March 2026

PROJECT SUMMARY

Waste-to-Energy: Fueling Sustainable Wastewater Treatment with Food Waste

KEY POINTS

Macerated food waste is an energy dense material able to produce 64m3 of methane per wet ton through biological anaerobic digestion, this corresponds to 2.2 GJ of heat energy.

Food waste breaks down quickly and is highly compatible with the treatment times of existing commercial anaerobic digesters

Co-treatment of food waste and food industry wastes at municipal WWTP can improve the composition of the biosolids residues, enabling the nutrients to be recycled as organic biosolids fertilizer.

Broad uptake of food waste co-digestion throughout Australia could result in annual GHG reductions of over 200,000 tonnes per year and produce over 200,000 GJ of renewable energy.

Figure 1. Anaerobic Co-digestion Test Facility

THE CHALLENGE

Australia generates over 14 million tons of organic waste per year with approximately 50% of this waste currently disposed to landfill. Of this organic waste, approximately 7.6 million tons is food waste. Food waste typically contains a large fraction of organic material along with valuable nutrients including nitrogen, phosphorus and potassium. If poorly managed the decomposition of food waste results in

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health risks, unpleasant odours and significant environmental pollution (Muratçobanoğlu et al., 2020, Wang et al., 2018). For example, methane generated from decomposition of food waste is a greenhouse gas that contributes to about 3% of Australia's total greenhouse gas emissions (FIAL, 2021). For these reasons, management of food waste and food industry waste (FIW) has emerged as a significant environmental and economic issue. If recovered or recycled, food waste could represent a significant resource stream, however the compositions of mixed food waste, such as wastes from supermarkets or households, can be highly variable (based on the time of year and local consumer habits) and there is a high risk of plastic and metal contamination. Robust and flexible solutions are needed for management of these lower value mixed waste streams.

THE **OPPORTUNITY**

Anaerobic digestion is the biological process of converting organic material (such as animal or food waste) into renewable energy and organic fertiliser. Anaerobic digesters can be built at any scale, from small digesters suppling heat to a single cooker in a kitchen, to large full-scale digesters producing enough biogas to constantly power thousands of average Australian households.

Currently, anaerobic digestion is already applied at municipal wastewater treatment plants and importantly these treatment plants are built with spare capacity to support population growth over time. The import of Solid Food Waste (SFW) and other Food Industry Wastes (FIWs) for co-treatment in these existing digesters presents a promising strategy to valorise food waste and boost renewable energy production. If executed successfully, co-treatment of food waste has the potential to transform sewage treatment plants from larger consumers of electricity into net energy exporters while providing established pathways and markers for the recycling of nutrient content of food waste as part of an organic fertilizer product called biosolids.

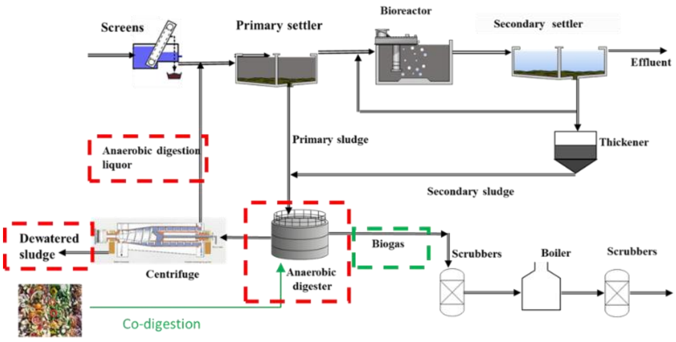

Figure 2. Application of food waste co-digestion within a municipal wastewater treatment plant.

OUR **RESEARCH**

The core goals of this work were to guide ongoing full-scale anaerobic co-digestion at the host site to provide tangible economic and environmental benefits, with outcomes being transferable from the host site to broader industry. To achieve this, the project conducted extensive laboratory testing on the composition and energy potential of selected commercial food industry wastes and developed a flagship co-digestion test facility to examine co-treatment strategies at scale, under real world conditions.

Target Food Industry Wastes in this project included Macerated Solid Food Waste (SFW), Beverage Processing Waste (BEV) and waste from Dairy and Milk Processing (DMP); grease trap waste (GTW) was also evaluated as a common industry waste targeted for co-digestion processes.

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OUTCOMES

The pilot-scale test facility was operated for over 400 days and examined co-substrate loadings from 10% of organic load up to 50% of organic load. While sludge was added to the pilot semi-continuously, the co-substrate was added to the pilot once per day as a spike dose (to simulate a waste tanker arriving on site). The pilot scale test work was largely successful in validating the laboratory results as a predictor of steady state behaviour at larger scale, this work demonstrates:

- In general, the methane production from the test facility was similar to the performance model predictions, while the solids destruction performance exceeded the lab-based performance models.
- Biogas production in the test facility was highly dynamic, biogas production peaked around 1 hr after a co-substrate spike dose with peaks in biogas production being more than double the average daily production rates. It is essential that equipment is designed around dynamic peaks and not average flows.
- Co-substrate spiking created some transient and negative impacts on the quality of the treated biosolids, i.e. there is an increased risk of odour from the biosolids for a short time after a large co-substrate spike.
- The Food Industry Wastes examined in this project contained significantly lower heavy metal concentrations when compared to mixed sewage sludge, which may improve the reuse opportunities for the biosolid product.

Macerated Solid Food Waste (SFW) contained approximately 17% solids and 83% water as received. In this form, SFW was able to produce 64 m3 methane per wet tonne corresponding to 2.2 GJ/ton heat energy. This compares very favourably to mixed sewage sludge at 10 m3/wet ton (as added to the current AD process) and is competitive with traditionally desirable co-substrates, such as GTW. SFW contained much higher concentrations of N and P compared to competitor substrates such as GTW, which will impact the costs of co-treatment. SFW did not result in the same process upset issues observed with highly fatty materials such as GTW and may be lower risk to established process.

Overall, co-treatment of food waste at municipal sewage treatment plants was confirmed as a promising strategy to valorise food waste, reduce environmental footprints of waste management and boost renewable energy production.

IMPACT

Renewable energy produced from full-scale co-treatment during the project offset an estimated 2300 t/y of Scope 2 greenhouse gas emissions and importing these waste streams may have avoided an additional 5,000 t/y of landfill emissions. Impacts from this project will continue beyond the project life due to new and existing commercial arrangements. Waste import levels are expected to expand, in part due to knowledge gained in the project, which will further increase the GHG impacts resulting from import activities. The project demonstrates that future GHG avoidance of 15,000 t CO2-e per year could be achieved at a single large WWTP in the future, without compromising existing plant operations. This impact could be expanded to multiple WWTP of similar size, already existing in large population centres throughout Australia. Broad uptake of project outcomes and co-digestion strategies throughout Australia could result in annual GHG reductions of over 200,000 tonnes per year.

NEXT **STEPS**

The core challenges with co-treatment of SFW relate to materials handling and variability in composition.

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SFW had poor flow properties and was more difficult to handle at the concentrations received, it may be necessary to dilute the SFW to manage process loading at the levels required for full scale implementation.

PROJECT TEAM

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PROJECT REPORTS/PUBLICATIONS

Jensen, P.D., Bai, X., Al-gertan, E. (2026). Waste-to-Energy: Fueling Sustainable Wastewater Treatment with Food Waste, Final Project Report. End Food Waste Cooperative Research Centre.

PROJECT WEBPAGE

https://endfoodwaste.com.au/waste-to-energy-fuelling-sustainable-wastewater-treatment-with-food-waste/

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Fact Sheet Version 1 – Date

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