Department of
Primary Industries and
Regional Development

GOVERNMENT OF
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Energy Snapshot Study:

Food and Beverage Manufacturing

Contents

About this study

Energy is fundamental to food and beverage manufacturing. It powers refrigeration, heating, cooling, processing, packaging and storage across a sector that ranges from small owner-operated bakeries, breweries and wineries to large meat, dairy and food processors. Although their products and production systems differ, manufacturers across Western Australia (WA) face a common challenge: maintaining reliable and efficient production while managing rising costs, ageing equipment and competing demands for capital. Against this backdrop, global markets, retailers, customers and supply chains are placing greater emphasis on energy efficiency, emissions transparency and credible climate action.

The Department of Primary Industries and Regional Development (DPIRD), in partnership with RSM Australia, undertook the *Food and Beverage Manufacturing Energy Snapshot Study* (Study) to improve understanding of energy use, greenhouse gas emissions and decarbonisation readiness across WA's food and beverage manufacturing sector.

The Study examined:

- Which manufacturing activities demand the most energy use and create significant emissions
- The actions businesses are taking to improve energy efficiency and reduce emissions
- Factors that may prevent progress towards energy-efficiency and emissions reduction
- Opportunities to improve energy efficiency, reduce costs and emissions, strengthen supply-chain competitiveness and support long-term business resilience.

This report consolidates the Study findings to provide manufacturers, industry organisations and government with practical evidence for informed decision-making.

A snapshot of a diverse industry

The Study captured insights from 124 businesses across 10 subsectors of WA's food and beverage manufacturing industry. The results highlight the industry's statewide presence with more than half of respondents located in regional WA and representation from every region.

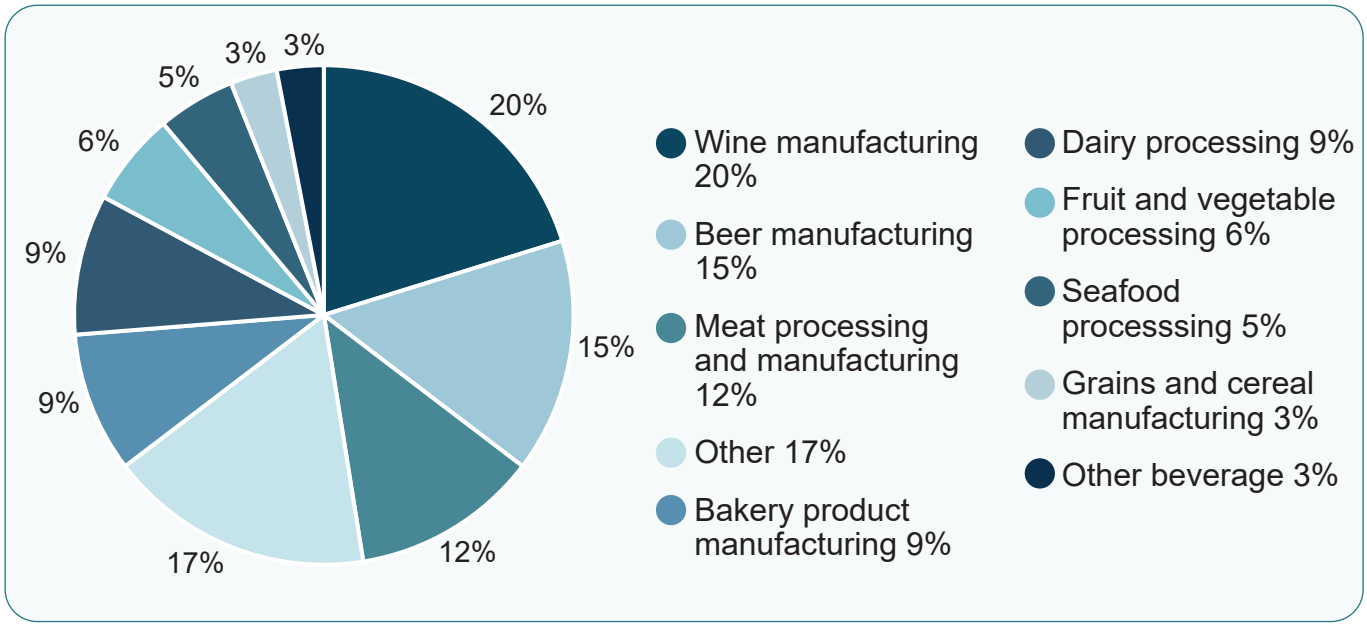


Figure 1: Participants by subsector

Most participants were micro, small or medium-sized enterprises. For these businesses, energy-efficiency investment often competes with immediate production, maintenance and workforce priorities. The Study largely captured the views of decision makers, with founders, executives or senior managers representing about 80% of respondents.

From this broader industry picture, four subsectors were examined in more detail: bakery product manufacturing, beer manufacturing, meat processing and manufacturing, and wine manufacturing. These subsectors were selected partly due to participant numbers, which provided a sufficient evidence base for meaningful analysis. They also represent diverse production systems and energy demands across the industry. Further detail on each of the four subsectors is provided in dedicated Subsector Snapshot reports, published as companion documents to this report. Businesses from the remaining subsectors are included in the comparative analysis under the category "Other", ensuring the report captures the diversity of WA's food and beverage manufacturing industry.

By tracking energy use across these operations, the Study identified where energy is typically used, what drives consumption and which improvements may deliver the greatest benefit. Emissions analysis focused on Scope 1 emissions from fuels, refrigerants and other sources directly controlled by a business, and Scope 2 emissions associated with purchased electricity. The Study boundary was limited to operational emissions and did not include Scope 3 emissions related to ingredients, packaging, freight, waste and other value chain activities.

The analysis focuses on energy use and emissions that manufacturers can most directly influence. It highlights opportunities to improve operating practices, upgrade equipment, electrify processes and adopt renewable energy, while also examining the practical barriers that can constrain action.

The report provides an evidence-based snapshot rather than a complete census or engineering audit of the industry. It demonstrates how energy challenges are being experienced across WA's food and beverage manufacturing sector and how targeted actions can reduce costs, improve operational performance and strengthen long-term resilience. [1]

1 *Note: this Study provides an evidence-based snapshot of participating businesses and should not be interpreted as a complete or statistically representative assessment of WA's food and beverage manufacturing sector. Emissions figures are based on available business-supplied data, publicly available data, recognised emissions factors and modelling assumptions and have not been independently audited or assured. Results cover Scope 1 and Scope 2 emissions only, and subsector and whole-of-sector figures are estimates intended to indicate the likely order of magnitude rather than measured totals, precise inventories or statistical confidence intervals. Comparisons should be treated as indicative, and all emissions estimates, potential savings and improvement opportunities should be verified using current, site-specific data before being used for reporting, investment or operational decisions.*

Energy use, emissions and opportunities for the sector

WA's food and beverage manufacturing sector is highly diverse, spanning small family-owned businesses, regional operators and large processing facilities. Common energy demands include refrigeration, cold storage, process heat, cleaning, packaging and equipment operation, but the scale, timing and emissions intensity of energy use varies across industries. These differences are driven by the distinct production, cooling, cleaning, packaging and storage processes used by businesses, highlighting the need for targeted energy efficiency measures across the sector.

The food and beverage manufacturing industry is a significant part of WA's value-added economy, with an estimated annual turnover of $9.75 billion, supporting around 22,200 jobs, and approximately 1,870 businesses operating across manufacturing, processing and production.[2, 3]

Energy efficiency can help WA move further up the value chain

WA has a strong opportunity to capture more value from its agricultural production through food and beverage manufacturing. The WA Government's *Future State: Accelerating Diversify WA* and *Made in WA* plans recognise value-added manufacturing as a key driver of economic diversification, jobs and industry growth. Supported by established supply chains across meat, seafood, grains, fruit and vegetables, WA is well positioned to expand its value-added food sector. Improving energy efficiency and reducing emissions can help manufacturers lower costs, remain competitive and meet growing demand for sustainable products, supporting a more resilient and globally competitive industry.[4, 5]

2 Australian Bureau of Statistics (ABS), *Australian Industry, 2024–25*, Industry by State data, Food Product Manufacturing and Beverage and Tobacco Product Manufacturing, released 19 June 2026.

