



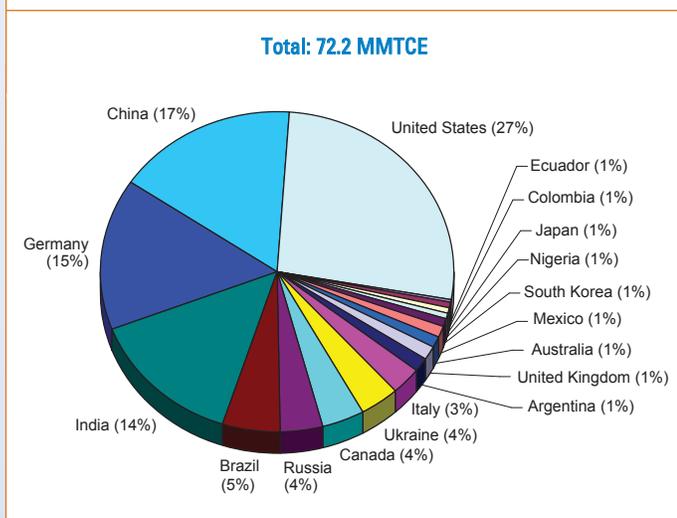
# Managing Animal Waste to Recover Methane International Opportunities for Project Development

**M**ethane is both the primary constituent of natural gas and a potent greenhouse gas when released to the atmosphere. Reducing methane emissions can yield substantial economic, environmental and energy benefits. In the agriculture sector, the implementation of anaerobic digestion technology can lead to improved air and water quality, odor control, improved nutrient management, a reduction in greenhouse gas emissions, and the capture and use of biogas—a source of clean, renewable energy. The Methane to Markets Partnership is building public and private sector alliances to advance the recovery and use of methane at livestock manure management operations around the world.

## BACKGROUND ON GLOBAL EMISSIONS

Methane is produced and emitted during the anaerobic decomposition of organic material in livestock manure. Globally, livestock manure management contributes approximately 72 million metric tons carbon equivalent (MMTCE) of methane emissions, roughly 4 percent of total anthropogenic (human related) methane emissions. Three groups of animals account for more than 80 percent of total emissions: swine (40 percent); non-dairy cattle (20 percent); and dairy cattle (20 percent). In certain countries, poultry is also a significant source of methane emissions. Figure 1 presents methane emissions from livestock waste for Partner countries.

**Figure 1: Methane Emissions From Livestock Manure Management in 2005**



While current estimates indicate that developed countries account for the largest percentage of total methane emissions, emissions from developing countries are substantial, and their share of emissions is expected to rise along with industrialization and population growth. The key factors driving methane emission increases in the developing world are the growth in livestock populations necessary to meet the expected worldwide demand for dairy and meat products and the trend toward larger, more concentrated commercialized livestock management operations. These larger and more intensive operations typically utilize more liquid-based manure management systems, which produce higher methane emissions.

## RECOVERY AND USE OPPORTUNITIES

Methane released from liquid manure management systems can be captured and used as a clean energy source to produce electricity, heat, or combined heat and power; in fuel gas-fired equipment such as engines, boilers, or chillers to meet a portion of the farm's energy requirements; or simply flared. Project development in this sector can help to reduce greenhouse gas emissions and provide alternative energy sources while also providing opportunities for agricultural diversification and wider environmental benefits.



**Covered Anaerobic Lagoon**

Techniques for recovery include covered anaerobic lagoons, plug flow digesters, complete mix digesters, and small scale digesters. The waste handled is in the form of liquid, slurry, or semi-solid, depending on the system design requirements. The

following are brief descriptions of conventional anaerobic digestion technologies:

- Covered anaerobic lagoons are constant volume reactors that can be operated at ambient temperatures. Manure is treated under anaerobic conditions producing methane, which is recovered by using impermeable floating lagoon covers and applying negative pressure.
- Complete mix digesters are heated digesters constructed of concrete or steel designed to enhance anaerobic decomposition and maximize methane recovery.



## Methane to Markets

- Plug flow digesters are heated systems that operate at a constant temperature year round, producing stable gas flows that support gas-to-energy applications in all climates.
- Small-scale digesters are small-scale versions of the above three types and are well suited for smaller farms in regions with technical, capital, and material resource constraints.

Anaerobic digestion can be cost-competitive when compared to conventional waste management practices. These systems can have payback periods of three to seven years when energy gas uses are employed as opposed to conventional waste systems, which do not pay back and represent sunk costs to the farm enterprise. In short, current technology offers a wide range of opportunities to abate livestock manure methane emissions at no cost or even while generating an alternative income source. Digesters also provide water quality benefits, by significantly decreasing or eliminating the run-off of animal wastes into water bodies and groundwater recharge areas, which is a growing concern in many parts of the world.

### ISSUES FOR PROJECT DEVELOPMENT

Although there are several effective ways to reduce methane emissions in the agricultural sector, there are also several important issues to consider for successful project development. Some of these include:

- Recognizing anaerobic digestion systems as a core business opportunity and directing available capital towards methane reduction projects.
- Providing valid information on and access to the many available commercial management practices.
- Ensuring that technologies appropriate to the local climate and waste handling method are used. In general, ambient temperature systems such as lagoons and fixed domes for farms are the preferred technologies for latitudes between 30 degrees north and 30 degrees south. Alternatively, heated systems such as plug flow digesters are better suited for latitudes above 30 degrees north and below 30 degrees south.

Addressing these important issues and facilitating project development in the agricultural industry is a primary focus of the Methane to Markets Partnership. The Partnership will work to overcome barriers to project development by:

- Engaging the livestock industry to improve awareness of methane reduction opportunities through anaerobic digestion techniques.
- Facilitating and enhancing the application and broad adoption of methane reduction technologies and management practices.

- Improving and facilitating access to capital to support project investment.
- Cooperating with Partners to improve markets and provide legal and regulatory frameworks that encourage project development.

### Case Study: The Global Environment Facility in China

In China, methane emissions from livestock manure contribute 10.4 percent of the country's total human-influenced greenhouse gas emissions. Beginning in 2006, the Global Environment Facility, through the World Bank, will provide a \$7 million grant over five years to support a comprehensive approach to reduce the significant environmental and health damage from increasingly concentrated livestock production. The proposed project (involving China, Thailand, and Vietnam) will integrate policy development and implementation, technological solutions and capacity building, and regional connections. The project will receive technical support from the United States Environmental Protection Agency. Its global environmental objective is to reduce livestock-induced, land-based pollution and environmental degradation of the South China Sea.

The grant will provide on-the-ground demonstrations of innovative, cost-effective livestock waste management technologies by private livestock producers. A successful project in China will be replicated within the country and in other countries with similar industrial practices and contribute to the protection and sustainability of one of the world's most biologically diverse regions.



**Small-Intermediate Scale Digester**