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Primary Industries and
Regional Development

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Energy Snapshot Study:

Meat Processing and Manufacturing

Contents

About this report

The *Meat Processing and Manufacturing Snapshot* forms part of the Department of Primary Industry and Regional Development (DPIRD)'s broader *Food and Beverage Manufacturing Energy Snapshot Study* (Study), undertaken in partnership with RSM Australia. Meat processors and meat product manufacturers contributed 15 of the Study's 124 responses, representing 12% of participants. Metropolitan and regional WA businesses of various sizes and operating models contributed.

This report focuses on meat processing, cured meat and small goods manufacturing. All businesses that contributed to the Study have been referred to as *processors* and the subsector is referred to as *meat processing and manufacturing*, regardless of size, production model, process used, or type of meat product produced.

This Subsector Snapshot explores energy use, operational emissions, actions already underway, barriers to further investment and opportunities to improve energy performance.

Results are indicative of participating businesses and should be read alongside the Energy Snapshot report for the full methodology, emissions boundaries and sector-wide findings.

Every processed meat product depends on reliable heat, cold, water and sanitation. For WA meat processors, energy is not a background cost. It is fundamental to food safety, production continuity and market access.

Western Australia's meat processing and manufacturing subsector is a critical part of the State's food and beverage manufacturing industry. It supports livestock producers, regional employment, domestic food supply, export markets, cold chain logistics, packaging, rendering, retail and foodservice.

The subsector includes a diverse range of operations, from large-scale beef, chicken, lamb and pork processors to smallgoods manufacturers, boning rooms, packaging operations, rendering facilities and regional processors. This diversity means that energy use and emissions profiles vary significantly between businesses.

For meat processors, energy use is closely linked to food safety, refrigeration, process heat, sanitation, hot water, wastewater treatment and cold chain requirements. These loads are essential to production, compliance and product quality.

This makes energy efficiency a practical business issue as much as an emissions issue. The Study suggests that WA meat processors are already taking steps to improve energy performance, but further progress is constrained by capital cost, specialised equipment needs and competing business priorities.

Meat processing: a critical link in WA's food supply chain

Meat processing plays a significant role in Australia's food manufacturing sector and supports a broad supply chain spanning livestock production, transport, processing, rendering, packaging, cold storage, retail and export logistics.

Nationally, the meat processing and manufacturing industry is dominated by beef, chicken, lamb and mutton, and pork meat production. Most of the industry is export-oriented, highly regulated and exposed to livestock supply cycles, international demand, food safety requirements, labour availability and retailer expectations.[1]

In WA, meat processing and manufacturing supports regional economies and provides important pathways to market for beef, lamb, pork and value-added meat products. Study participants from the subsector included producers of beef, lamb and pork cuts, bacon and ham, smallgoods, packaged meat, animal lard and tallow rendering.

Businesses that participated in the Study were of various operational sizes, ranging from micro, small, medium and large. These operators were located across the Perth metropolitan area, Great Southern, South West, Mid West, Peel, Kimberley and Pilbara regions. This geographic spread reinforces the role of meat processing as both a metropolitan and regional manufacturing activity.