3 Australian Business Register (ABR), *ABR Explorer*, Industry by State data, Food Product Manufacturing and Beverage and Tobacco Product Manufacturing, accessed 31 August 2026

4 Government of Western Australia, *Future State: Accelerating Diversify WA* (Perth: Department of Jobs, Tourism, Science and Innovation, 2023).

5 WA Labor, *Made in WA* (Perth: Australian Labor Party (Western Australian Branch), 2025), 2–3, 7, 15, http://www.rogercook.com.au/documents/madeinwaplan.pdf.

The food and beverage manufacturing sector transforms the State's agricultural, seafood and beverage inputs into higher-value products for domestic and export markets. As a critical link between primary producers and consumers, the sector supports food security, economic resilience and the efficient movement of products through local and global supply chains.

WA has strong foundations for value-added food and beverage production, including extensive agricultural resources, high-quality seafood, established meat and dairy industries, and a growing premium beverage sector. The State's reputation as a trusted food supplier to Asia-Pacific markets creates opportunities to capture more value from locally sourced ingredients through processing and manufacturing.

The sector has a significant economic footprint across metropolitan and regional WA, supporting employment, regional development and activity across wholesale, retail, tourism, hospitality and export markets. It also underpins a broad network of related industries, while local processing strengthens supply chains, builds capability and enhances the competitiveness of WA products in domestic and international markets.

Energy sits at the centre of this story

Food and beverage manufacturers rely on refrigeration, freezing, process heat, hot water, compressed air, packaging equipment, motors, pumps and cleaning systems to make safe, high-quality products. These systems affect power bills, production efficiency, food safety, product quality and equipment reliability. They also drive a large share of operational greenhouse gas (GHG) emissions particularly through purchased electricity, gas, LPG, diesel, petrol and refrigerants.[6]

Energy use and emissions are closely linked. For many businesses, reducing avoidable energy consumption is the most practical first step towards reducing emissions. Improving refrigeration performance, managing heat and hot water demand, upgrading equipment, reducing leaks, installing solar and optimising controls can reduce operating costs while simultaneously lowering Scope 1 and Scope 2 emissions.

Many businesses operate with tight margins, perishable products and fixed production schedules, meaning wasted energy can quickly become a cost and competitiveness issue. Effective energy management can reduce waste, control costs, improve reliability and strengthen resilience.

The Study findings reinforce this connection. Lower power bills were the strongest driver for action, identified by 96% of businesses. This demonstrates that energy and emissions initiatives are most compelling when they support cost control, operational efficiency and long-term competitiveness. For WA's food and beverage manufacturing sector, reducing emissions is not separate from business performance. It is part of building a more efficient, resilient and competitive sector.

6 Department of Climate Change, Energy, the Environment and Water, "Food and Beverage Manufacturing"; World Resources Institute and World Business Council for Sustainable Development, The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, rev. ed. (Washington, DC and Geneva: WRI and WBCSD, 2004), 25, https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf.

96% of companies are motivated by reducing energy costs

Emissions reduction - a universal commitment

Greenhouse gas emissions contribute to global warming and climate change. Reducing emissions is a global effort, reflected in the Paris Agreement and in national commitments made by countries including Australia. Australia has set national emissions reduction targets, including a 2035 target to reduce emissions by 62–70% below 2005 levels, as part of its Nationally Determined Contribution under the Paris Agreement.[7]

Meeting these commitments will require action across the whole economy, including energy, transport, industry, agriculture, buildings and manufacturing. For food and beverage manufacturers, operational emissions are closely connected to energy use, including electricity, gas, LPG, diesel and refrigerants. This means emissions reduction is not only a climate issue; it is also linked to energy productivity, cost control, customer expectations, market access and future competitiveness. Reducing operational emissions can help lower power bills, improve energy efficiency, prepare for evolving customer and supply chain expectations, and contribute to broader national and global emissions reduction efforts.

7 Department of Climate Change, Energy, the Environment and Water, "International Climate Action – Paris Agreement," Australian Government, last updated 17 March 2026, https://www.dcceew.gov.au/climate-change/international-climate-action.

Where energy is used

Energy is used across almost every stage of food and beverage manufacturing. It is needed to receive and store ingredients, process products, maintain food safety, package goods and move finished products through storage and distribution. While each business is different, most energy use in the sector can be grouped into a small number of common functions: heating, cooling, refrigeration, movement, cleaning and packaging.

The largest energy loads often come from managing temperature, including refrigeration, freezing, chilling, cold rooms, ice making, chilled storage and temperature-controlled handling. These systems are essential for food safety and product quality, particularly where businesses handle perishable ingredients or finished products. Many operate continuously, meaning even small improvements to controls, seals, insulation, maintenance and set-points can deliver meaningful energy savings over time.

Process heat is another major energy use across the sector. Manufacturers use heat for pasteurisation, cooking, baking, boiling, blanching, drying, distilling, hot water and sanitation. Heat is supplied through electricity, natural gas, LPG, diesel or steam systems. These processes are often central to product quality, meaning energy improvements need to be carefully planned and implemented. Practical opportunities may include improving insulation, recovering waste heat, maintaining burners or boilers, optimising controls, upgrading hot water systems and reviewing whether processes or equipment are running longer or at higher temperatures than required.

Mechanical and electrical systems also contribute to energy use across the sector. Pumps, motors, conveyors, fans, mixers, mills, compressors and compressed air systems are common in many facilities. While less visible than ovens, boilers or cold rooms, they often operate for long hours and support critical production tasks. Opportunities for energy efficiency include leak reduction, pressure optimisation, variable speed drives, motor upgrades, preventive maintenance and switching off equipment when not required.

Packaging and storage can add further energy demand. Bottling, canning, sealing, wrapping, labelling, palletising, conveyors, compressed air and warehouse operations all use energy. For some businesses, packaging lines run in short bursts, while for others, they are a major part of daily operations. Storage areas, retail spaces, tasting rooms, offices and amenities can also add to electricity use through lighting, heating, ventilation, air conditioning and refrigeration.

Cleaning and sanitation are also important energy-using activities. Food safety requirements mean many businesses rely on hot water, cleaning-in-place systems, washdown, dishwashing, chemical dosing and wastewater handling. As these activities use both energy and water, improvements to scheduling, temperature control, insulation, flow control and maintenance can help reduce waste without compromising hygiene or compliance.

Energy hotspot	Operational area
Process heat	Used for pasteurisation, cooking, baking, boiling, distilling, blanching, drying, hot water and sanitation
Refrigeration and freezing	Required for milk, seafood, chilled produce, frozen goods, cold rooms, display, storage and food safety
Cleaning and sanitation	Food safety requires hot water, cleaning-in-place, washdown, dishwashing and chemical cleaning
Motors, pumps and compressed air	Used in pumping, conveying, milling, packaging, bottling, air tools and controls
Packaging	Canning, bottling, wrapping, labelling, sealing, conveyors and compressed air can add material load
Storage, retail and hospitality areas	Retail stores, cellar doors, restaurants or tourism venues[8]

The emissions profile of a food or beverage manufacturing site depends on the equipment it uses and the energy sources that supply it. Purchased electricity generally contributes to Scope 2 emissions. On-site fuel use, such as natural gas, LPG, diesel and petrol, contribute to Scope 1 emissions. Refrigerant losses can also contribute to Scope 1 emissions if cooling systems leak. This means that the same efficiency action can often deliver both cost and emission-reduction benefits.

The Study showed that many manufacturers are already acting on these issues. The strongest activity has been in practical areas such as site infrastructure upgrades, process equipment upgrades and operational improvements. This suggests many businesses have started implementing energy performance initiatives, but there is still an opportunity to make these actions more targeted through capturing useful energy data, sub-metering, monitoring and emissions tracking.

