

# Combustion from cattle waste: harvesting the energetic potential of manure

What can be done to manage the millions of tons of animal excretion produced every day on farms? In a recent study published in *Waste Valorization*<sup>1</sup>, authors J.J. Chávez-Fuentes et al. examine real-world data to determine the global potential for capturing valuable biogas from manure.

## Who could benefit from biogas capture?

Reducing and recycling household waste are daily habits for people trying to reduce their environmental impact, but humans make up only a fraction of waste-producing organisms. The farm animal population outnumbers humans by more than three times, and every day livestock produces an estimated 15 million tons of manure that must be processed and disposed of or used. By recycling such waste to produce biogas, a methane-rich product of anaerobic digestion, farmers have an opportunity to become more self-sufficient and conserve their resources, even if not every farm has the same potential to benefit from this practice. Researchers from the Slovak University of Technology in Bratislava, Slovakia examined the intersection of a country's livestock species, culture, and infrastructure to estimate the biogas production potential of more than 200 countries. They find that most countries could produce more than 100,000 Nm<sup>3</sup> (*Normal cubic meter*, the volume of gas under 1.0 atmosphere of pressure at 0° Celsius) of biogas per day, with some countries even positioned to exceed 1 million Nm<sup>3</sup> per day. The resulting biogas can be used for many applications, serving as a combustion fuel in the place of propane or natural gas, which consists largely of methane. Biogas pioneers in Sweden have even purified it for use as a clean fuel in automobiles<sup>2</sup>, demonstrating the valuable resource contained in animal waste.

## All manures are not created equal

Different livestock species, such as cattle, chickens, goats, or horses, have both specific diets and varying capabilities to absorb essential nutrients. As a result, they produce manure with vastly different characteristics. The manures of both pigs and chickens have relatively high potentials for producing biogas, with 495 and 425 liters of biogas possible per kilogram of organic matter, respectively. In contrast, the manure of cattle can make only 295 liters of biogas per kilogram of organic matter. Despite this, cattle represent the greatest potential for biogas production worldwide, due in large part to their abundant production of a useful type of manure. For example, in 2015, there were 22% more head of cattle than sheep worldwide, but these cattle produced a disproportionate 126% more organic matter than the sheep did. Integrating these data with information on water, sanitation, and transportation infrastructure for any

particular country allowed the authors to estimate its biogas potential. Larger countries tend to have a greater opportunity for production, with Brazil, China, and the United States each capable of producing over 1 million Nm<sup>3</sup> of biogas each day.

### Additional benefits

Aside from combustible fuel savings, anaerobic manure digesting systems also offer less quantifiable benefits. The comprehensive report, *Methane Recovery from Animal Manures, The Current Opportunities Casebook* (1998)<sup>3</sup>, cites several farmers who report the reduction of odor and flies as positive side-effects of capturing biogas. In addition to containing offensive smells, these sealed systems also prevent the escape of methane, a gas estimated to exhibit 25 times the global warming power of carbon dioxide. Since livestock manure is the source of up to 40% of human-originated methane released each year, further implementation of biogas recovery systems can help preserve the Earth's atmosphere while saving money and resources for farmers willing to invest in this promising technology.

1. Chávez-Fuentes, J. J., Capobianco, A., Barbušová, J. & Hutňan, M. Manure from Our Agricultural Animals: A Quantitative and Qualitative Analysis Focused on Biogas Production. *Waste Biomass Valorization* 8, 1749–1757 (2017).
2. Vanciu, G. A. & Miresashvili, N. Biogas cars in Sweden: An emerging market. (2012).
3. Lusk, P. Methane recovery from animal manures the current opportunities casebook. (National Renewable Energy Lab., Golden, CO (US), 1998).

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