Dairy Australia

WHEY TO ENERGY

THE BUSINESS CASE FOR CONVERTING DAIRY PROCESSING WASTE INTO BIOGAS

Project Overview

The objective of this Dairy Australia Technology Assessment (DATA) Scheme project was to develop a detailed feasibility assessment for the use of anaerobic digestion (AD) as a process for both treating and deriving value from the whey and trade waste produced by a Victorian dairy manufacturer (Manufacturer).

AD technology converts organic material in waste streams into biogas which can be used as fuel in gas-powered generators to cogenerate both process heat and electricity. The process also substantially reduces the organic load in the water fraction that exits the AD system - meaning the trade waste and waste management costs are significantly reduced.

Although very common in other parts of the world – particularly Europe - the use of AD technology by dairy processors in Australia is limited.

The scope of this project was novel in that it included assessment of two separate business cases. The first considered a low-risk option of third-party 'over-the-fence' ownership/operation of the AD system adjacent to their existing site, while the second looked at a higher risk scenario where the Manufacturer owned and operated the AD and cogeneration assets themselves.

The advantage of the first scenario was that the Manufacturer would avoid capital and operating costs/risks of the AD system and instead sign onto longer term, discounted power purchase and waste management agreements with the third-party AD system owner.

The advantage of the second scenario is that the Manufacturer had the potential to realise the full benefit of the savings generated by the AD system as they would be not be paying for waste provided to the AD system or for energy delivered.

Both scenarios were of interest to Dairy Australia as they have the potential for broad application across the Australian dairy industry.

Business need that the project was seeking to address

Recent increases in both energy costs and trade waste charges, along with the Manufacturer's rapid expansion, have put increased pressure on its wastewater system, energy usage and waste recovery costs. The key driver for undertaking this project was therefore to assess the commercial potential for AD technology to:

a. reduce the cost of managing/disposing of the Manufacturer's whey and trade waste streams

b. reduce the Manufacturer's grid-supplied energy costs

c. support the Manufacturer's commitment to improve the environmental outcomes of its operations.

The Manufacturer produces two main by-products of interest to an AD project:

- 'Trade waste' - the wastewater developed by the Manufacturer as result of running and cleaning the plant. This wastewater typically contains high levels of organic matter (mainly milk solids) which results in significant discharge costs when it is sent to sewer.
- Whey – a by-product of production which is high in lactose but not of suitable value to justify further refinement. This is currently transported to third party sites for beneficial re-use. The environmental footprint and costs associated with whey transport and disposal are a concern to the Manufacturer.

Generally, the Manufacturer was seeking to improve the environmental outcomes of its operations while improving performance and reducing costs.

Dairy Australia's interest in the project was to understand the current business case for AD technology at Australian dairy manufacturing sites and hopefully support further uptake (where appropriate) by socialising the outcomes of this work.

Relevance to Australian Dairy Industry Sustainability Targets

Anaerobic digestion, as a renewable waste-to-energy technology, has the capacity to support the Australian Dairy Industry Sustainability Framework's targets to both reduce greenhouse gas emissions intensity (Target 10.1[1]) and waste-to-landfill intensity (Target 11.1[2]).

By converting the high organic loads in dairy manufacturing trade waste, and by-product streams like whey into biogas, not only does AD lead to reduced waste material exiting the site but it also provides a renewable energy source. Where the biogas is combusted to cogenerate heat and power, AD can substantially reduce a factory's grid-supplied energy needs while also reducing their greenhouse gas emissions intensity.

Key Outcomes

The key outcomes of this DATA Scheme project were that the business case for both the Manufacturer-owned and third-party owned AD scenarios were extremely positive.

The volumes of whey and trade waste generated on site and their methanogenic potential would allow the production of enough biogas to offset the site's grid-supplied heat and power requirements.

For the site studied this renewable energy substitution equates about 30,000 tonnes of carbon dioxide equivalents per year (t (CO2-e)/yr) being abated.

For the third-party owned and operated scenario:

- The costs associated with trade waste discharge could be reduced by up to 47 per cent and whey disposal costs could be cut by 40 per cent.
- Utility costs could potentially be reduced by 25 per cent.
- The availability of capital along with space restrictions at the Manufacturers current site make this an attractive option. The benefits of this scenario are highly dependent on the eventual location of the AD system, however, as this will impact waste transfer costs and gate fees.

For the Manufacturer-owned scenario:

- The costs associated with trade waste discharge could be reduced by up to 47 per cent and whey disposal costs could be eliminated altogether.
- Grid-supplied energy usage charges would become close to zero.
- The significant cost savings projected to result from the AD system considered made the project financially very attractive with a potential return on investment of about three years.

Potential next steps

Although the results of the feasibility assessment were convincing, there are still key points that need be validated by the Manufacturer around long term business planning, capital and space availability before committing to an anaerobic digester project.

FOR FURTHER INFORMATION

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1 Target 10.1 of the Australian Dairy Industry's Sustainability Framework is, 'Reduce greenhouse gas emissions intensity by 30% by 2030 across whole industry (based on 2015 levels)'
2 Target 11.1 of the Australian Dairy Industry's Sustainability Framework is, 'Reduce waste-to-fill intensity by 40% by 2020 (based on a 2010/11 baseline)'

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