Cold chain reliability supports both quality and resilience

A cold chain is the refrigerated or temperature-controlled system that keeps perishable food safe and fresh from processing through to storage, transport and sale. The WA aquaculture climate risk assessment reinforces the importance of reliable cold chains and logistics for seafood businesses. It notes that the journey from farm to consumer generally includes harvesting, processing, transport and market stages, and that temperature management and efficient logistics are crucial for maintaining product quality, especially for live or fresh products.[9]

This sector-wide Study demonstrates that there is no single pathway to improved energy performance and emissions reduction across WA's food and beverage manufacturing sector. The best opportunities depend on each site's production process, operating hours, equipment age, fuel mix, product type and level of control over its premises. The common starting point for all manufacturers is to understand how and where energy is used, optimise existing systems, and plan upgrades in line with business needs and equipment replacement cycles.

8 Department of Climate Change, Energy, the Environment and Water, "Food and Beverage Manufacturing," *energy.gov.au*, Australian Government, https://www.energy.gov.au/business/sector-guides/manufacturing/food-and-beverage.

9 Hannah E. Fogarty and Gretta T. Pecl, *Risk Assessment of Impacts of Climate Change for Key Aquaculture Species in Western Australia, Part 1: Aquaculture Risk Assessment* (Aquaculture for the Future, 2025), 5, https://aquaculturecouncilwa.com/climate-risk-report-2025

What the carbon data tells us

This Study focuses on operational emissions that manufacturers can most directly influence: Scope 1 and Scope 2 emissions.

Scope 1 emissions are direct emissions from sources controlled by the business. In food and beverage manufacturing, these typically arise from natural gas, LPG, diesel, petrol, refrigerant losses, boilers, ovens, hot water systems, company-controlled vehicles, forklifts, generators and other on-site process heat processes.

Scope 2 emissions are indirect emissions from purchased electricity. Across the sector, electricity is used for refrigeration, freezers, chillers, pumps, motors, compressed air systems, lighting, packaging lines, heating, ventilation and air conditioning, controls, cold rooms, retail areas and office or amenity areas.

For most WA food and beverage manufacturers, Scope 1 and Scope 2 emissions are closely linked to equipment already managed by the business. This creates a practical opportunity for emissions reduction. Improvements such as better controls, maintenance, metering, refrigeration optimisation, heat recovery, solar and equipment upgrades can reduce operating costs while reducing emissions.

Emissions capability is still developing across the sector. Around 79% of businesses reported that they do not currently track emissions, despite 37% indicating that fuel and electricity data is easily available. This suggests that many businesses may already hold the information needed to prepare a simple Scope 1 and Scope 2 baseline but need support to organise the data and turn it into useful emissions information.

The data gap is not unique to WA manufacturers

The data gap seen in this Study is mirrored in wider food-sector research. The Transition Pathway Initiative Centre found that 73% of the 26 major global food producers it assessed had no disclosures or unsuitable disclosures for comparable emissions intensity assessment.[10] This reinforces the need for practical support that helps food manufacturers move from utility bills and fuel records to simple, usable Scope 1 and Scope 2 emissions baselines.

10 Cristobal Budnevich Portales, Vera Jahn, Simon Dietz and Abdul Amin, *Food Producers and Net Zero: A Review of Progress* (London: Transition Pathway Initiative Centre, London School of Economics and Political Science, 2024), 4, 9.

The broader food system also has significant value-chain emissions. The Transition Pathway Initiative Centre notes that the food sector is responsible for up to one-third of global greenhouse gas emissions.[11] It also observes that food system emissions are mostly concentrated upstream in agriculture, while processing, transport and packaging still contribute to the global food system footprint.

For this Study, the distinction is important. Scope 3 emissions, including those associated with ingredients, packaging, freight, waste and retail activity are not the focus. However, they remain relevant to customer expectations, retailer requirements, export market access and emerging reporting obligations. For most small and medium-sized manufacturers, the practical starting point is Scope 1 and Scope 2 emissions. Once this baseline is established, businesses can start considering emissions across the wider value chain.

An estimated 455,000 tonnes of operational emissions[12]

WA's food and beverage manufacturing sector is estimated to generate approximately **455,000 tCO_2-e in Scope 1 and Scope 2 emissions each year**. To provide a sense of scale, this is broadly comparable to the annual tailpipe emissions of around 215,000 Australian vehicles.[13] This highlights the sector-wide significance of the energy and emissions challenges identified throughout this report. Decisions made by individual manufacturers regarding equipment, process efficiency, electricity supply and fuel use collectively represent a substantial opportunity to reduce emissions and improve productivity.

The estimate also highlights the diverse nature of emissions across the sector. Meat processing and manufacturing represents the largest identified contribution, while bakery products and the broad range of manufacturers grouped as "Other" also account for a significant share of emissions. Some subsectors are driven primarily by electricity use, while others rely more heavily on fuels, process heat and refrigeration. These differences reinforce the need for targeted, subsector-specific approaches to energy efficiency and emissions reduction.

11 Cristóbal Budnevich Portales, Valentin Jahn, Simon Dietz, and Ali Amin, *Food Producers and Net Zero: A Review of Progress* (London: TPIGlobal Climate Transition Centre, London School of Economics and Political Science, 2024), 4.

12 *Unless otherwise stated, emissions figures relate to operational Scope 1 and Scope 2 emissions and are expressed as tonnes of carbon dioxide equivalent (tCO2-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.*

13 *Calculated using the National Transport Commission's average rated emissions intensity for registered Australian light vehicles of 190.8 g CO_2/km and the Australian Bureau of Statistics average passenger-vehicle travel distance of 11,100 km per year. This equates to approximately 2.12 t CO_2 per vehicle per year. The comparison is illustrative and excludes vehicle manufacturing, fuel production and electricity-related emissions.*

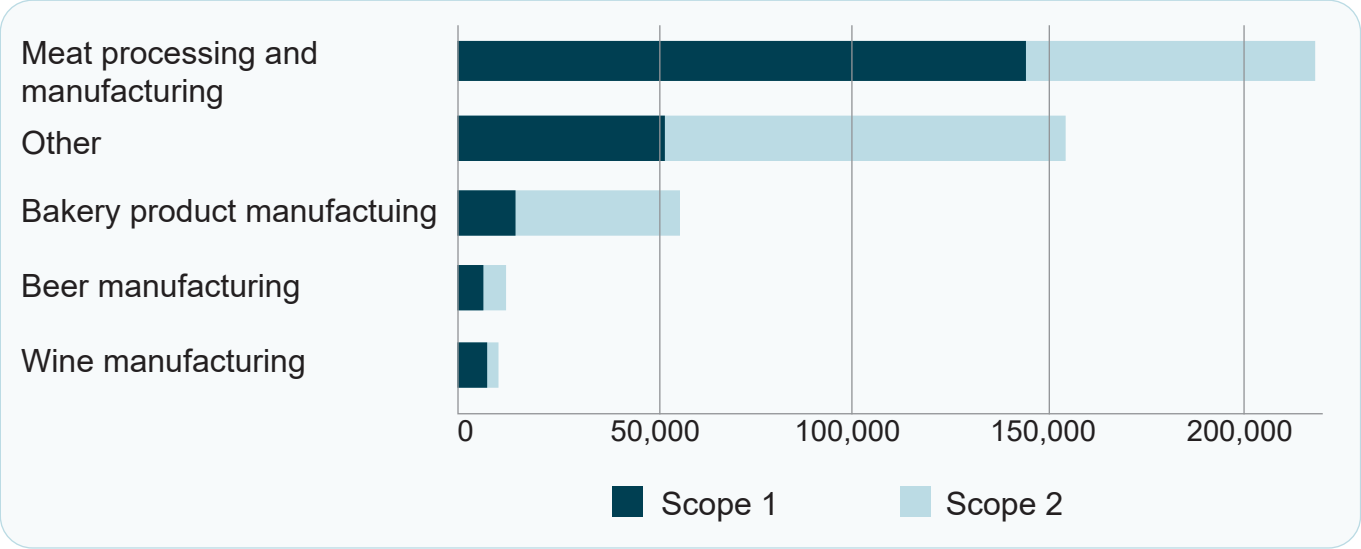


Figure 2: Estimated emissions by sub sector (tCO_2-e)

The sector's strong representation of small and medium-sized businesses, including regional manufacturers, is equally important. The Study found that many businesses recognise opportunities to improve energy performance and reduce emissions but face barriers including capital constraints, limited energy data, competing operational priorities and access to specialist expertise. Achieving reductions at scale will depend on translating identified opportunities into practical, financially achievable projects.