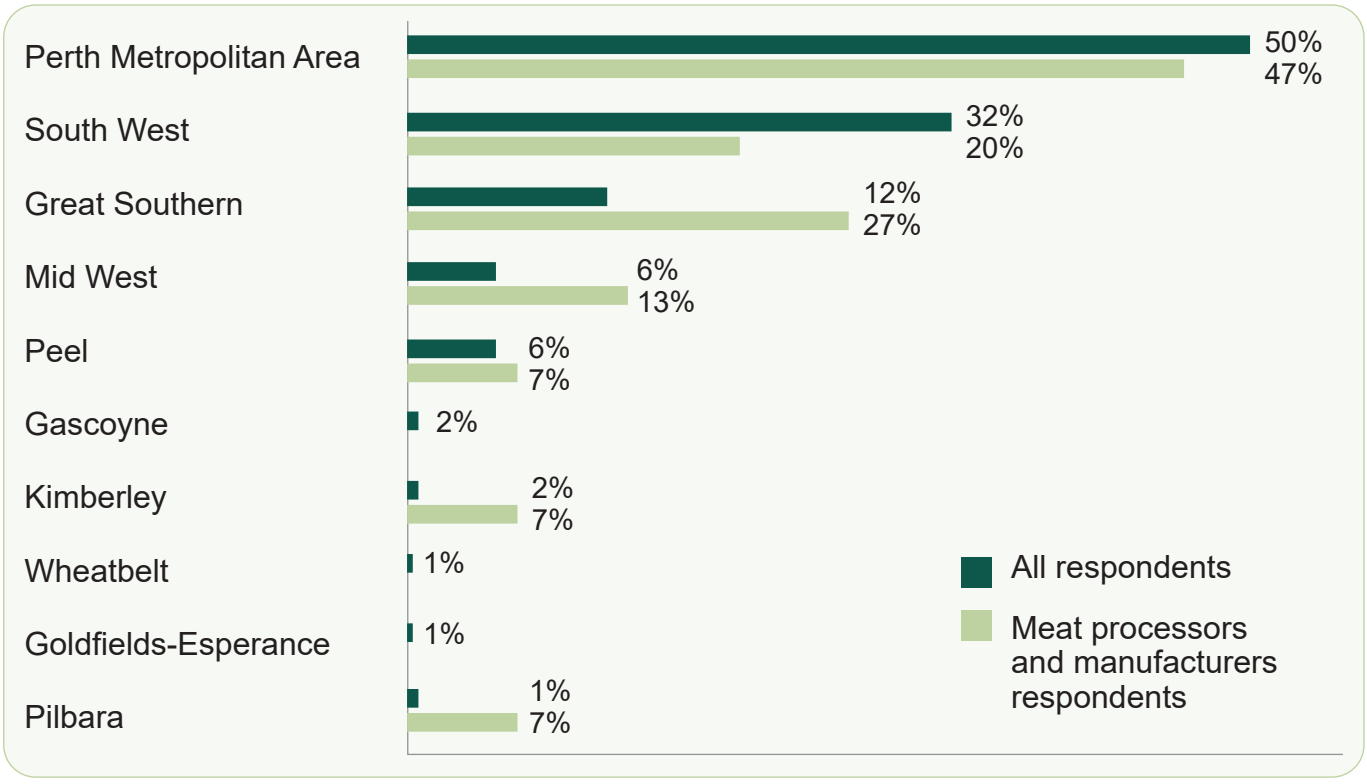

Figure 1: Respondents by region - meat products

Note: Respondents could select more than one location. Accordingly, percentages do not sum to 100%.

1 IBISWorld (2025), *Meat Processing in Australia*, Manufacturing ANZSIC C1111, IBISWorld.

The operating environment for the subsector is evolving. Processors are increasingly responding to energy and labour pressures, food safety and traceability requirements, retailer and customer expectations, export market demands and growing expectations regarding sustainability credentials.

For meat processors, reducing energy use and greenhouse gas emissions can support:

- lower operating costs
- improved energy productivity
- improved refrigeration and equipment reliability
- stronger customer and market positioning
- better preparedness for evolving retailer and supply chain expectations
- improved emissions data and reporting readiness.

Where and how energy is used

Meat processing is energy-intensive because it requires strict temperature control, reliable refrigeration, hot water, sanitation, processing equipment, compressed air, pumps, lighting, packaging and cold storage.

Energy use is concentrated in several recurring operational areas.[2]

Energy hotspot	Operational area
Refrigeration and cold storage	Required for carcass chilling, boning rooms, cold rooms, freezers, finished goods storage and food safety compliance. Refrigeration is often one of the most significant electricity loads.
Process heat and hot water	Used for sanitation, washdown, sterilisation, scalding, cooking, smoking, rendering and other thermal processes. Often supplied by natural gas, LPG or electric systems.
Cleaning and sanitation	Meat processing requires frequent washdown, sterilisation and hygiene controls. This drives hot water, steam, chemical dosing, pumps and wastewater loads.
Rendering and by-product processing	Rendering tallow, lard and by-product processing can require significant thermal energy and may also create opportunities for heat recovery or bioenergy.
Packaging and materials handling	Packaging lines, conveyors, motors, compressed air, vacuum systems and cold chain handling contribute to electricity demand.
Wastewater treatment	Wastewater treatment can be energy intensive but may also provide opportunities for biogas recovery where organic loads are material.
Compressed air and motors	Compressors, pumps, fans, conveyors and other motor-driven systems can create material electricity loads, particularly where equipment runs continuously.

2 Australian Food and Grocery Council (2025), *Australian Food and Grocery Council Electrification Fact Sheet*, Australian Food and Grocery Council.

The energy profile of each meat processor can depend on:

- product mix
- facility type
- level of processing
- refrigeration load
- operating hours
- cleaning intensity
- wastewater treatment system
- on-site or off-site rendering and further processing.

Large integrated processors may have significant loads across refrigeration, hot water, boilers, rendering, packaging, wastewater treatment and cold storage. Smaller processors may have lower absolute energy use but may face higher unit costs, limited technical capacity and fewer options to justify major capital upgrades.

Meat processing energy requirements

Meat processing typically requires:

- **Medium-temperature hot water and low-to-medium pressure steam** for activities such as:
  - scalding
  - defeathering
  - sterilisation, sanitation
  - cooking.
- **Higher energy-consuming thermal processes** such as:
  - rendering
  - smoking, cook-smoking
  - roasting
  - frying
  - other direct heat applications.
- **Refrigeration for chilling and freezing** for food safety, shelf life and product quality. Refrigeration loads may be continuous and can be affected by:
  - ambient temperature
  - door openings
  - insulation
  - equipment age
  - condenser performance
  - temperature set points
  - defrost cycles
  - product throughput.

The important interaction between heat and steam

Meat processing and manufacturing facilities often require both large refrigeration loads and significant hot water demand. This creates opportunities for heat recovery, where waste heat from refrigeration systems can be used to preheat water for cleaning, sanitation or process use.[3]

