock Development in Thailand, EPA project support has expanded to explore methane reduction opportunities in the wet market waste sector.[13] The purpose of this sector expansion is to identify upstream methane-reducing options for these wastes before they are deposited in landfills. Based on the results of the Thailand RA, wet market waste is one of the sectors with large methane emission reduction potential. The analysis, which consists of characterizing waste handling and management across all wet markets in Bangkok, identifies and ranks various opportunities according to economic and operational merits. Examples of these opportunities include active and passive composting systems, vermiculture, AD, and other methane-reduction processes. The overall project objectives are to identify potential demonstration projects and to apply the analytical approach to rural areas in Thailand as well as other GMI countries. Some key findings to date include:

- In 2007, Thailand generated approximately 15 million metric tons of municipal solid waste (MSW). Wet market waste was estimated to represent about 9 percent of MSW. Therefore, potential reductions could be realized from the organic fraction of more than 1 million tons of waste.
- Methane emissions from Bangkok's wet market waste management (primary solids collection and landfill disposal) were estimated at 49,250 metric tons of methane per year, or approximately 1 $MMTCO_2E$ per year.[14]

EPA has also been assisting Thailand in reducing methane emissions from swine farms. Swine farming is a major subsector of Thailand's livestock industry. As of December 2008, Thailand had approximately 8.5 million pigs and hogs managed through a combination of "standard" commercial farms (about 3,400 operations representing 60 percent of the industry) and nonregistered commercial and backyard farms (totaling more than 200,000).

Sludge drying bed at Thailand's Kanchana Farm.

Thailand began working with GMI to reduce methane from swine farms in three provinces near Bangkok in 2010. Continued support from GMI, the World Bank's Global Environmental Facility (GEF), and Thailand's Department of Livestock Development and Energy Policy and Planning Office, resulted in nearly 60,000 $MTCO_2E$ of methane emission reductions in 2010 from more than a dozen swine farms—raising approximately 200,000 pigs total—that converted from open lagoons to biogas systems (e.g., Kanchana Hybrid Farm in Ratchaburi Province).

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[13] Wet market wastes are found in open markets in developing countries and consist of spoiled vegetable, meat, fish, and other perishable organics sold through these types of markets, which are typically disposed of in landfills.

[14] Based on IPCC's default method for solid waste disposal.

Continuing Methane Reducing Efforts With the World Bank

GMI's agricultural sector continues to work with the World Bank in other countries to provide technical support to reduce methane emissions from agricultural sources, improve living conditions, and increase the rate of economic development in rural areas. The main emphasis of this partnership is to develop a country-specific programmatic framework that enables project development. In 2010, EPA continued to support activities in Vietnam, China, the Philippines, Mexico, and Thailand—often through a *Program of Activities (PoA)*—to reduce carbon emissions from the LFPW sector.

The Philippines, for example, has used the *PoA* approach as the primary basis for developing an advanced program in the household- and commercial-scale pork sectors.[15] This approach has been responsible for the development of a number of household- and large-scale methane recovery projects using various types of AD systems.

An assessment of national capacity demonstrated a need for affordable delivery and maintenance of methane-reducing technologies in the Philippines. Therefore, in consultation with Philippine partners, EPA planned a series of hands-on trainings to transfer methane recovery and gas use technologies that had been used effectively in similar GMI projects around the world. In 2010, Philippine partners identified a select group of approximately 30 individuals in the government and private sectors to receive training on AD and the PoA as the first phase of a multi-year project. EPA conducted the first of a series of trainings for this group on AD technologies for small and large farms, gas utilization technology, techniques for conducting farm feasibility assessments, and estimating energy production and emission reduction potential, followed by a hands-on training for the group on construction of household-scale ferrocement fixed dome digesters. The partnership between GMI and the World Bank allowed the organizations to leverage resources at a ratio of about $1:$8 and provides an excellent model that could be replicated in other developing countries that are members of the Initiative.

Stacked fixed dome digester construction at Nueva Vizcaya, Philippines.

[15] Mexico has also used this approach to expand the use of AD in the pork sector.