Different subsectors, different emissions profiles

The carbon data shows that there is no single emissions profile across food and beverage manufacturing. Across the Study, Scope 1 represented 65% of emissions and Scope 2 represented 35%. Meat processing, wine and beer manufacturing were more Scope 1-intensive, with direct emissions accounting for approximately two-thirds of emissions. Bakery product manufacturing and businesses grouped as “Other” were more electricity-dependent, with Scope 2 accounting for respectively 73% and 66% of emissions.

These differences point to different decarbonisation pathways across the sector. Electricity efficiency measures, on-site renewable energy and renewable electricity procurement may have the greatest immediate impact in Scope 2-intensive subsectors. In subsectors with higher Scope 1 emissions, greater emphasis may be required on process-heat efficiency, fuel switching, electrification and refrigerant management.

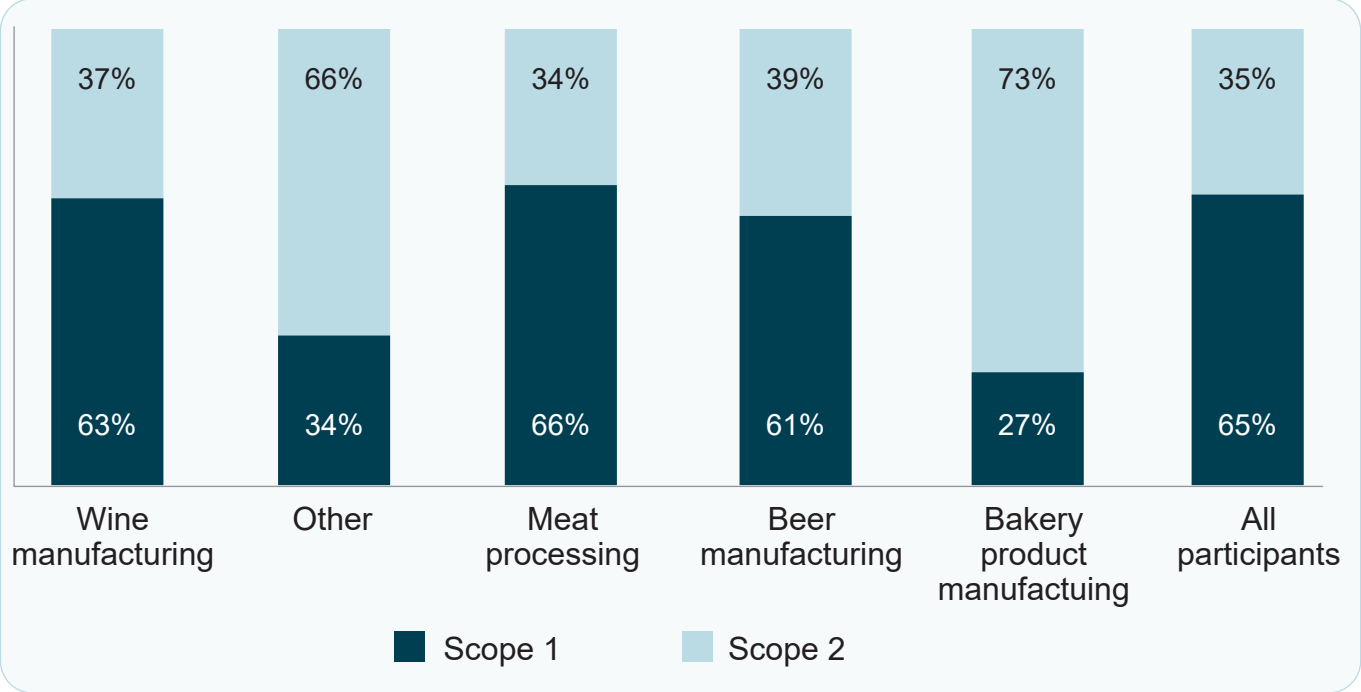


Figure 3: Emissions scope by subsector

Emissions-reduction priorities need to consider both the size of each subsector footprint and the sources producing those emissions.

What WA food and beverage manufacturers are already doing

The Study showed that many WA food and beverage manufacturers are proactively taking practical steps to improve energy performance, providing a strong foundation for further emissions reduction.

77%

of businesses have made site upgrades to reduce energy usage

Around 65% of businesses reported using renewable energy, mostly as part of a mixed energy supply rather than a fully renewable supply. On-site solar was the most common renewable energy source, reported by around 60% of respondents.

Energy improvement activity is strongest in practical and visible upgrades. Around 77% of businesses reported undertaking site infrastructure upgrades, such as lighting, insulation, doors, heat pumps or heating, ventilation and air conditioning systems. Around 50% reported upgrading process equipment, while around 52% reported making operational or process changes to reduce energy use. By comparison, around 31% had conducted an energy audit and around 30% had installed monitoring, smart meters or automated controls. Energy management software was less common, reported by around 8% of respondents.

Some WA manufacturers are building on a strong foundation, having already invested in equipment and infrastructure upgrades and implemented operational improvements. DPIRD's *Digital Manufacturing on a Shoestring* program provides a practical example of this progress, supporting food and beverage businesses to trial affordable tools for monitoring energy use, temperature, humidity and waste.[14] Noshing, a Western Australian food manufacturer, used low-cost power monitoring to identify excessive cool-room electricity use. Subsequent changes reduced electricity consumption from 11 MWh to 8 MWh per billing cycle and lowered monthly power bills by 30%.

This pattern suggests businesses are making changes either independently or via government industry supported programs, particularly through equipment and infrastructure improvements. The next opportunity is to move from one-off upgrades to more deliberate energy management. This includes tracking energy use, linking energy consumption to production activity and identifying where targeted improvements can deliver the greatest energy, cost and emissions benefits.

14 Department of Primary Industries and Regional Development, "Food and Beverage Business Development," Government of Western Australia, accessed 28 July 2026; Shoestring, "Our Digitalisation Solutions,".

The food and beverage manufacturing subsectors are at different starting points in their emissions reduction journey.

Dairy businesses have focused on broad-based investments such as renewables, site infrastructure and process equipment.

Seafood processors have improved equipment including upgrading infrastructure and process equipment.

Fruit vegetable processors have made operational change with a strong focus on optimising day-to-day practices.

Grain processors have invested in site infrastructure.

Spirit and other beverage manufacturers are moving towards renewables and adopting operational improvements.

Sustainability requirements are becoming embedded in market access

Sustainability is increasingly shaping how food products are marketed, ranged and assessed by customers, retailers and supply-chain partners. For example, Coles reports that around 90% of its emissions are generated in its supply chain and has set a target for 80% of suppliers by spend to have science-based emissions reduction targets by the end of FY29.[15]

For WA food and beverage manufacturers, practical energy and emissions action can support cost control, credible sustainability claims and market access.