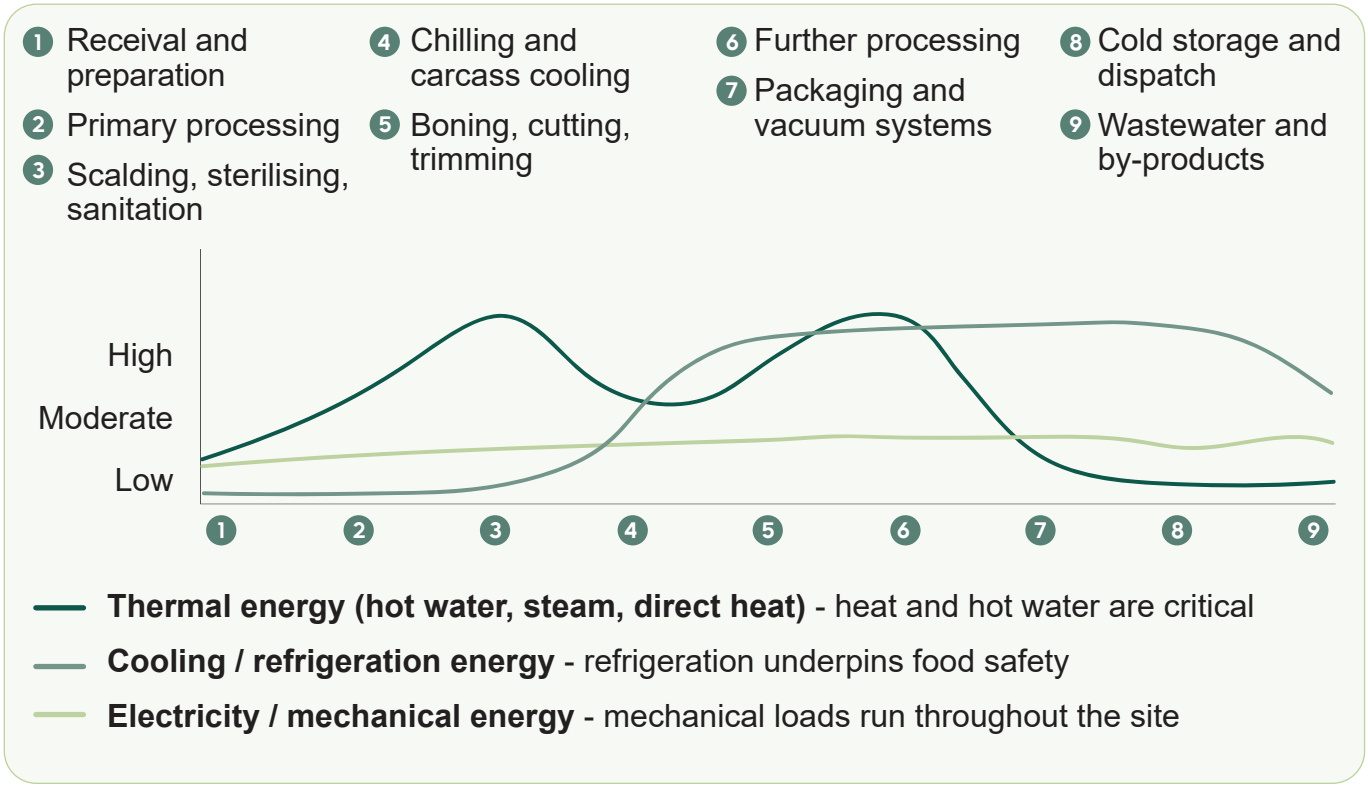

Figure 2: Meat processing and shifting energy demand

3 Australian Food and Grocery Council, *Australian Food and Grocery Council Electrification Fact Sheet*.

What the carbon data tells us

The carbon footprint analysis for this study focuses on operational emissions: **Scope 1 and Scope 2.**

Scope 1 emissions are direct emissions from sources controlled by the business. For meat processors, these are generally associated with:

- natural gas or LPG used for boilers, hot water, steam, cooking, smoking, rendering, sterilisation or sanitation
- diesel or petrol used in company-controlled vehicles, forklifts, generators or equipment
- refrigerant losses from refrigeration and cooling systems
- biogas combustion
- wastewater treatment emissions, within the operational boundary.

Scope 2 emissions are indirect emissions from purchased electricity. For meat processors, electricity is used across:

- refrigeration and freezer systems
- compressors, pumps, motors and fans
- lighting and ventilation
- packaging and processing equipment
- wastewater treatment
- cold rooms and storage
- administration and site services.[4]

For many meat processors, operational emissions are likely to be mixed, with Scope 1 linked to process heat and fuel use, and Scope 2 linked to refrigeration, cold storage and equipment electricity demand.

Meat processing often has the dual challenge of reducing electricity use from refrigeration and equipment, while also limiting fuel use associated with process heat and hot water.

4 Tao, L., Chua, M.F. and Gilmour, G. (2025), *An Overview of Lowering Australian Pork's Carbon Footprint*, Food Agility CRC.

Meat processing and manufacturing is central to industry decarbonisation

The meat processing and manufacturing subsector is estimated to generate approximately **220,000 tCO_2-e in operational emissions each year**.[5] This represents almost half of the estimated 455,000 tCO_2-e generated across WA food and beverage manufacturing, making meat processing a critical focus for industry-wide emissions reduction.

The estimate reflects the energy-intensive nature of meat processing, including continuous refrigeration and cold storage, process heat, hot water, sanitation, rendering and wastewater treatment. Meaningful reductions will require action across both electricity and direct emission sources – not simply the installation of renewable electricity. Refrigeration optimisation, heat recovery, efficient boilers and hot-water systems, refrigerant management, electrification and biogas recovery can significantly contribute, depending on the facility.

The findings also show that improvements at a relatively small number of larger processing and manufacturing facilities could materially reduce emissions across the wider food and beverage manufacturing sector. Smaller processors can contribute through more targeted efficiency measures that reduce operating costs as well as emissions.

Among meat production respondents, **Scope 1 emissions** accounted for approximately **66% of operational emissions**, while **Scope 2 emissions represented 34%**. This indicates that direct emissions – particularly from fuels used for process heat, hot water, sanitation and onsite equipment – were the larger contributor. Purchased electricity for refrigeration, cold storage, pumps and processing equipment also remained significant. The split was almost identical to the overall Study sample of 65% Scope 1 and 35% Scope 2 emissions.

