St. Cloud NEW Recovery Facility

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Organization Background

The St. Cloud Nutrient, Energy, and Water Recovery Facility (St. Cloud NEW Recovery Facility) operates 24/7 to treat 9.6 million gallons of wastewater each day from residents in St. Cloud and the surrounding cities. The facility is owned by the City of St. Cloud and is operated by 24 employees, including plant operators, laboratory analysts, and maintenance personnel. In addition to biological nutrient removal from the influent wastewater, the site produces Class A biosolids through anaerobic co-digestion of municipal solids and high strength waste. It is recognized nationally as a premier resource recovery facility, utilizing renewable energy from solar and biogas produced onsite to achieve nearly net zero energy consumption.

DONOHUE

CITY OF ST.CLOUD MINNESOTA PUBLIC UTILITIES

STEARNS BENTON SHERBURNE

"Working on the pilot this summer allowed me to combine my passions for engineering, laboratory analysis, and sustainability to work toward providing a more sustainable disposal option for Minnesota's food waste. It was an honor to be on the research end of such an exciting project, and I am grateful for both MnTAP and the City of St. Cloud for providing me the opportunity." ~ BK

Project Background

The Food Waste Co-Digestion Pilot was a collaborative effort between the City of St. Cloud, the Tri-County Solid Waste Commission, Donohue & Associates, and MnTAP to pilot a food depackaging system at the NEW Recovery Facility. Packaged food waste from local businesses that would ordinarily enter a landfill was delivered to the facility and depackaged before entering the existing anaerobic digesters at the NEW Recovery Facility. A study was conducted over a 10-week period in which the depackaging process was refined and laboratory samples were collected to characterize the food waste properties and monitor digester health. The data collected will be used to help the City of St. Cloud and Tri-County Solid Waste make informed decisions concerning the sustainable implementation of a permanent food waste co-digestion program.

"I appreciated Brandon's work ethic and commitment, ability to work independently and ask great questions, and his attention to detail. Brandon's contributions were instrumental to the success of the project."

- Shanna Czeck, Water Quality Coordinator
St. Cloud Public Utilities

Incentives To Change

Food waste makes up over 14% of the Tri-County region's landfill waste, representing a significant source of avoidable greenhouse gas emissions. Diverting food waste toward anaerobic digestion at existing facilities in St. Cloud would substantially reduce emissions and produce additional renewable biogas for energy production. The development of a full-scale food co-digestion program would be step forward for sustainable waste disposal in the US. This facility would be the third of its kind in the Midwest and the first in Minnesota.

SOLUTIONS

Depackaging Process

To expand collection beyond packaging free organics, a T30 Turbo Separator was used to depackage food waste collected from several local businesses in St. Cloud. Over 50 tons of food waste from commercial vendors was depackaged over the course of the 10-week pilot, including a mix of expired produce, deli food, dairy products, and canned goods. Operating data was collected to determine useful values such as the observed processing rates, equipment usage, and the volume of high strength waste needed for organics dilution. This information was used to develop estimates for full-scale production capacity.

Solutions

Laboratory Analysis

Routine laboratory analysis was completed on samples from the NEW Recovery Facility's four digesters to determine what effects the continued loading of food waste may have on digester health and gas production. Tests were completed on-site to monitor pH, alkalinity, total solids content, volatile solids content, and volatile fatty acids concentration. No significant changes were observed to any parameters over the course of the pilot, concluding that the addition of food waste poses little risk to digester health.

Regular laboratory analysis was also completed on food samples collected from the depackaging unit to determine their energy and nutrient content, including tests for chemical oxygen demand, volatile solids content, nitrogen, and phosphorous. These tests concluded that the food waste possesses a beneficial energy to nutrient ratio and has an estimated biogas potential that is over three times that of the municipal solids currently digested at the facility. External laboratory analysis is being completed to determine the exact methane production potential of the food waste, as well as a composite mixture of food, high strength wastewater, and municipal solids.

Financial Analysis

Operational data from the pilot was used to estimate labor and capacity requirements for a full-scale system that would keep the program financially viable. A variety of factors including hauling costs, electricity demand, additional gas production, and tipping fees were considered. An estimation of capital costs was used to provide a payback period over a range of production annual capacities.

Environmental Impact

The environmental impacts of diverting food waste toward anaerobic digestion compared to the current practices of landfilling and incineration in the Tri-County region were explored. Information from the depackaging process and published emissions factors from the Environmental Protection Agency were used to estimate the reduction in greenhouse gas emissions per ton of food waste diverted. Additional environmental impacts were considered, including improvements to public health and water bodies. Data was also collected to determine the risk of plastics contamination from the depackaging process, and recommendations were made to reduce contamination through physical and behavioral means.

Recommendation	Annual Reduction	Annual Savings	Status
Implement Pilot Scale Depackaging, 10 Weeks	51.7 tons Landfill Waste Diversion 19,000 kg CO_2 EQ 12,200 kWh energy produced 1320 therm biogas produced	$1,000	Implemented
Implement Full Scale Depackaging (Annual)	13,000 tons Landfill Waste Diversion 4,800,000 kg CO_2 EQ 3,000,000 kWh energy produced 330,000 therms biogas produced	$250,000	Proposed

MnTAP Advisor: Kira Peterson, Engineer