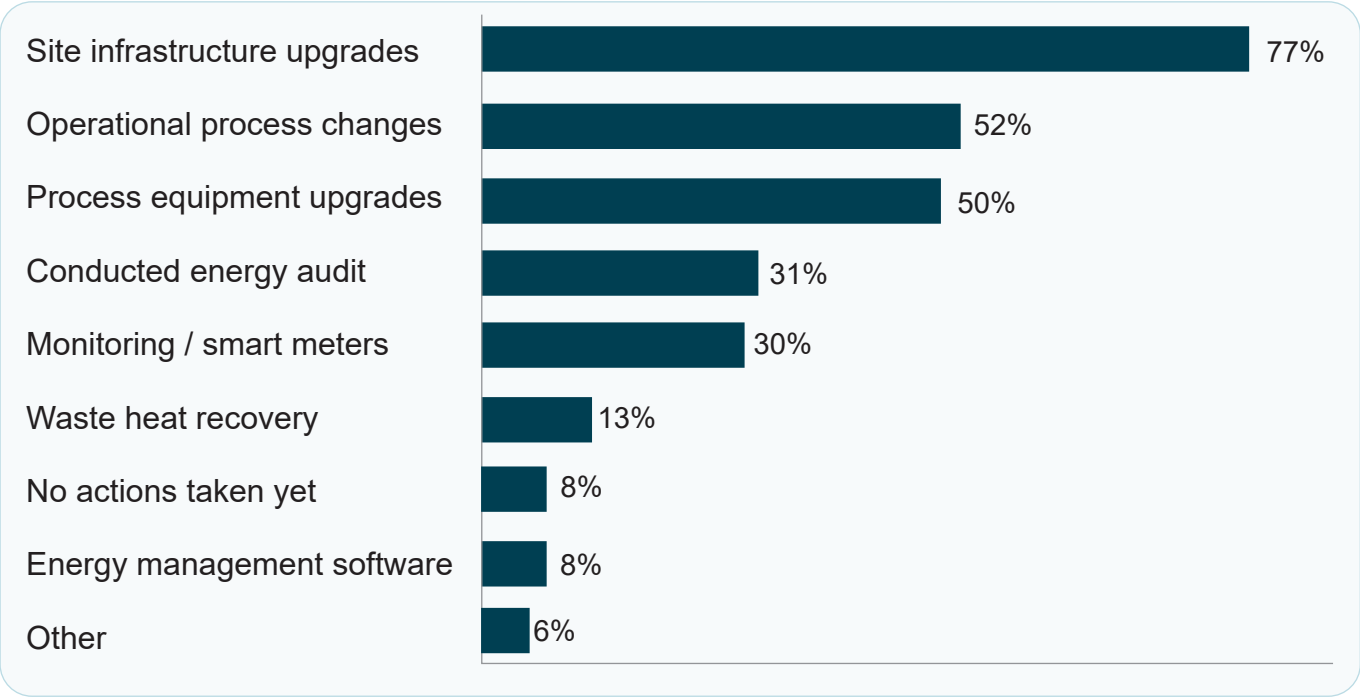


Figure 4: Energy efficiency actions of WA food and beverage manufacturers

15 Coles Group, *2025 Sustainability Report* (Melbourne: Coles Group, 2025), 17, https://www.colesgroup.com.au/FormBuilder/_Resource/_module/ir5sKeTxxEOndzdh00hWJw/file/Sustainability_Report_2025.pdf

Foodfolk Australia – improving efficiency through site consolidation

Moving to a new Perth Airport facility gave Foodfolk Australia an opportunity to improve how its ready-made airline meal operations worked and used energy.

Previously, production, warehousing and logistics were split across multiple sites, requiring additional vehicle movements, staff time and coordination. Bringing these activities together at a centralised site reduced unnecessary movement and created a smoother flow from production through to dispatch.

The new facility gave Foodfolk a clean slate for managing energy. Before moving in, the site's electrical capacity was checked and plans laid for how major equipment would work within the new layout. Automated lighting now avoids illuminating empty areas, centralised climate control manages conditions across the facility, and newer equipment has replaced ageing, high-maintenance systems.

> **Consolidating our operations at Perth Airport gave us an opportunity to make energy-conscious decisions. Alongside improving operational efficiency and reducing unnecessary vehicle movements, we introduced automated lighting and centralised climate control and invested in more efficient equipment. We are now exploring better energy measurement and renewable energy options, including solar. — Nadia Hazife, Chief Customer Officer and Director at Foodfolk Australia**

Foodfolk has not yet quantified the energy, cost or emissions savings from the move. As production grows, tracking measures such as energy use per meal will help demonstrate performance improvements. Solar is also being explored, subject to engineering and landlord approvals.

Foodfolk's experience shows that meaningful energy savings do not always depend on installing new equipment. Improvements can be achieved through a smarter facility layout, better controls and a coordinated approach to managing operations.

Renewable energy and lower-emissions technologies

The adoption of renewable energy is already contributing to the sustainability and competitiveness of the food and beverage manufacturing sector. On-site solar is the most common renewable energy option used by the Study sample. This is practical for businesses with daytime electricity loads, roof space, direct control over their site and suitable electrical capacity.

Solar is likely to be most useful where electricity demand is at its highest or peaks during the day. This may include refrigeration, cold rooms, packaging, pumps, cleaning, offices, retail spaces, bottling, dairy processing, seafood processing, fruit and vegetable packing, grain processing and some hospitality operations.

65%

of WA food and beverage businesses surveyed are using renewable energy

However, solar does not solve every energy challenge. Many food and beverage businesses have early morning, overnight or seasonal loads. Heat-intensive processes may still rely on gas or LPG. In addition some businesses operate from leased premises, shared facilities or regional locations where roof access, network connections or landlord approvals can limit the feasibility of solar installations.

Lower-emissions technologies should therefore be assessed in stages. Practical options may include:

- heat pumps for suitable hot water or low-temperature process heat loads
- electric boilers or hybrid systems where technically and commercially viable
- improved refrigeration plant efficiency
- variable speed drives for pumps and fans
- compressed air leak reduction
- heat recovery, better insulation
- battery storage, thermal storage and renewable electricity procurement.[16]

For dairy manufacturing, the most relevant opportunities are likely to include refrigeration optimisation, hot water efficiency, heat recovery, cleaning systems and renewable electricity. For seafood processing, the priority is likely to be efficient and reliable cold chain systems, including freezers, ice machines, cold rooms and backup systems. For fruit and vegetable processing, the right technology depends on whether the product is fresh, chilled, frozen, dried, cooked, juiced or canned. For spirit manufacturing, process heat and cooling are central. For grain processing, motors, compressed air, dust extraction, drying, ovens and packaging equipment are likely to be important.

16 Department of Climate Change, Energy, the Environment and Water, "Food and Beverage Manufacturing"; Australian Food and Grocery Council, *Electrification Fact Shee*t (December 2025), 3, 17–18, 26–30, https://afgc.org.au/wp-content/uploads/2026/03/20260127-AFGC-Electrification-Fact-Sheet-vF.1.pdf.

Businesses should not start with a preferred technology. They should start with the question: where are we using the most energy, and what is running when it does not need to be running?