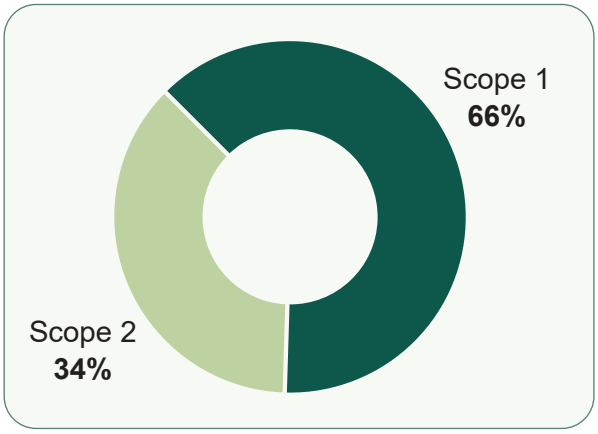

Figure 3: Scope 1 and Scope 2 split for meat production respondents

Value chain context

While this report focuses on operational Scope 1 and Scope 2 emissions, meat supply chains also have significant Scope 3 considerations. Upstream emissions can include livestock production, feed, manure management, transport and purchased inputs. Downstream emissions can include cold chain distribution, retail, foodservice, waste and product use.[6]

For this report, the practical focus is on what meat processors can directly influence within their operations: energy use, refrigeration, process heat, hot water, cleaning, wastewater, renewables, fuel use and emissions measurement.

5 *Unless otherwise stated, emissions figures relate to operational Scope 1 and Scope 2 emissions and are expressed as tonnes of carbon dioxide equivalent (tCO_2-e). Industry and subsector totals are indicative estimates rather than formal greenhouse gas inventories and are subject to uncertainty arising from data availability, sample coverage, scaling assumptions, emission factors and differences between businesses. Figures have been rounded and should be interpreted as estimates of scale rather than precise totals. Scope 3 emissions are excluded.*

6 Copley, M.A., McGahan, E.J., McCormack, K. and Wiedemann, S.G. (2024), 'Environmental impacts of Australian pork in 2020 and 2022 determined using lifecycle assessments', *Animal Production Scien*ce, vol. 64, AN23352; Department of Primary Industries and Regional Development (2024), *Chicken Meat and Greenhouse Gas Emissions*, Department of Primary Industries and Regional Development, Western Australia; Tao, Chua and Gilmour, *An Overview of Lowering Australian Pork's Carbon Footprint*.

Scale and processing shape energy use

The energy and emissions profile of a meat processor is heavily dependent on its operating model, scale and level of processing.

Large integrated processors are more likely to have emissions concentrated in refrigeration, process heat, rendering, wastewater treatment and cold storage, reflecting the complexity and scale of their operations. Smaller processors may have lower overall energy consumption, but a greater proportion of energy use may be associated with refrigeration, hot water, sanitation and cold storage requirements.

As a result, energy use, emissions intensity and improvement opportunities can vary significantly across the subsector and any comparisons should be made between businesses with similar operating characteristics.

Scope 1 and 2 emissions associated with meat processing and facility operations

Scope 1

Direct emissions from sources controlled by the business

- Natural gas or LPG used for boilers, hot water, steam, cooking, smoking, rendering, sterilisation or sanitation
- Diesel or petrol used in company-controlled vehicles, forklifts, generators or equipment
- Refrigerants losses from refrigeration and cooling systems
- Biogas combustion where applicable, from recovered biogas used on site
- On-site wastewater treatment emissions

Scope 2

Indirect emissions from purchased electricity

- Refrigeration and freezer systems
- Compressors, pumps, motors and fans
- Packaging and processing equipment
- Lighting, ventilation and controls
- Cold rooms and storage
- Administration and site services

Operational emissions are only the tip of the iceberg

A WA-specific study of Harvest Road Group operations found that most beef supply chain emissions occur upstream of processing, with over 90 per cent of emissions arising from third-party suppliers, primarily enteric methane from cattle. The same study found that meat processing represented 2.8 per cent of full supply chain emissions, with processing-only emissions intensity reported at 0.59 kg CO_2-e per kg hot standard carcass weight.[7] This reinforces the need to distinguish between facility-level emissions and broader supply chain emissions, while highlighting the role processors play in coordinating data, market signals and emissions reduction across the value chain.

7 Meat & Livestock Australia (2022), *Carbon Footprint and Reduction Options for Harvest Road Group Operations*, Project P.PSH.1259, prepared by Integrity Ag & Environment, Meat & Livestock Australia, North Sydney.

What meat processors are already doing

WA meat processors have already taken important first steps. The Study shows a subsector responding to energy cost pressures through practical, site-based action. The first stage of this work has focused on infrastructure: improving buildings, upgrading equipment, reducing losses in cooled areas and investing in systems that support day-to-day production.

This reflects the operational realities of meat processing and manufacturing. Energy underpins refrigeration, hot water, cleaning, pumping, compressed air and temperature-controlled environments, all of which are essential for food safety, product quality and production continuity. Consequently, many energy-efficiency measures are operational improvements that strengthen reliability, compliance and cost competitiveness rather than separate sustainability projects.

