Snapshot Report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

# Red Meat Processing Closing the Loop on Process Energy and Emissions

Project code
2024-1011

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## Project description

Like all large energy users, G&K O'Connor (GKO) face an uncertain future with regards to energy and carbon emissions costs. In addition, the pressure to decarbonise comes from its supply chain and trading partners implementing their own decarbonisation commitments including Scope 3 emissions. It also comes from consumer demand for products produced by organisations that respect the plant and are good for people.

The final report for the Project is titled "Closing the Loop on Red Meat Processing Energy & Emissions – Integrated Scenarios & Roadmap".

The Project, co-funded by the Australian Meat Processor Corporation (AMPC), Australian Renewable Energy Agency (ARENA), and G. & K. O'Connor Pty Ltd, comprised the roll out of an integrated energy and water metering and monitoring system on site.

This first stage of the Project provided the necessary data to enable the second stage of the Project which is a detailed technical and economic feasibility assessment of the merits of adopting various technologies to reduce carbon emissions in red meat processing.

This detailed assessment establishes a recommended road map for GKO to reduce its process energy consumption based on proven technology and value for money. It recommends a pathway for significant emissions reduction.

The Project identifies that there is no single clear technical or financial solution that will transform red meat processing operations to full decarbonisation.

The Integrated Scenarios assessed as part of the Project are useful in providing potential integrated strategic options for decarbonising operations and concludes that a pathway based on maximising energy efficiency on plant is the preferred scenario both from a technical and financial viability perspective.

## Project content

The Project was commenced in August 2023 and completed in October 2024.

The Project Group comprised the following expert team and scope of work:

**Northmore Gordon:** Installation and operation of the integrated metering and monitoring system.

Assess the technical and economic feasibility of integrating heating and cooling systems, improving thermal efficiency and heat recovery, installing thermal energy storage, and electrifying heat loads to reduce energy use and greenhouse gas emissions.

Design review of proposed plant upgrade projects to front end energy efficiency initiatives

Project manage and prepare the final integrated scenarios evaluation report and road map.

**Beam Energy:** Assess the technical, economic and environmental feasibility of electricity generation from Solar PV, energy storage, co-generation from biogas, demand flexibility, and off-site renewable electricity. Integrated modelling of projects as part of the integrated scenarios evaluation.

**Johns Environmental Group:** Assess the technical and economic feasibility of installing a CAL to treat wastewater from the plant with delivery of biogas for boiler fuel to substitute fossil natural gas

**Enhar:** Assess and high-level design planning of existing VESI electrical infrastructure to accommodate planned renewable generation and storage infrastructure. Liaise with Ausnet Limited to determine limitations on the distribution network.

## Project outcomes

**Stage 1**
The completion of Stage 1 of the Project (roll out of an integrated metering and monitoring system on site) has allowed GKO to:

- Reduce workload and inefficiencies associated with manually recording and tracking energy and water data.
- Increase visibility of and access to energy and water data across operations.
- Conduct an energy and water balance analysis, breaking down total consumption by different areas of the site.
- Record baseline energy and water performance so that savings from energy and water efficiency projects can be properly evaluated
- Identify unexpected increases to energy use and water consumption.
- Validate billing information against onsite meters.
- Track energy and water use for each area of the plant, assigning resource costs to these areas.
- Streamline routine environmental reporting procedures.
- Ensure that energy and water consumption does not drift over time.
- Build on the monitoring system implementation to develop a formal Energy Management System (EnMS) to set decarbonisation targets for continuous improvement and quantify GKO's performance against these targets.
- Generate energy savings certificates from future energy efficiency initiatives.
- Detect poorly performing areas or equipment early.
- Keep its team accountable in achieving energy savings
- Determine the economic viability and right sizing of potential energy efficiency and renewable energy projects for the site.

Whilst a complex project in terms of its delivery given the varied age and condition of existing infrastructure on site, the establishment of the metering and monitoring system has been the critical first step in determining a viable decarbonisation road map for the site.

**Stage 2**
The completion of Stage 2 of the Project (technical analysis, integrated scenarios, and recommended roadmap for decarbonisation) has enabled GKO to determine a viable roadmap for decarbonisation of its operations having regard to baseline data, technical and financial considerations, and the particular specific circumstances of operations on site.