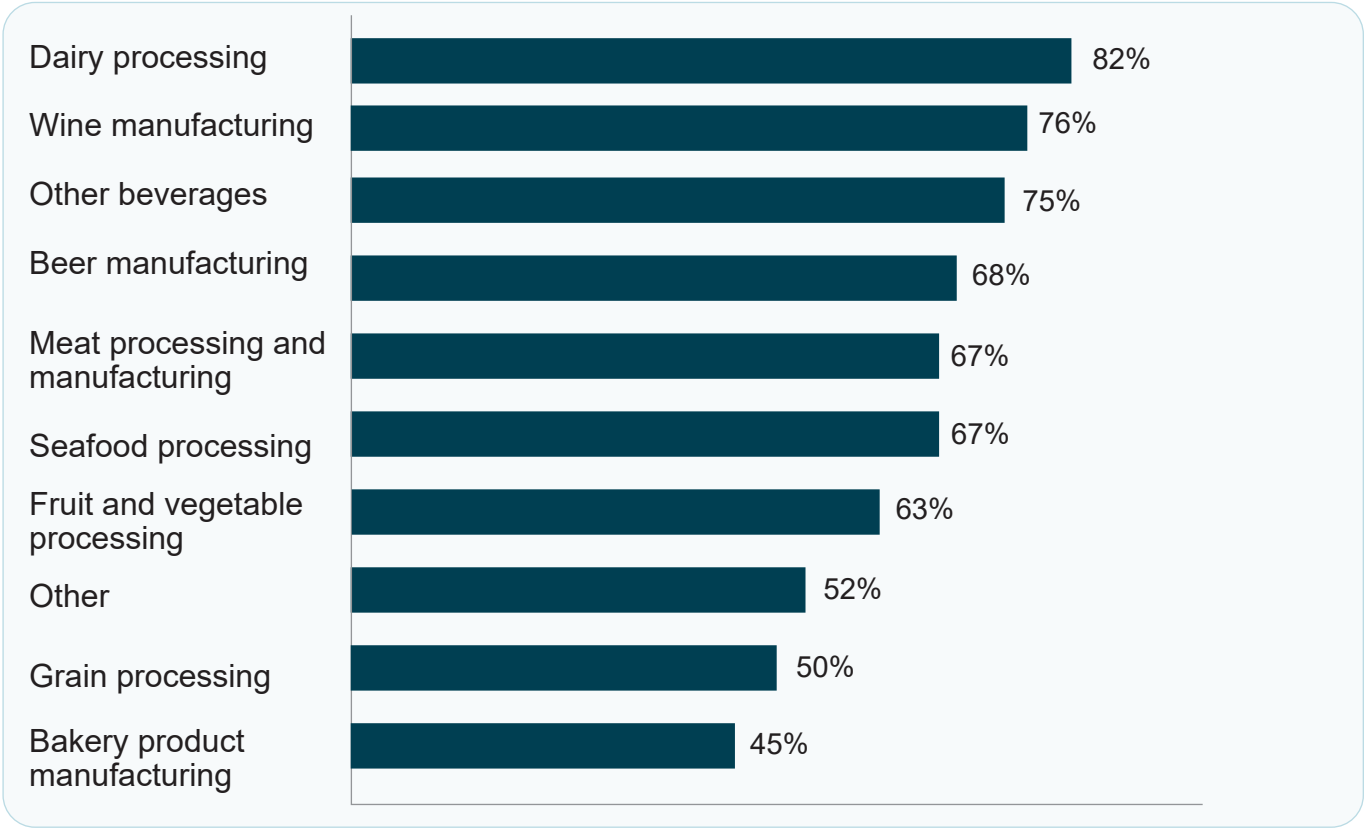


Figure 5: Adoption of renewable energy and lower-emissions technology by subsector

What is driving food and beverage manufacturers to act

Food and beverage businesses indicated that energy and emissions action is driven by both commercial and values-based reasons. The strongest driver was lower power bills, identified by around 96% of businesses. The second highest driver was business values and ethics, selected by around 76% of respondents. This shows that many WA businesses are financially motivated, but also by a desire to operate responsibly and reduce environmental impact.

Customer and market expectations were also deemed important by 56% of businesses, while corporate sustainability goals were identified as a motivator by around 40%. Together, these results show that energy and emissions reduction is not being driven by one factor alone. **For many manufacturers, the case for action is strongest when it supports lower operating costs, aligns with business values and helps prepare for changing customer and supply-chain expectations.**

Energy efficiency can help reduce wasted energy, manage operating costs, improve equipment reliability and build confidence for future investment. For many manufacturers, the best starting point is not a major capital project. It is **understanding where energy is used, improving the systems already in place, and planning efficient upgrades when equipment is due for replacement.**

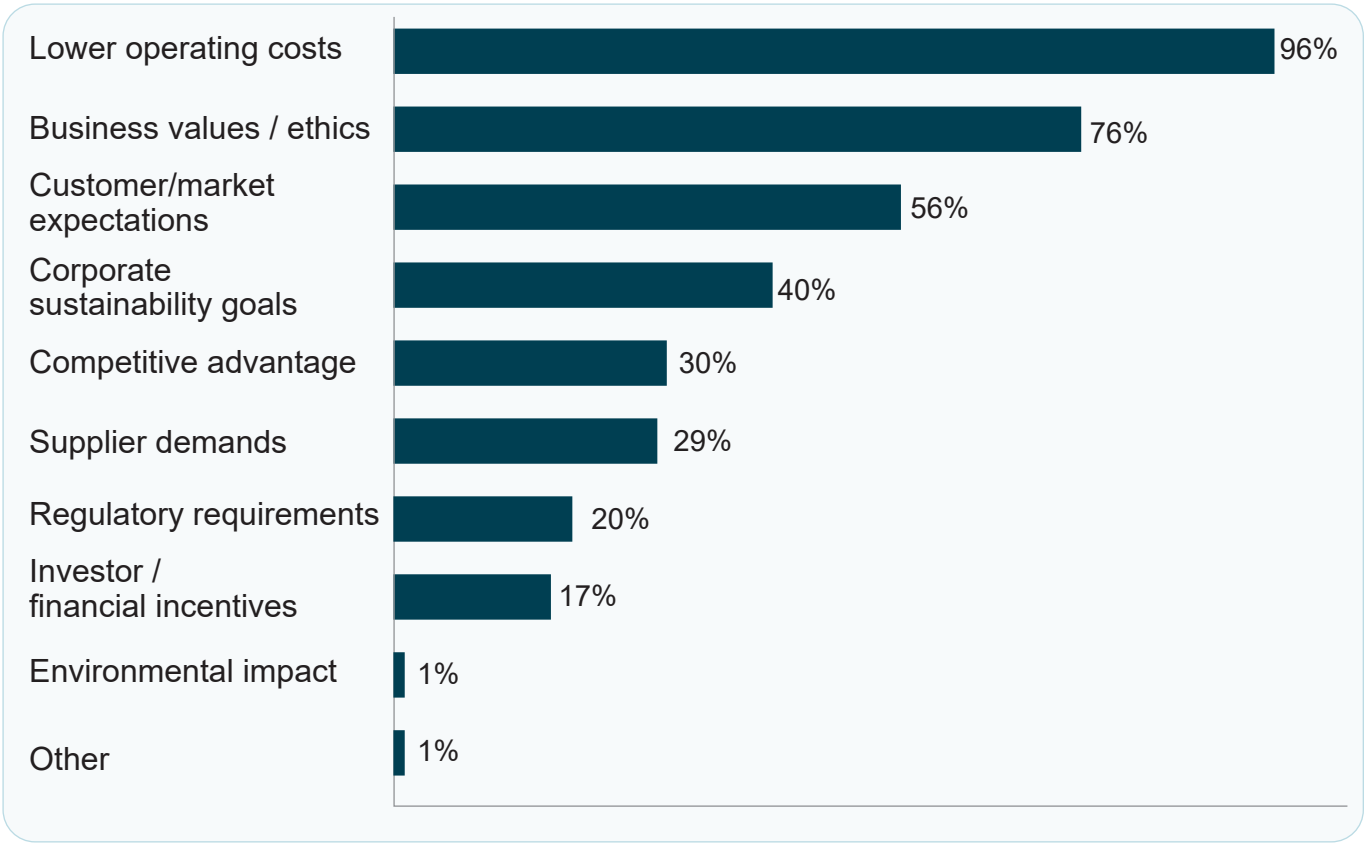


Figure 6: Emissions reduction drivers for food and beverage manufacturers

Food and beverage manufacturers are operating in an increasingly complex and demanding business environment. Rising input, labour, energy and compliance costs are competing with investment in efficiency, technology and sustainability initiatives. For many, the challenge is not a lack of intent, but balancing these priorities while maintaining productivity, profitability and regulatory compliance.

Customer and market expectations are also becoming more relevant. Retailers, foodservice buyers, export customers and investors are increasingly asking suppliers to understand emissions, sustainability credentials and evidence improvements. Larger businesses may feel these expectations first, but smaller suppliers can also experience them through supply chains.

Credible sustainability claims are critical to maintaining consumer trust and market confidence. The Australian Competition and Consumer Commission (ACCC) states that environmental and sustainability claims must be truthful, accurate and supported by evidence. It also warns that broad claims such as “green”, “environmentally friendly” or “sustainable” can be misleading if they are not properly explained.[17] As expectations from regulators, customers and supply chain partners continue to evolve, there is increasing scrutiny of ESG and sustainability claims to ensure they are credible, substantiated and verifiable. For WA businesses, practical, evidence-backed action is more useful than broad marketing claims.

17 Australian Competition and Consumer Commission, *Making Environmental Claims: A Guide for Business* (Canberra: ACCC, December 2023), 1, 13, 21–22, https://www.accc.gov.au/system/files/greenwashing-guidelines.pdf.

What is holding food and beverage manufacturers back

The main barriers are practical and commercial. Around 87% of manufacturers identified high upfront costs as a barrier to further action. Around 47% identified specialised equipment constraints,11% identified unfamiliarity with technologies or solutions, and a further 27% identified competing business priorities.

