WASHINGTON STATE UNIVERSITY
EXTENSION

ANAEROBIC DIGESTION OF AND NUTRIENT RECOVERY FROM MANURE AND FOOD WASTE

BY THE NUMBERS

- Anaerobic Digestion technology has been installed on 22 dairies in WA, ID, and OR, representing 104,000 wet cow equivalents and 161 tons per day food waste.
- Delivered 20 invited oral presentations at multiple regional and national conferences related to organics and manure management and overall sustainability.
- Processing 15 Extension peer-reviewed fact sheets as part of an AD systems manual.

2016

ISSUE

Certain atmospheric gases, including carbon dioxide, methane, and nitrous oxide, are known as greenhouse gases because of their impacts on earth's climate. These gases enter the atmosphere through a number of natural processes. A total greenhouse gas impact can be calculated from all of the known gaseous releases and their known relative strengths, and is reported in million-metric tons of carbon dioxide equivalents (MMT CO_2e).

Approximately 6% of Washington's annual emissions are a result of agricultural activities, with livestock producing nearly half of those direct greenhouse gas emissions. The state's large dairy industry is a considerable contributor, with a cow's enteric respiration and manure decomposition resulting in significant methane releases, a potent (21 times that of carbon dioxide) greenhouse gas.

Anaerobic digestion (AD) technology can dramatically reduce greenhouse gas emissions by capturing and utilizing methane that otherwise would be released from manure and other organics during their storage and disposal. Estimates suggest that roughly 1 MMT CO_2e could be mitigated annually in Washington through the application of AD technology on our dairies, assuming: installation on 40 of our larger dairy farms, totaling 70,000 cows or 30% of state inventory; co-digestion of the manure with an extra 15-20% by volume of off-farm organics diverted from landfills and other non-beneficial disposals; and use of produced electricity to offset production from coal power plants. This mitigation amounts to 1% of total Washington emissions and 18% of the state's agricultural emissions. AD is a core technology that can be utilized within a larger system of technologies not only to mitigate greenhouse gases, but also to resolve additional and important environmental issues related to nutrient management and their impacts on air quality and surface/groundwater quality. Realization of these AD systems on the 40 dairies would result in even more greenhouse gas savings as well as far more sustainable use of manure nutrients within a watershed.

RESPONSE

A field-day event, held in Lynden, Washington, on July 9, 2016, featured a summary of the applied research and technology demonstrations that have been developed over the last decade in pursuit of an AD system vision for on-farm manure and organics management, and demonstration of dairy system modeling and economic decision support tools. In conjunction with the field day, a companion video was completed, and an AD systems manual is near completion, both summarizing the AD system vision.

For more information, please contact Chad Kruger, Director of the Washington State University Center for Sustaining Agriculture & Natural Resources, 1100 N. Western Ave., Wenatchee, WA 98801, call: 509-663-8181 Ext. 242 or email: **cekruger@wsu.edu**.

QUOTES

“Washington State University’s anaerobic digester research has had a tremendous impact on the digester industry. They have produced relevant research that has led to real technologies and solutions that have seen implementation into current operating systems. Washington State University has been a wonderful resource and research partner for us.” - Bryan Van Loo, Regenis

"It gives us the diversification, to have more than one item to sell, and also helps us control the nutrients, the manure, and that sort of thing." - Steve Vander Haak, dairy farmer

PHOTO CREDITS

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Outreach continues and has been intensified through:

- Establishment of an experiment evaluating the use of fertilizer products recovered from digested manure for food safety, agronomics, and nutrient management in raspberry and blueberry production systems.
- Development of a new Center for Sustaining Agriculture and Natural Resources (CSANR) website with pages dedicated to waste management and renewable energy, and AD research, efficiently linking and making available CSANR information and materials within these research and Extension areas;
- Delivery and online availability of an AD Technician curriculum in partnership with Bellingham Technical College;
- Completion of extensive literature reviews for a national audience on nutrient recovery technology (report to Innovation Center for U.S. Dairy), compost odor management (report to Washington State Department of Ecology), and air/water emissions from animal manure management (report to EPA);
- Completion of dozens of bio-methane potential and anaerobic toxicity assays on behalf of AD industry members and partners interested in resolving digester performance concerns, or for project development;
- Offering of hundreds of hours of technical expertise to regional and national government/regulatory agencies, non-profits, project developers, and farm/waste processing industry stakeholders; and
- Involvement in bi-weekly and quarterly work group calls with the WA State Bioenergy Team, WA State Anaerobic Digestion Working Group, the American Biogas Council AD Technical Working Group, the EPA Agstar Technical and University Advisory Groups, and the EPA Technology Challenge Team.

IMPACTS

Twenty-two commercial farm-based AD projects are now operating in the Pacific Northwest (Washington, Idaho, and Oregon), processing more than 7,800 tons per day of organic wastes (104,000 wet cow equivalents, 161 tons per day food waste), representing approximately 30 megawatts of electrical capacity installed, mitigating more than 1 MMT CO2e annually, and representing an estimated $125 million in capital invested. Data has been collected through a survey of project developers, and estimates are based on existing research.

Four commercial-scale nutrient recovery facilities have been installed nationally based on WSU patented technology.