Investment in site infrastructure is already strong

Upgrades to site infrastructure were reported by 93% of respondents, well above the broader food and beverage sector average of 77%. This suggests many processors are already investing in site improvements as a foundation for better energy performance. Process equipment upgrades were also common, selected by 60% of respondents, compared with 50% across the broader sample, indicating a strong focus on improving the efficiency of core production systems.

Together, these findings demonstrate that processors are actively investing in the assets that shape daily energy performance and site efficiency: cold rooms, refrigeration systems, machinery, doors, controls, lighting, and production equipment.

Processors are implementing practical solutions

Participants reported a wide range of actions, including LED lighting, solar panels, batteries, energy-efficiency upgrades to equipment, cooling and refrigeration systems, variable speed controllers, automatic doors in cooled areas and improved temperature control systems. Other examples included higher-pressure cleaning circuits to reduce hot water demand, automated factory controls, heat recovery using dehumidifiers, and biogas from covered anaerobic lagoon treatment. These examples demonstrate that processors are pursuing improvements across both site infrastructure and production processes.

Capital investment is leading operational optimisation

Around 33% of businesses reported having conducted an energy audit, slightly above the food and beverage industry average, while 13% reported using energy management software, also above the broader sample. By contrast, monitoring and smart meters were reported by only 20% of meat processors, below the wider industry average of 30%, suggesting there is still room to strengthen real-time energy visibility and day-to-day performance monitoring. Operational process changes were also less prevalent than in the broader study sample (40% compared with 52%), indicating that investment has primarily been directed towards capital upgrades rather than operational optimisation.

Building from action to measurable progress

Many businesses are likely to have the electricity, gas, LPG, diesel, fuel or refrigerant data needed to estimate Scope 1 and Scope 2 emissions. There is now an opportunity to convert that existing information into a structured emissions baseline which can help processors move from individual efficiency actions to clearer benchmarking, informed investment decisions and better evidence of progress.

WA meat processors are investing in efficiency, particularly through site and equipment upgrades. The next opportunity is to turn existing energy data into a practical Scope 1 and Scope 2 baseline.

Renewable energy and lower-emissions power

Renewable energy uptake is strong

Renewable energy is part of the energy mix for many meat processing participants. Overall, 67% of respondents reported some form of renewable energy adoption, with on-site solar the most common option at 60%. This reflects the practical role solar can play in reducing purchased electricity, particularly where facilities have daytime loads from refrigeration, processing equipment, pumps, compressors, lighting and site services.

Solar forms part of a broader solution

However, as meat processors have a more complex energy profile than electricity-driven businesses, solar is not the whole solution. While renewable electricity can help reduce Scope 2 emissions, meat processing and manufacturing also requires significant energy for refrigeration, cold storage, hot water, sanitation, process heat, wastewater treatment and, in some cases, rendering or further processing. Solar may not fully align with continuous refrigeration demand or thermal loads that occur outside daylight hours.

The strongest emissions reduction opportunities are likely to combine renewable electricity with improvements to core site systems.

For larger facilities, organic-rich wastewater and processing by-products may create opportunities for anaerobic treatment and biogas recovery. Biogas can provide a renewable energy source while supporting improved management of wastewater and organic waste.

These projects will not suit every facility, as viability depends on site scale, wastewater characteristics, capital availability and technical capability. However, they may offer significant opportunities for larger integrated processors with material and consistent organic waste streams.

Heat recovery can reduce thermal energy demand

Heat recovery is also highly relevant. Meat processing facilities generate waste heat from refrigeration systems while also requiring hot water for cleaning, sanitation and process use. Capturing and reusing this heat can reduce demand for gas, LPG or electricity used for water heating and can provide a practical bridge between energy efficiency and lower-emissions operations.

Site and financial constraints continue to influence uptake

For participants not using renewable energy, the main barriers were costs or leased premises with a lack of control over the site. This suggests uptake is shaped not only by technology, but also by capital availability, landlord approvals, roof access, grid connection requirements, site ownership and confidence in the business case.

Solar can reduce electricity emissions, but meat processing needs a broader energy strategy.

What is driving meat processors to act

The Study suggests that many meat processors are ready to take the next step, but implementation needs to be practical, commercially viable and carefully managed. Equipment is specialised, refrigeration reliability is critical, downtime can be costly, and any change to equipment or process settings must protect food safety, throughput, cold chain performance and product quality.

Customer and market expectations was a consideration by 60% of meat processing participants. This is relevant for businesses supplying major retailers, foodservice customers, export markets and supply chain partners that are increasingly interested in traceability, sustainability and emissions data.[8]

Business values and ethics were also identified by 60% of participants, while corporate sustainability goals by 47%. This suggests emissions reduction is not being driven by cost alone, but also by reputation, customer expectations and internal business priorities.

8 Tao, Chua and Gilmour, An Overview of Lowering Australian Pork's Carbon Footprint; Budnevich Portales, C., Jahn, V., Dietz, S. and Amin, A. (2024), Food Producers and Net Zero: A Review of Progress, Transition Pathway Initiative Centre, London School of Economics and Political Science, London; McKinsey & Company (2022), Decarbonizing Grocery, McKinsey & Company.

Overall, the strongest signal is commercial: energy efficiency needs to reduce costs, improve reliability and support business resilience, while also helping meat processors respond to emerging customer and market expectations.

Supplier demands, regulatory requirements, investor or financial incentives and competitive advantage were identified by less participants as contributors, though these factors may become important as reporting, retailer expectations and finance-sector requirements continue to develop.

The strongest signal from survey respondents is commercial: energy efficiency needs to reduce costs, improve reliability and support business resilience.