Food and beverage manufacturers cannot easily take risks with equipment that affects food safety, product quality or daily production. If a refrigeration system, boiler, oven, compressor, pump or packaging line is central to operations, any change must be planned carefully.

Support preferences point to practical needs. Financial incentives and grants were the strongest support preference, mentioned by around 94% of respondents and ranked in the top three by around 86%. Advice on energy-efficient equipment and information on renewable energy options were also highly valued, each mentioned by around 94% of businesses.

This suggests that businesses need tailored guidance. WA businesses may need supplier-neutral advice, site-specific assessments, help to compare equipment options, guidance on payback, access to funding and confidence that upgrades can be implemented without disrupting production.

For policymakers and industry stakeholders, the support opportunity is clear: practical programs that combine data, technical advice, and funding pathways are more likely to help businesses act than general awareness campaigns alone.

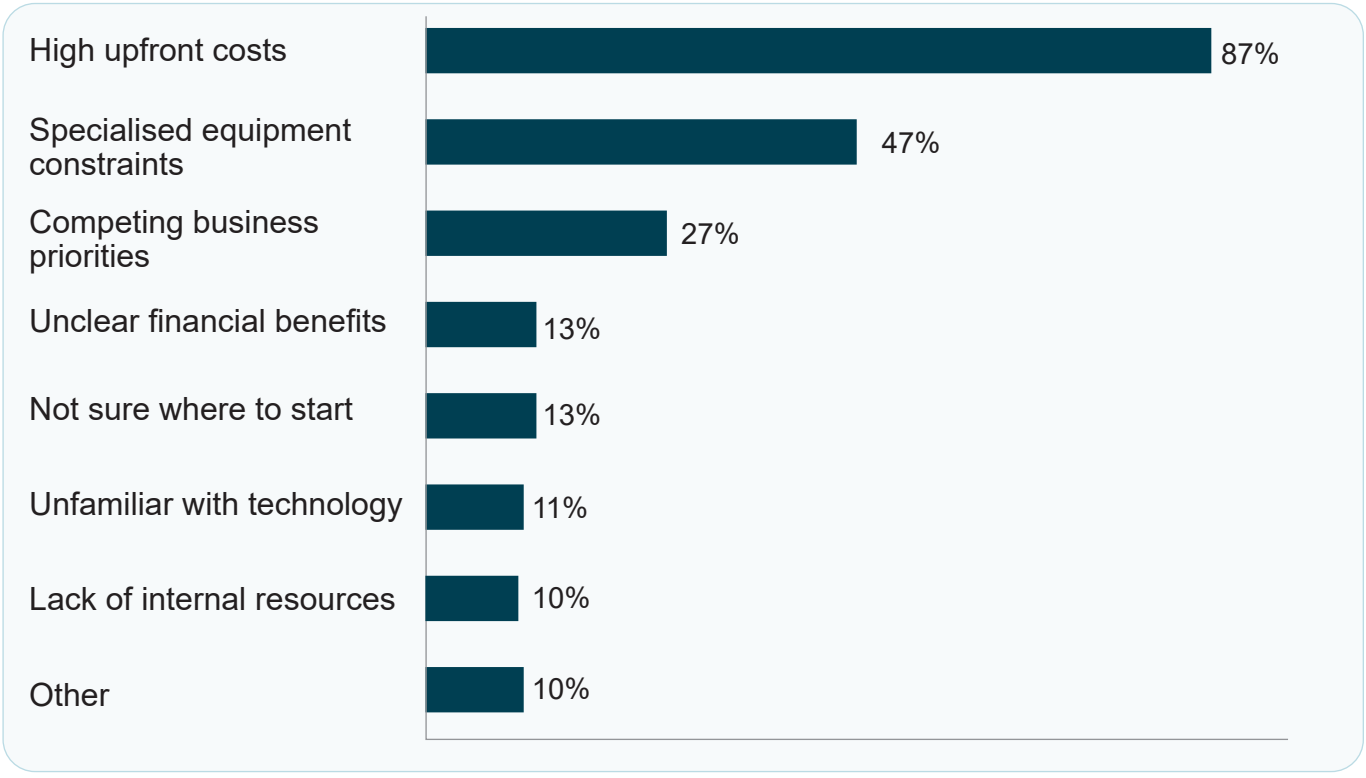


Figure 7: Barriers to energy efficiency for food and beverage manufacturers

The future: efficient, resilient and lower-emissions food and beverage manufacturing

The most practical pathway for WA food and beverage manufacturers is staged:
Measure → Optimise → Upgrade → Decarbonise.

This pathway recognises that businesses are at different stages. Some businesses may already have installed solar, made equipment upgrades and conducted an energy audit. Others may not yet be tracking emissions. The pathway works because it starts with information, then moves toward better operation, planned investment and lower-emissions energy where practical.[18]

Measure: build a useful baseline

Start by understanding energy use by collecting electricity, natural gas, LPG, diesel, petrol and refrigerant information, then linking this data to practical business activity measures such as production volume, operating hours, tonnes processed, litres produced, kilograms packed, trading days or revenue.

Begin with utility bills and a simple spreadsheet. Sub-metering can be added later for refrigeration, ovens, boilers, compressors, packaging lines, cold rooms or major production areas. Avoid complex reporting systems. The goal is to know where energy is going and what is changing over time.

Optimise: improve daily controls and maintenance

Energy savings can come from optimising existing equipment operation, including:

- shutdown routines
- refrigeration set-points
- cold room door management
- condenser cleaning
- compressed air leak checks
- boiler maintenance
- insulation repairs
- timer settings
- lighting controls
- reviewing equipment that runs after hours.

This stage can reduce energy use without major capital spending. It also builds confidence before larger upgrades are considered. For many WA businesses, optimisation is often the lowest-risk place to start.

18 Department of Climate Change, Energy, the Environment and Water, “Food and Beverage Manufacturing”; Australian Food and Grocery Council, *Electrification Fact Sheet*, 26–30.

Smarter refrigeration delivers rapid savings for McCain Foods

At McCain Foods' Lisarow facility, refrigeration was a major source of electricity demand. Rather than replacing the entire refrigeration system, the business installed variable head-pressure control, allowing the existing plant to respond more efficiently to changing operating conditions.

The upgrade cost less than $22,000 but reduced electricity consumption by approximately 320 MWh a year, avoiding an estimated 307 tCO2-e and cutting energy costs by around 13%. Annual savings of approximately $49,000 meant the investment paid for itself within months.[19]

Upgrade: target equipment at the right time

Plan major equipment upgrades around maintenance cycles, asset replacement, production expansion, lease changes or site works. Priority areas across food manufacturing commonly include:

- refrigeration
- boilers
- hot water
- pumps
- compressors
- motors
- heating
- ventilation and air conditioning
- lighting
- process equipment
- packaging lines
- control systems.

Good upgrade decisions consider more than purchase price. They should account for:

- energy use
- maintenance
- reliability
- downtime risk
- product quality
- food safety
- staff capability
- future energy needs.

Where possible, compare whole-of-life costs rather than upfront costs alone.

19 Office of Environment and Heritage, *I Am Your Industrial Refrigeration Guide* (Sydney: State of New South Wales, 2017), https://www.energy.nsw.gov.au/sites/default/files/2022-08/2017_06_NSW_IndustrialRefrigerationGuide.pdf

Decarbonise: shift remaining energy demand to lower-emissions sources

Once energy waste has been reduced, WA businesses can shift remaining demand to lower-emissions sources where practical. This may include rooftop solar, renewable electricity procurement, heat pumps, electric boilers, hybrid systems, batteries, thermal storage or bioenergy. The right solution will depend on site layout, roof space, electrical capacity, production schedule, fuel use, equipment age and payback.

If full electrification is not practical in the short term, the pathway still has value. Energy efficiency, better controls, renewable electricity, heat recovery and planned replacement can all reduce emissions and improve resilience.

