Animal waste: Future energy, or just hot air?

- Story Highlights
- Livestock globally produce 13 billion tons of manure a year
- One cubic foot of biogas can be produced from one pound of cow manure
- Biomass market growing 25-35 percent a year

By Rachel Oliver
For CNN

(CNN) -- While the meat-producing community is often condemned for its contribution to climate change, some observers of late have become as interested in what the animals expel as the animals themselves: Manure.

Manure, when properly processed, can provide a reliable and clean source of electrical and heat energy. And as there is so much of it, many are pinning their hopes on it as the latest new renewable energy source, leading the New York Times to recently suggest it could be "the ultimate renewable source of fuel."

According to the United Nations' Food and Agricultural Organization (FAO), there are about 1.3 billion cattle worldwide (one for every five people), slightly more than 1 billion sheep, around 1 billion pigs, 800 million goats and 17 billion chickens.

Between them, they produce a lot of fecal matter -- around 13 billion tons of it a year, according to various estimates.

Within that matter is 55 percent to 65 percent methane, which when released into the atmosphere is bad news for us (it traps heat at 23 times the rate that carbon dioxide does) -- but when burned is another matter entirely. It gives us energy.

According to Ecofriend, one cubic foot of biogas can be produced from one pound of cow manure (heated at around 28 degrees Celsius, or 82.4 degrees Fahrenheit). That, it says, is enough to cook one day's worth of meals for four to six people in India. One cow in one year can produce enough manure, which when converted into methane can match the fuel provided by 200 liters-plus (about 53 U.S. gallons) of gasoline, it adds.

Around 7,500 cattle can produce 1 megawatt (MW) of electricity (1MW can power the average home in the developed world), according to the University of Alberta, Canada. The university also says it would take all of the manure of 6 million cows to fulfill the needs of 1 million homes -- or about six cows per home.

Dangers from untreated manure

It's about time those cows and pigs started giving back, say some environmentalists. In 2006, an FAO report called the global livestock sector "one of the top two of three most significant contributors to the most serious environmental problems at every scale." Livestock rearing was responsible for 18 percent of global greenhouse gas emissions, it said, putting it easily ahead of the transportation sector in the list of environmental villains (which emits around 13 percent of global emissions).

Livestock produces 9 percent of human-induced carbon dioxide (CO_2); 37 percent of all human-induced methane (CH_4); and 64 percent of ammonia, which is tied to acid rain. It also generates 65 percent of human-induced nitrous oxide (N_2O), which the FAO says has 296 times the global warming potential of CO_2. ("Most of this comes from manure," it says.)

Despite the fact that manure can have many positive uses, such as fertilizing crops and enriching the soil, when left untreated and in large quantities (where there is too much manure for the land available), it can have a number of unpleasant effects, too. According to the FAO, the manure coming from industrial scale livestock operations in the developing world have already been found to be responsible for:

- "Leaching of nitrates and pathogens into groundwater";
- "Oversupply of nutrients that damages soil fertility" (the FAO says that in many parts of Asia as much as 25% of all the crop areas have already suffered from "significant nutrient overloads" such as excess phosphorous);
- "Destruction of fragile ecosystems such as wetlands, mangrove swamps and coral reefs."

One of the most potent effects of leaving animal waste untreated is when run-off gets into the water supply, causing eutrophication, which essentially is when rivers and streams are starved of oxygen. And some of the worst kinds of waste for causing this kind of damage come from Confined Animal Feeding Operations (CAFOs) -- otherwise known as factory farms. (More than 50 percent of Europe's water pollution has been traced to run-off from mass farming operations, according to the Swiss Union for Vegetarianism).

Feed-lots can produce waste that is "ten to several hundred times more concentrated than raw domestic sewage," according to Canada's Animal Alliance. When such waste seeps into the water supply "the results can be and frequently are catastrophic," the organization said.

Turning manure into power or fuel, therefore, has got many people excited and has produced an international biogas market that has experienced growth rates of as much as 25 percent to 30 percent a year, attracting $100 billion in investment in 2006 alone, according to the San Francisco Chronicle. And the potential market for manure gas is the equivalent of 250 million barrels of oil a year, reports the Reuters news service.