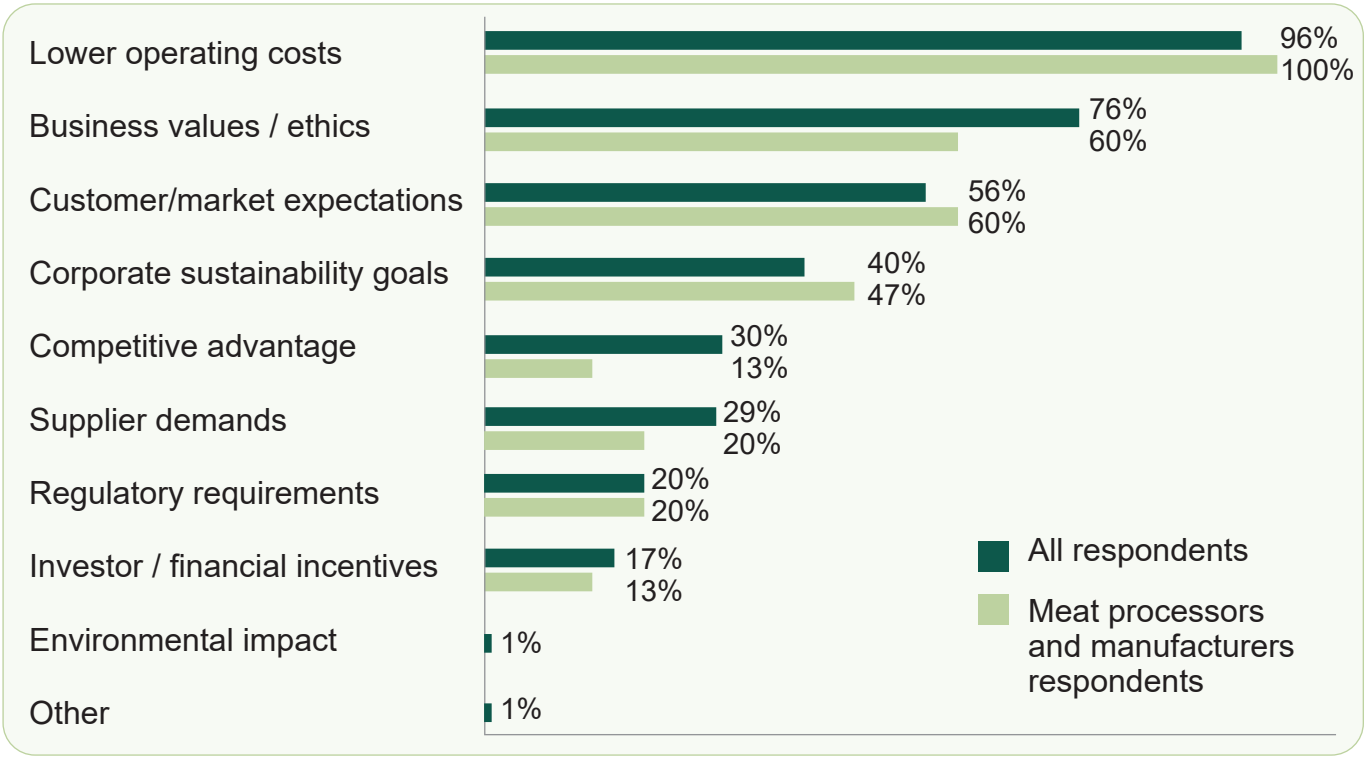

Figure 4: Emissions reduction drivers for meat processors

What is holding meat processors back

The main barriers to energy efficiency and emissions reduction are practical and commercial. Meat processing relies on specialised equipment, stringent food safety requirements and reliable refrigeration, while production downtime can be costly. Any operational changes must maintain product quality compliance and production performance. High upfront costs were the most commonly reported barrier to improving energy efficiency, identified by 87% of meat processors. This was consistent with the broader food and beverage industry average, confirming that affordability is a sector-wide challenge.

Competing business priorities are a notable barrier cited by 40% of participants, compared with 27% across all food and beverage manufacturers. This suggests that while energy efficiency is valued, operational priorities such as labour, supply, food safety, compliance and production continuity often take precedence.

87%

of participants identified high upfront cost a barrier to improving energy efficiency

Barrier	Consideration
High upfront cost	Larger upgrades such as refrigeration systems, boilers, heat recovery, wastewater treatment or electrification can require significant capital.
Specialised equipment	Meat processing equipment must meet food safety, hygiene, throughput and product quality requirements, limiting easy substitution.
Competing priorities	Processors are managing labour, livestock supply, customer requirements, food safety, export compliance and cost pressures.
Production disruption	Downtime for upgrades can affect throughput, contracts, cold chain reliability and product availability.
Technical uncertainty	Businesses may be unsure which technologies are suitable for their site or whether projected savings are reliable.
Data limitations	Without sub-metering or energy management systems, it can be difficult to identify the best opportunity or prove the business case.

