10.1071/ANv62n10–11abs

# ANIMAL SCIENCE IN AUSTRALIA

Proceedings of the Australian Association of Animal Sciences

Volume 34

## Anchoring knowledge – exploring the animal science ecosystem

34th Biennial Conference

Australian Association of ANIMAL SCIENCES
34TH BIENNIAL CONFERENCE
Anchoring knowledge – exploring the animal science ecosystem

Pullman Cairns International Hotel, Cairns, Queensland
5–7 July 2022

# Novel opportunities for value adding to piggery effluent

*S. Willis*[A,E], *J. E. Riley*[B], *P. Brosnan*[C], *L. Brosnan*[C] *and E. McGahan*[D]

[A]Department of Agriculture and Fisheries, Qld 4350, Australia.
[B]JCR Associates International, Qld 4356, Australia.
[C]Bettapork, Qld 4405, Australia.
[D]Integrity Ag & Environment, Qld 4352, Australia.
[E]Corresponding author. Email: sara.willis@daf.qld.gov.au

The agricultural industry is committed to sustainable development to improve the long-term viability of businesses. As enterprises increase in size, investment in waste management technology has both environmental and economic benefits. Biogas generation systems provide opportunities for pork producers to generate energy from piggery waste and produce organic fertiliser and soil conditioners as well as reducing greenhouse gas (GHG) emissions. Exploring the novel use of surplus 'green/renewable' energy provides a pathway to enhance return on investment.

A large Queensland family-owned 1600 sow farrow-to-finish piggery funded a biogas plant in 2015 to power the lighting and environmental control systems in the piggery buildings as well as the feed mill, which produces over 13 000 tonnes of feed annually. Hot water pads installed in the farrowing rooms use the heat energy produced to enhance piglet performance. The business offsets up to 115% of their energy requirement using biogas generated at the farm.

The objective of the study was to review the production and use of energy from co-digestion of feedstocks in a biogas plant. The facility has two linked digesters with a total capacity of 6000 $m^3$, operating on a 30-day cycle. Piggery effluent from three production sites is piped to a 500 $m^3$ storage tank. Each day raw effluent (40 $m^3$) is mixed in a substrate tank with the locally sourced abattoir paunch then pumped to the digestor. In addition, a further quantity of effluent (160 $m^3$) is pumped directly to the same digestor. The digestate from the process is high-value phosphate fertiliser, high-fibre soil conditioner, and the liquid waste fraction which is mixed with fresh dam water to irrigate 100 ha for crop production.

Key performance indicators (Fig. 1a) recorded for the period July 2020 to June 2021 showed the variation in paunch supply with limited availability during the summer season abattoir shutdown. Fig. 1b, c shows that the lack of paunch changed the balance of the feedstock which impacted on the digestor operation, lowering both biogas production and the methane ($CH_4$) content of the biogas compared to when the primary feedstock was solely piggery effluent. The time lag in Fig. 1b, c compared with Fig. 1a is due to the digesters operating on a 30-day hydraulic retention time.

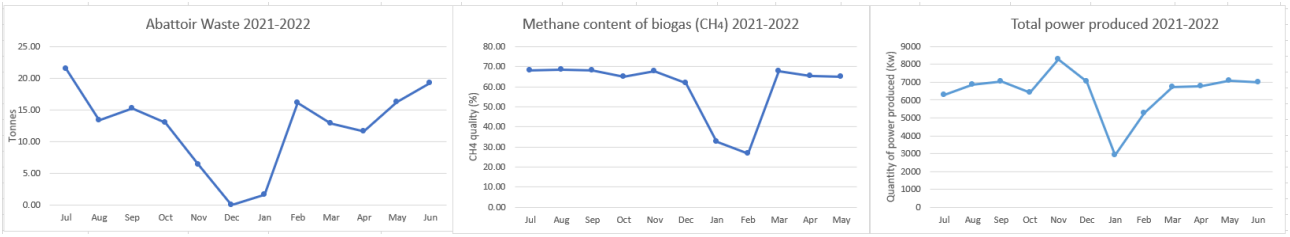


**Fig. 1.** Relationship between a) abattoir waste delivered to farm, b) methane content of biogas and c) total power output.

The use of co-digestion in anaerobic digestion systems assists $CH_4$ yields as positive synergisms are established in the digestion medium, and missing nutrients are introduced by the co-substrates (Chow *et al*. 2020). Other feedstock choices for co-digestion include food waste that never leaves farms, food that is lost during transport, or food waste from the retail and hospitality sectors. Food waste that costs the Australian economy $20 billion/year (Australian Government 2017) can have maximum $CH_4$ producing capacities exceeding 700 $m^3$ $CH_4$/tonne of volatile solids (VS) compared with piggery effluent at 450 and abattoir paunch at 470 $m^3$ $CH_4$/tonne VS (Commonwealth of Australia 2019). Diverting food waste to anaerobic digestion would turn a cost into an opportunity, generating revenue from energy production and co-products and potentially reducing GHG emissions from other sectors of the economy.

When electricity supply exceeds farm demand, up to 100 kW of power is donated to the national grid. Previously, biogas surpluses were flared but now a feasibility study is evaluating an additional income stream. Selling power to drive high energy-demanding cryptocurrency mining terminals could return over $100 000/year. The number of terminals is constrained by the amount of electricity generated which is limited by the amount of feedstock available to fuel the plant.

The results indicate that the co-digestion of feedstocks with consistent supply improves $CH_4$ quality and yield. The performance of the biogas plant is currently constrained by a shortage of abattoir waste during the summer season shutdown. Cooperating with others in the food supply chain to source a consistent supply of food waste would increase biogas yield significantly and allow an increase in the mining of bitcoin and the exploration of other novel opportunities.

**References**

Australian Government (2017) 'National Food Waste Strategy.' Available at https://www.awe.gov.au/environment/protection/waste/publications /national-food-waste-strategy

Chow WL *et al.* (2020) *Processes* **8**(1), 39.

Commonwealth of Australia (2019) 'Supplement to Carbon Credits Methodology Determination.' Available at http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/Supplement-to-the-2022-blue-carbon-method.aspx