Energy Resources Center

Technical Education and Analysis for Community Hauling and Anaerobic Digesters

TEACH AD

Project Profile

University of Wisconsin–Oshkosh

Demonstration of "Dry" AD Technology

MOTIVATION

Landfills are the third largest source of human-related methane emissions in the Unites States, accounting for about 15 % of greenhouse gas emissions. The Food and Agriculture Organization of the United Nations estimated that approximately one-third of all food produced for human consumption worldwide is lost or wasted. Aware of these negative statistics, the University of Wisconsin –Oshkosh (UWO) asked itself "What could we do about this?" Answer:

- ✓ Build first commercial scale dry fermentation anaerobic digester in US to demonstrate the technology
- ✓ Contribute to Campus sustainability goal
- ✓ Further reduce carbon footprint
- ✓ Provide hands-on education, research, and training of UWO students: microbiology, chemistry, engineering technologies and environmental science student tours, lab projects, research, internships
- ✓ Workforce development: On campus American Biogas Council digester operater certification courses and internship opportunities

THE PROCESS: HOW IT WORKS

Six days a week several trucks, including the campus collection truck, deliver food/organic waste to the receiving bay, which is under negative pressure so odorous compounds are captured and treated. The wet food waste is then mixed in the receiving bay with dryer organic waste to make a structured, stackable pile that is deposited into one of four anaerobic digestion chambers. The dryer organic waste varies during the year but consists of yard waste from the City of Oshkosh and Winnebago County and local farm straw.

Wood chips are typically added to the mixture to create porosity and structure. The desired "mixing recipe" is around 55% food waste and 45% other organic waste. Once sufficiently mixed over a week's time, a front-end loader fills (approximately 80% volume) one of the four anaerobic digestion chambers which are sealed behind stainless steel doors.

HIGHLIGHTS

LOCATION: Oshkosh, Wisconsin

SECTOR: University

FEEDSTOCK PROCESSED: 10,000 tons/yr. - Food waste (55%), yard waste (37%), farm straw (8%)

FOOD WASTE: 5,500 tons/year, 200 tons/year of which are from Campus

DIGESTER TYPE: Dry-batch

BIOGAS YELD: 170,000 ft3/day (62% from plant and 38% from WWTP)

BIOGAS USE: Cogeneration (CHP)

CHP size: 370 kW

ELECTRICITY PRODUCTION: 2.2 million kWh/year

IMPLEMENTATION COST: $5 Million - Grant Funding: 1.8 million

O&M COST: $240k-260k/year

THERMAL APPLICATION: currently heating AD, future heat adjacent building

General view of the site: the CHP unit can be seen on the left. The large white door is the entrance to the bay area and the AD chambers

Inside the sealed AD chamber, ceiling nozzles spray the food waste with a liquid inoculum of bacteria (percolate produced during the digestion process) to speed up the anaerobic breakdown process. The liquid inoculum gravity flows through the pile and is collected through floor drains and recirculated through the ceiling sprayers. The biogas produced from the AD process is piped to a flexible bladder located on top of the chamber. After a roughly 28 day closed loop retention time, the chamber is opened and the mostly dry residual material is removed and trucked to an independent composting business that sells soil amendment products. Thus, once a week, one of the four AD chambers is emptied and filled. Liquid leachate (minimal) is collected in a tank and either land applied as fertilizer or transported to waste water treatment plant.

UWO Student at work: the plant is a learning living laboratory and research site for students and faculty

On the right: view of the feedstock receiving & mixing bay area. On the left: view of the digester chambers

ADVANTAGES OF DRY FERMENTATION

- ✓ Less equipment/moving parts resulting in low system maintenance and repair costs
- ✓ Less energy required
- ✓ No pre-treatment or sorting of inputs required prior to system loading

In this application, the biogas produced by the dry digesters is a) treated to condense the water out and reduce hydrogen sulfide via activated carbon filter, b) combined with biogas from community WWTF to fuel the CHP, and c) soon waste heat will be supplied to a campus building next door

COMMUNITY BENEFITS

- ✓ Campus food waste recycled, reducing landfill volume
- ✓ Community food waste recycled (local businesses, local hospital, local food processors)
- ✓ Oshkosh WWTF biogas (used to flare it, now piped to AD from adjacent property)
- ✓ Accept Winnebago County yard waste
- ✓ Accepts City yard waste (located across the street)
- ✓ Solid digestate (by-product) to local compost business for further processing
- ✓ Accept local farm waste (straw)
- ✓ Electric power generated goes to the grid via a PPA

"It has been very rewarding being part of building the biogas program here at UW Oshkosh over the past 11 years. Not only are we helping achieve our campus sustainability goals but we are a resource to our community and a living-learning laboratory for our students to learn about the many advantages of incorporating biogas systems into our everyday lives."

Brian Langolf, Biogas Program Director

LESSONS LEARNED

- ✓ It's worth ensuring the food/organic waste is clean (no plastics) so that digestate can be readily converted to business products (soil amendments).
- ✓ Digesters require skilled operators to keep the system operating safely and efficiently. Provide staff with training, support, and resources to provide a combination of mechanics, electronics, biology, and chemistry.
- ✓ Perform lab testing to understand your feedstock and for tracking the digester health and performance
- ✓ Track and trend all operational data
- ✓ Proactive maintenance and find/use good local service support for parts and service. Determine critical parts to have on hand as spares

FOR MORE INFORMATION

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