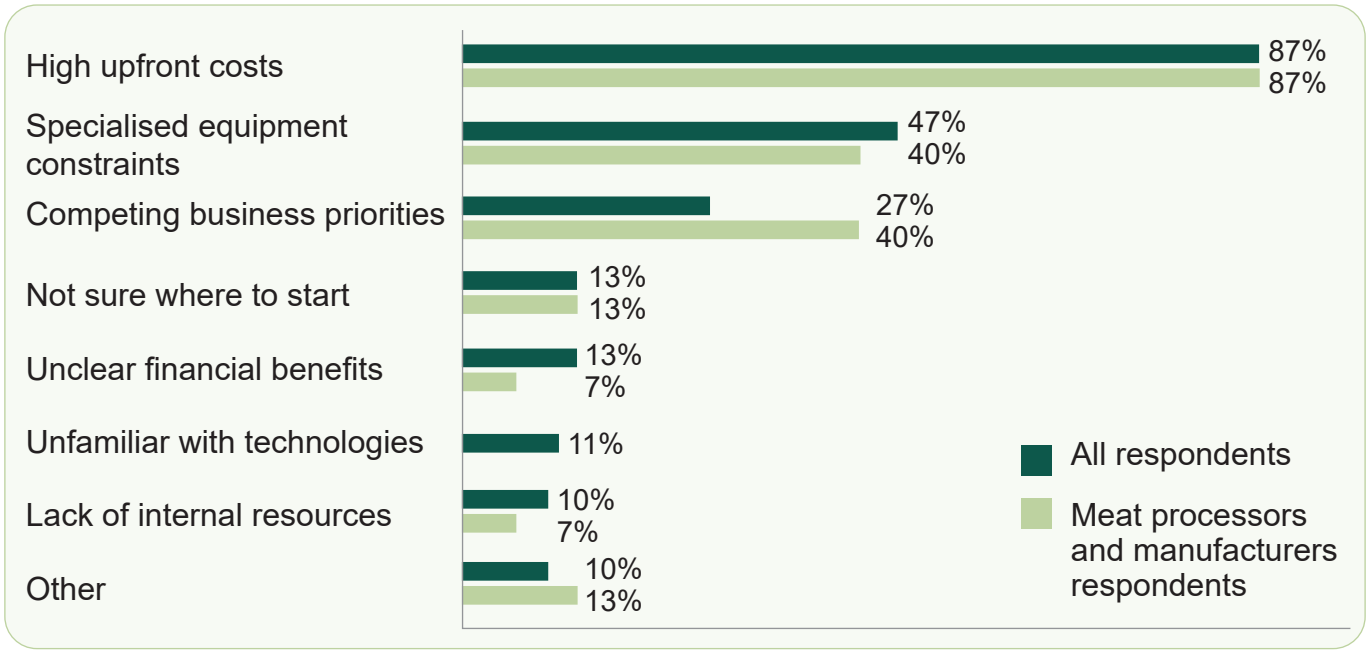

Figure 5: Barriers to energy efficiency for meat processors

The barrier is not a lack of interest in energy efficiency, it is implementation.

Meat processors are acting on energy efficiency, but larger upgrades require capital, confidence, technical support and a clear business case. Practical support, including grants, feasibility assessments, supplier-neutral advice and case studies from comparable facilities, will be important to help businesses move from intent to investment.[9]

9 World Economic Forum (2025), *Sustainability Meets Growth: A Roadmap for SMEs and Mid-Sized Manufacturers*, World Economic Forum.

The future: efficient, resilient and lower-emissions meat processing

For WA meat processors, energy and emissions reduction is both a sustainability and a business resilience opportunity.

The subsector is energy-intensive, highly regulated and operationally complex. Food safety, refrigeration, hot water, sanitation, cold storage, wastewater treatment and process reliability are essential to daily operations. This means lower-emissions meat processing needs to be practical, staged and aligned to each site's operating requirements, equipment profile, production schedules and investment capacity.

The Study revealed that meat processors are already acting on energy efficiency opportunities. Many participants have upgraded site infrastructure, improved process equipment, installed solar, undertaken energy audits or changed operating practices. Emissions tracking remains at an earlier stage, with larger projects constrained by capital cost, specialised equipment requirements, production disruption and competing business priorities.

Using the report's **Measure → Optimise → Upgrade → Decarbonise** framework, the pathway for meat processors can be staged according to each business's energy maturity, production profile, equipment intensity, site configuration and investment capacity. This means focusing on refrigeration, cold storage, hot water, sanitation, process heat, wastewater treatment and lower-emissions energy opportunities where practical.

Measure: Find the biggest energy loads

The first step is to **measure** energy use and emissions by establishing a simple and repeatable Scope 1 and Scope 2 baseline. This should capture electricity, natural gas, LPG, diesel, petrol and refrigerant use, supported where possible by production data such as tonnes of meat processed, carcass throughput, packaged product volumes, cold storage volumes, hot water or steam use, wastewater treatment activity and renewable energy generation. Sub-metering and energy management software can help processors isolate major energy loads, identify abnormal consumption patterns and develop stronger business cases for future investments.

Optimise: Get more from existing equipment

Once energy use is better understood, processors can **optimise** existing systems through lower-cost operational improvements. This includes reviewing **refrigeration and cold storage**: temperature set points, reducing overcooling, maintaining condensers and evaporators, and improving cold room seals. Operators can consider opportunities to **reduce heat and hot water** use by tuning boilers and burners, reviewing hot water set points, reducing unnecessary hot water generation, improving pipework insulation and recovering waste heat where practical. Businesses can **enhance cleaning and sanitation cycles**, by improving high-pressure systems, reducing unnecessary rinse times and reviewing chemical dosing. **Compressed air systems and motors** can be checked for leaks and investigate opportunities to shut down idle equipment. These actions are generally lower cost and less disruptive than major equipment replacement, and can also improve reliability, reduce avoidable energy use and support food safety outcomes.

