Ingham’s turkey processing facility is based in Tahmoor, NSW. A study was conducted to assess the feasibility of installing a biogas plant utilising spent poultry litter at the facility.

The NSW DPI Energy Efficiency Solutions project conducted feasibility studies to assess the technical and commercial feasibility of proposals that would address the cost, reliability and sustainability of energy use on farms. Proposals were sought through public advertisements and more direct engagement with associations and networks. An independent advisory group identified ten priority proposals through a merit selection process, then an independent expert assessor was matched to each priority proposal to undertake a detailed feasibility study. This case study summarises the context, proposal and results of the Ingham’s Turkey Processing, Tahmoor feasibility study.

**Context**

Ingham’s is the largest integrated poultry producer in Australasia, with 345 facilities and farms in operation across Australia and New Zealand. Ingham’s specialise in growing chickens and turkeys for meat and have 25 poultry farms in New South Wales, and a turkey processing facility located in the township of Tahmoor. The business has ambitions to improve the sustainability of their operations by reducing energy consumption and emissions.

The Tahmoor turkey processing facility utilises electricity and natural gas for its energy needs. Electricity use accounts for two-thirds of the annual energy consumption at the plant, with the largest consumers being refrigeration equipment for chilling and freezing product. The electrical base load is 400 kVA. Natural gas use accounts for the remaining one-third of total energy consumption. Steam from the natural gas boiler is used for process heating requirements and generating hot water for cleaning.

This feasibility study sought to determine the operational and financial viability of installing a biogas plant utilising spent poultry litter at the Tahmoor processing facility. The proposed
Feasibility Case Study – Ingham’s Turkey Processing, Tahmoor

The biogas plant would generate renewable electricity and heat for use within the turkey processing facility, reducing imported electricity and natural gas.

Proposal

One of the main waste products of the chicken and turkey farms is poultry litter. The litter is a mixture of poultry manure, urine, spilled feed, feathers and bedding material such as wood shavings. It is removed from the poultry sheds at the end of the growing or laying cycle, depending on the farm. Currently, the spent litter is collected by local fertiliser companies and on-sold to their customers as fertiliser.

To unlock the energy potential in the poultry litter from seven farms owned and operated by Ingham’s farms, it was proposed that a centralised biogas plant be installed adjacent to the Tahmoor turkey processing facility. 6,000 m$^3$/year of poultry litter is collected from seven Ingham’s farms.

Several digestion technologies were investigated, with a covered anaerobic lagoon (CAL) being selected due to its lower cost to produce biogas compared to other options. The poultry litter would need to be screened and diluted with water, before being pumped into the lagoon. The anaerobic digestion process would produce biogas, which would be collected and treated to produce methane.

System design

The methane would then be combusted in four 65 kW Capstone microturbine combined heat and power (CHP) units to generate 220 kW of electricity (net), once parasitic loads from the two biogas compressors and ancillary equipment have been taken into account. The
electricity would be supplied into a main switch board inside the Tahmoor processing facility, offsetting imported electricity.

480 kW of waste heat from the combustion process would be recovered to generate 90°C hot water. This hot water would be stored in a buffer tank near the CHPs, then pumped across to the processing facility to be used as makeup water for the hot water system and boiler feedwater tank. This heat would offset reticulated natural gas used in the existing boiler.

### Estimated costs and benefits

<table>
<thead>
<tr>
<th><strong>Project cost excl GST</strong></th>
<th>$4.0 million</th>
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</thead>
<tbody>
<tr>
<td><strong>Net cost savings</strong></td>
<td>25% p.a.</td>
</tr>
<tr>
<td><strong>Energy use reduction</strong></td>
<td>13,000 GJ p.a. (35%)</td>
</tr>
<tr>
<td><strong>Emissions reduction</strong></td>
<td>1,900 tCO2e p.a. (30%)</td>
</tr>
<tr>
<td><strong>Simple payback period</strong></td>
<td>18 years</td>
</tr>
</tbody>
</table>

Note, net cost savings take into account reductions in energy costs offset by additional operating costs for maintenance and staffing.

Other benefits associated with the proposed biogas system include:
- Increased energy security at the Tahmoor processing plant.
- The digestate from the biogas plant could be on-sold as a high-quality fertiliser.

### Key Findings

The payback period of this proposal is long and is affected by a number of factors:
- Waste disposal costs: the poultry litter from the Ingham’s farms has value as it is being on-sold as fertiliser and Ingham’s are not incurring costs for disposal. If a site was incurring disposal costs, the project payback would shorten.
- Scale: larger biogas plants provide better economies of scale and shorter paybacks.
- Energy costs: if energy costs were higher, the payback would reduce.
- Continual removal of litter: poultry farms that operate a batch process, such as broiler and breeder farms, are not ideally suited as storage of litter is required. Litter is continually removed at caged chicken laying farms and is therefore likely to provide a better opportunity for biogas production.
- Wastewater: ammonia levels are high in poultry litter and inhibit the digestion process. To reduce this effect, dilution of the poultry litter is required. Wastewater is ideal, increasing methane production and decreasing the amount of fresh water required.
- Biomethane potential: ideally conduct laboratory tests of poultry litter and wastewater at each site to establish how much methane would be produced.
Acknowledgments

The Climate Change Research Strategy (CCRS) is an initiative of the NSW Department of Primary Industries (DPI), supported by an investment from the NSW Climate Change Fund. The Energy Efficiency Solutions project is one of seven CCRS projects. More information is available online here: https://www.dpi.nsw.gov.au/climate-and-emergencies/climate-change-research-strategy

The objective of the Energy Efficiency Solutions project is to help energy-intensive farms identify options to improve their energy efficiency and reduce costs. The project is led by NSW DPI, advised by a steering committee. NSW DPI contracted the Australian Alliance for Energy Productivity (A2EP) to provide management services for the conduct of ten feasibility studies. This case study summarises the findings of a detailed study that was undertaken by independent expert consultants, DETA Consulting.

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