Biogas takes off

There are basically two ways to turn manure into energy (called biogas or biomass): Biodigestors and bioreactors, the latter being much faster, but more energy intensive (often using the energy it produces to power its own operation).

Biodigestors use a process known as anaerobic digestion (AD) and it effectively expands manure's usefulness fourfold. Farmers using AD on animal waste can provide themselves with methane gas for heat and power; liquid waste for fertilizer (removing the need for petrochemical-produced, environmentally- damaging fertilizers), fibrous matter for animal bedding; and waste heat to warm their homes (and barns).

According to carbon-offset program Terrapass, if all the uncovered manure lagoons in the United States were fitted with methane digestors, it would have the effect of taking more than 10 million cars of the road a year. (That's based on its own estimate that manure is emitting 40 million tons of CO_2-equivalent methane a year).

The world leader in biogas is Germany, with 70 percent market share, producing 1,100 MW of electricity from biogas in 2006, enough to power 1 million homes, reports Reuters. But the world's biggest biogas plant is in Gothenburg, Sweden, which is said to be able to produce as much as 1,600 cubic meters of biogas an hour, according to The Ecologist.

Sweden plans to build 200 new biogas stations during the next couple of years, which it expects will save the country 50,000 tons a year in greenhouse gas emissions and will save it 35 million liters of gasoline at the pumps, reports The Ecologist. Biogas has taken off in a big way in Sweden, with sales of biogas cars soaring 49 percent in 2005.

Some countries are keener on the prospects of biomass than others. According to The Ecologist quoting a study by the UK's Institute of Science in Society (ISIS), 11.7 percent of the UK's energy needs could be met by converting the country's 88 million tons of waste via AD. It could also save the country 15.8 percent of its CO_2 emissions; power 50 percent of its transportation needs; and cut transportation-related emissions by 50 percent.

Success in the developing world

The U.S.-based Sierra Club, however, doesn't hold much hope for biomass. It believes that AD manure has limited potential in the U.S., pointing out that even if all the 7,000 farms in the U.S. cited by the EPA as "good candidates" for AD were to use the technology, they could only produce 0.0002 percent of all energy consumed in the country today.

Proponents of biogas say that using waste products is far more preferable than biofuel since it steers clear of the "food crops v. fuel crops" dilemma. They also favor the fact that biogas negates the need for chemical fertilizers, since natural fertilizer is a by-product of the AD process, which means even more benefit in terms of greenhouse gas emissions (in the UK chemical fertilizers are responsible for 14 percent of greenhouse gas emissions according to The Ecologist).

But its opponents say manure does not have enough energy in it to be cost-effective, and the only way they can work on a large scale is to pour large quantities of public money into it. Some countries find this prospect more appealing than others.

A recent New York Times Op-Ed cited a study by the University of Minnesota that found that "methane digestors are dependent on big subsidies to break even" and "electrical rates would have to double to pay the full cost of digestors." Why? Because you have to build the digestors in the first place and then run them, which means only industrial-scale operations can afford to run them, which the op-ed warns would be a catastrophe for small farmers, pushing "family farms further toward the brink of extinction."

The Sierra Club appears to agree, pointing out that due to its lower energy density to traditional fuels such as natural gas, storing and transporting it can become an issue. But the ultimate factor deciding the success or failure of biomass -- non-government subsidized biomass operations anyway -- is money.

The places worldwide where biomass has found real success has been in the developing world. The UK's Institute of Science in Society (ISIS) in a 2005 report praised biogas as "a major boon for Third World countries," largely because, "biogas plants do not require big capital to set up".

Sri Lanka, for example, satisfies a whopping 45 percent of it's energy needs from biomass, while around 85 percent of Nepal's fuel comes from biomass, according to ISIS.

The kicker? "[Nepal's] biogas program would not have been possible if the users had not received subsidies."

(Sources: New York Times; United Nations' Food and Agricultural Organization; Ecofriend; University of Alberta; Swiss Union for Vegetarianism; Animal Alliance Canada; San Francisco Chronicle; Reuters; Terrapass; The Ecologist; Sierra Club; Institute of Science in Society)

Find this article at:
http://www.cnn.com/2008/WORLD/asiapcf/01/07/eco.about.manure/index.html?iref=allsearch

☐ Check the box to include the list of links referenced in the article.