Upgrade: invest where the business case is clear

The next stage is to **upgrade** equipment and controls where there is a clear business case. Relevant opportunities include **high-efficiency refrigeration** and **hot water systems**, improved refrigeration controls, automatic doors in cooled areas, lower-impact refrigerants, heat recovery from refrigeration, efficient boilers or burners and heat pumps for hot water. Opportunities lie in **digital and site energy**, including sub-metering, energy management software, solar PV, battery storage and automated controls. For larger processors, the strongest opportunities are likely to be in **biogas recovery** from wastewater treatment, covered anaerobic lagoons, efficient compressed air and demand management. Smaller processors can benefit from lighting, refrigeration maintenance, solar, equipment replacement, operational controls and basic metering.

Old boiler, new savings: AJ Bush upgrades process heat

AJ Bush & Sons replaced a 50-year-old gas-fired boiler at its Riverstone animal by-product processing facility. An energy audit had identified that the ageing boiler was approaching the end of its serviceable life. The replacement increased capacity from 7.3 MW to 10 MW and introduced an economiser, oxygen-trim control, electronic air-to-gas ratio control and automatic blowdown management. These features reduce heat losses and improve combustion efficiency while supporting the reliability required by a facility operating six days a week.

The upgrade was calculated to save approximately 11,790 GJ of energy and more than $80,000 in operating costs annually. Support through the NSW Energy Savings Scheme provided approximately $120,000 in energy-saving certificate value. This project demonstrates how a necessary equipment replacement can also improve energy performance. Auditing ageing assets early, incorporating energy-efficiency features into equipment specifications, and exploring available incentives can strengthen the business case for upgrading.[10]

10 Northmore Gordon n.d., *AJ Bush & Sons reduces energy costs with needed upgrade*.

Decarbonise: shift remaining demand to cleaner energy

Over the longer term, processors can **decarbonise** by exploring site-specific opportunities such as renewable electricity, solar PV and battery storage, heat pumps, electric boilers, heat recovery from refrigeration, biogas recovery from wastewater, lower-impact refrigerants and fuel switching where practical. Planning for electrification when replacing or expanding equipment can also support future emissions reduction. These options are most viable at sites with consistent production, high hot water demand, significant wastewater volumes, or planned equipment upgrades and expansion.[11]

The transition pathway should be aligned with normal asset replacement cycles. This allows processors to avoid locking in inefficient emissions equipment where lower-emissions alternatives may become viable. It also ensures investment decisions are commercially realistic and do not compromise food safety, throughput, cold chain performance or product quality.[12]

The Study revealed the importance of practical support. Meat processors identified useful forms of support such as:

- financial incentives and grants
- advice on energy-efficient equipment
- information on renewable energy options
- guidance on emissions reduction strategies
- waste management and circular economy information
- energy provider guidance
- industry case studies.

This reinforces that funding pathways, credible advice, comparable examples and support to build investment confidence are also important.

The opportunity for WA meat processors is to improve energy productivity, reduce avoidable energy use, manage cost exposure and strengthen sustainability credentials in domestic and export markets. The future of lower-emissions meat processing will not depend on a single technology. It will be achieved through better data, improved process control, staged investment and practical support that reflects the operational realities of food safety, refrigeration, process heat, production requirements and commercial viability.

11 Australian Food and Grocery Council, *Australian Food and Grocery Council Electrification Fact Sheet*.

12 Australian Alliance for Energy Productivity (2016), A Roadmap to Double Energy Productivity in Manufacturing by 2030, Australian Alliance for Energy Productivity; Australian Food and Grocery Council, *Australian Food and Grocery Council Electrification Fact Sheet*.

Meat Processing and Manufacturing

A practical pathway to efficient, resilient and lower-emissions meat processing and manufacturing

Step 1: measure

Establish simple and repeatable baseline data

- **Capture energy and emissions:** electricity, natural gas, LPG, diesel, petrol, refrigerants
- **Capture activity:** tonnes of meat processed, carcass throughput, packaged product volumes, cold storage volumes, hot water or steam use, wastewater treatment data
- **Track:** both absolute emissions and emissions intensity over time
- **Tools:** sub-metering, energy management software

Step 2: optimise

Prioritise low-cost operational improvements first

Refrigeration and cold storage	**Heat and hot water**	**Cleaning and sanitation**	**Compressed air and motors**

Fast, low cost, low disruption improvements to boost reliability and reduce energy waste

Step 3: upgrade

Make targeted investments in equipment and controls

Refrigeration and cold storage	**Process heat and hot water**	**Digital and site energy**	**Wastewater and site improvements**

Opportunities: larger processors
Refrigeration, process heat, hot water, rendering, wastewater treatment, compressed air, cold storage

Opportunities: smaller processors
Lighting, refrigeration maintenance, solar, equipment replacement, operational controls, basic metering

Develop a strong business case to support payback periods, production downtime, and/or site constraints

Step 4: decarbonise

Plan for longer-term decarbonisation opportunities

Renewable electricity procurement	**Solar PV and battery storage**	**Heat pumps for hot water**	**Electric boilers**
Heat recovery from refrigeration	**Electrification infrastructure**	**Biogas recovery from wastewater**	**Lower-impact refrigerants and fuel switching**

Site-specific options are best suited to larger operators with high hot water or wastewater loads, or planned equipment upgrades

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+61 1300 374 731 | enquiries@dpird.wa.gov.au | dpird.wa.gov.au

ABN: 18 951 343 745

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