The following table summarises the technologies assessed as part of Stage 2 of the Project:

| Tech category | Technology descriptions |
|---|---|
| **Solar** | • On site renewable electricity generation using Solar PV systems<br>• Thermal energy storage systems, that input electricity and output steam |
| **Biogas** | • On site wastewater treatment using a Covered Anaerobic Lagoon (CAL) to produce biogas for steam generation in place of natural gas. |
| **Energy Efficiency** | • Waste heat recovery options using desuperheaters and simple heat exchangers |
| **Heat Pumps** | • Heat pumps producing hot water<br>• Hot water tanks to store sterilisation, washdown or handwash water, acting as thermal energy storage. |
| **Electrification** | • Electric rather than natural gas boilers producing steam |
| **Other** | • A Biomass boiler using logging waste as fuel, replacing the natural gas fired steam boiler |

Four Integrated Scenarios were considered each with the following technology focus:

| Scenario | Technology focus |
|---|---|
| **Solar Led** | Maximising the amount of solar PV capacity installed and utilising excess solar for thermal energy storage. |
| **Biogas Led** | Using conditioned biogas from a new Covered Anaerobic Lagoon (CAL) to substitute a portion of natural gas (NG) used for'difficult to electrify' consumers of natural gas - primarily steam generation. |
| **Efficiency Led** | Cost effective and energy efficient technologies, plus a biomass boiler |
| **Full electrification** | Replacement of all natural gas consuming equipment with electric alternatives, on site energy storage and the procurement of renewable energy or onsite generation |

A Multi-Criteria Decision Making Matrix and Value-Ease Assessment was used to assess the strengths, weaknesses, opportunities, and threats associated with each of the Scenarios. This approach ensured that decisions were not only based on potential outcomes but also took into account the resources, time, and effort required to achieve outcomes.

The analysis determined that there is no single technical or financial solution that will transform GKO's operations to low or no carbon emissions. Each of the Integrated Scenarios provides potential integrated options for doing so.

For GKO, the Efficiency Led Scenario is the preferred Roadmap for decarbonisation because:

- It has the most appealing payback and highest NPV
- It is based on proven technology
- By adopting energy efficiency measures first to reduce load, this approach ultimately reduces the size/cost of electrification.

The success of the Efficiency Led Scenario requires an organisational wide focus on energy performance targets.

On an industry wide basis, the Project provides a comprehensive assessment of the pathways available to decarbonise red meat processing operations, and relevant considerations for determining the suitability of decarbonisation projects in relation to particular processing sites.

## Benefit for industry

The Project identifies some broad considerations for the applicability of various technologies for red meat processors:

- On-site solar electricity generation requires a significant footprint, so is likely to be limited for each application by accessible land or roof area.
- Electrification projects all face limitations of electrical supply from distributors, and from onsite transformers and electrical distribution boards.
- It is critical to consider the inter-relationships of potential energy efficiency projects when evaluating their applicability and merits. For example, a project such as the econolisers that potentially remove heat from wastewater may negatively impact downstream biological processing.

The following table summarises the applicability of the various technologies considered by the Project to red meat processors:

| Project | Applicability to Industry |
|---|---|
| **Onsite Solar** | Red Meat Industry: All<br><br>Limitations: Land/roof area |
| **Hot water storage** | Red Meat Industry: Processors of medium to large scale<br><br>Limitations: Application specific – may be space, planning regulations or economies of scale considerations that must be considered |
| **Covered Anaerobic Lagoon (CAL)** | Red Meat Industry: Processors with onsite wastewater treatment, medium to large scale<br><br>Limitations: Land area and economies of scale. |
| **Econolisers** | Red Meat Industry: Processors with hot water knife sterilisers<br><br>Limitations: Impact on wastewater temperature; potential regulatory hurdles relating to food hygiene and export requirements. |
| **Air Comp HR** | Red Meat Industry: All<br><br>Limitations: Heat recovery is less effective on air cooled compressors than oil cooled compressors – this may affect usefulness of recovered heat. |
| **Condensate Return HR** | Red Meat Industry: All<br><br>Limitations: Heat recovery is less effective on air cooled compressors than oil cooled compressors – this may affect usefulness of recovered heat. |
| **Energy Efficiency Design** | Red Meat Industry: All new cool rooms/ refrigerated storage spaces<br><br>Limitations: None |
| **Ammonia Heat Pump** | Red Meat Industry: All sites with ammonia refrigeration systems<br><br>Limitations: Electricity supply capacity. |
| **CO2 Heat Pump** | Red Meat Industry: All sites with 90 degrees hot water demand.<br><br>Limitations: Electricity Supply capacity |
| **Electric Boilers** | Red Meat Industry: All sites with steam demand<br><br>Limitations: Electricity supply capacity, onsite solar or spot market electricity contract to avoid increased energy cost from electricity (greater than natural gas at current prices). |
| **Biomass Boiler** | Red Meat Industry: All sites with steam demand<br><br>Limitations: onsite space, fuel availability and security, site emissions limitations; complexity of operating fuel supply. |

| Project | Applicability to Industry |
|---|---|
| **TES w/ Spot Exposure** | Red Meat Industry: All sites with steam demand.<br><br>Limitations: Capital costs are significant, making this less relevant to sites with smaller steam demands. |
| **Off-Site Renewables/. Spot Exposure** | Red Meat Industry: All sites with a net zero emissions requirement<br><br>Limitations: Spot exposure value likely to be realised only by sites with significant electricity demand. |

## Useful resources

N/A