Energy efficient food and beverage manufacturing

Step 1: measure

Build a useful baseline and understand energy use

- Gather electricity, gas, LPG, diesel, petrol and refrigerant data
- Link energy data to business activity e.g. production volume, operating hours, tonnes processed, litres produced, kilograms packed, trading days or revenue
- Start with utility bills and a simple spreadsheet
- Add sub-metering later for refrigeration, ovens, boilers, compressors, packaging lines, cold rooms or major production areas

Goal: know where energy is going and what is changing over time

Step 2: optimise

Improve daily controls and maintenance

- Improve shutdown routines and timer settings
- Review refrigeration set-points and cold room door management
- Clean condensers and repair insulation
- Check compressed air leaks and maintain boilers
- Improve lighting controls and review equipment running after hours

Often the lowest-risk place to start

Step 3: upgrade

Target equipment at the right time

- Plan upgrades around maintenance cycles, asset replacement, lease changes, production expansion or site works
- Typical priorities: refrigeration, boilers, hot water, pumps, compressors, motors, HVAC, lighting, process equipment, packaging lines, control systems,compare whole-of-life costs, not just upfront cost
- Consider energy use, maintenance, reliability, downtime risk, product quality, food safety, staff capability and future energy needs

Planned investment supports better business decisions

Step 4: decarbonise

Shift remaining demand to lower-emissions energy

- Consider rooftop solar, renewable electricity procurement, heat pumps, heat recovery, electric boilers, hybrid systems, batteries, thermal storage or bioenergy
- Choose options based on site layout, roof space, electrical capacity, production schedule and fuel use
- Plan equipment replacement and upgrades based on asset age and payback

Reduce remaining emissions where practical

The opportunity ahead

Several WA food and beverage manufacturers have improved energy performance through upgrades and renewable energy adoption. The opportunity now is to make more targeted, measurable actions and integrate them into business operations.

Rather than requiring major capital projects, meaningful gains can be achieved by identifying key energy users and prioritising improvements with the greatest operation and financial benefit.

A more structured approach to energy management enables businesses to prioritise high-impact systems such as refrigeration, process heat and compressed air, track improvements over time and make informed decisions about maintenance, equipment replacement and future investment.

For food and beverage manufacturers, energy efficiency is largely a commercial consideration. It can lower costs, improve asset performance and build resilience, while helping meet growing sustainability expectations. Investment decisions, however, must balance these benefits against operational realities, including upfront costs, production continuity, food safety requirements and competing business needs.

For WA food and beverage manufacturers, a staged pathway provides a practical way forward:

Measure → Optimise → Upgrade → Decarbonise

By first understanding energy use, then improving existing systems, planning upgrades around asset replacement cycles and shifting remaining demand to lower-emissions energy where viable, businesses can progressively reduce costs, improve resilience and lower operational emissions.

Bakery Product Manufacturing

The most effective approach to improve energy performance for WA bakeries is likely to be practical, staged and aligned with each business's equipment, operating hours, premises and investment capacity.

The first step is to **measure** energy use by establishing a simple Scope 1 and Scope 2 baseline. Businesses can track electricity, gas, fuel and refrigerant use alongside operational measures such as production volumes, oven hours or trading days. Better energy visibility helps identify priority areas and build stronger business cases for future investments.

Once energy use is better understood, bakeries can **optimise** existing systems through lower-cost operational improvements, including:

- Optimise oven start-up, pre-heating and batch scheduling
- Improve refrigeration settings, cool room seals, airflow and maintenance
- Align lighting, HVAC and display cabinet operation with trading hours
- Reduce unnecessary hot water use and equipment runtime
- Improve shutdown procedures and identifying equipment operating when not required.

The next stage is to **upgrade** equipment and controls where there is a clear business case. Opportunities include:

- High-efficiency ovens, burners, motors and variable speed drives
- Refrigeration and display cabinet upgrades
- Efficient hot water systems and lower-impact refrigerants
- Smart meters, automated controls, energy management systems and LED lighting
- HVAC improvements, efficient café equipment and solar PV.

Over time, bakeries can further **decarbonise** by transitioning to lower-emissions technologies where practical, including renewable electricity, heat pump hot water, battery storage, electric or hybrid heating systems, lower-impact refrigerants and electric vehicles.

A full analysis of the subsector is available separately in the *Bakery Product Manufacturing Sector Snapshot* report.

Bakery Product Manufacturing

A practical pathway to efficient, resilient and lower-emissions baking

Step 1: measure

Establish simple and repeatable baseline data

- **Capture energy and emissions:** electricity, natural gas, LPG, diesel, petrol, refrigerants
- **Capture activity:** production volume, flour use, oven hours, trading days, refrigeration loads, deliveries, revenue
- **Track:** both absolute emissions and emissions intensity over time
- **Tools:** smart data loggers, sub-meters, spreadsheets

Step 2: optimise

Prioritise low-cost operational improvements first

Baking and ovens	**Proofing and refrigeration**	**Retail facility and HVAC**	**Hot water and controls**

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

Step 3: upgrade

Make targeted investments in equipment and controls

Ovens and process equipment	**Refrigeration and display**	**Digital and site energy**

Opportunities: commercial bakeries
Ovens, proofers, refrigeration, packaging and hot water

Opportunities: retail and café bakeries
Display refrigeration, lighting, HVAC, dishwashing and customer areas

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

Step 4: decarbonise

Plan for longer-term decarbonisation opportunities

Renewable electricity	**Solar PV and battery storage**	**Heat pump hot water**	**Electric or hybrid heating**
Lower-impact refrigerants	**Electric delivery vehicles**	**Electrification of ageing fossil-fuel equipment**	**Renewable electricity for retail and café loads**

Site-specific options are most viable for stand-alone bakeries with suitable roof space, or with plans to replace equipment or relocate premises

Beer Manufacturing

For beer manufacturers, energy and emissions reduction is both a sustainability and business resilience opportunity. The most effective approach is likely to be practical, staged and aligned with each brewery's production model, venue operations, site constraints and investment capacity.

The first step is to **measure** energy use by establishing a simple Scope 1 and Scope 2 baseline. Businesses can track electricity, gas, fuel and refrigerant use alongside production and activity data. Better energy visibility helps identify priority areas and build stronger business cases for future investments.

Once energy use is better understood, breweries can **optimise** existing systems through lower-cost operational improvements:

- Optimise refrigeration and cooling systems through improved temperature control, maintenance and cool room management
- Improve the efficiency of heat and hot water systems through insulation, boiler tuning and better scheduling
- Reduce energy use in cleaning processes and compressed air systems
- Improve operational controls, including equipment shutdown procedures and start-up checklists

The next stage is to **upgrade** equipment and controls where there is a clear business case. Opportunities include:

- High-efficiency refrigeration systems, improved glycol controls, lower-impact refrigerants and variable speed drives
- Efficient motors, pumps and packaging line controls
- Boiler upgrades, condensate recovery and improved insulation
- Energy management software, automated controls, efficient hot water systems and solar PV
- Upgrades to HVAC systems, kitchens, lighting and cool rooms for venue-based breweries.

Over time, breweries can further **decarbonise** by transitioning to lower-emissions technologies where practical, including renewable electricity, battery storage, heat pumps, electric boilers, heat recovery, CO_2 recovery from fermentation and biogas recovery.

A full analysis of the subsector is available separately in the *Beer Manufacturing Sector Snapshot* report.

Beer Manufacturing

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

Step 1: measure

Establish simple and repeatable baseline data

- **Capture energy and emissions:** electricity, natural gas, LPG, diesel, petrol, refrigerants
- **Capture activity:** litres of beer produced, packaged volumes, keg volumes, venue operating hours, kitchen or hospitality activity, refrigeration loads
- **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 cooling	**Heat and hot water**	**Cleaning and compressed air**	**Operational controls**

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

Step 3: upgrade

Make targeted investments in equipment and controls

Equipment and controls	**Heat and utility systems**	**Digital and on-site energy**

Opportunities: production-led breweries
Process heat, refrigeration, packaging, compressed air and cold storage

Opportunities: venue-led breweries
HVAC, kitchens, lighting, cool rooms, beer reticulation and operating hours

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	**Battery storage**	**Heat pumps**	**Electric boilers**
Integrated heat recovery	**Electrification infrastructure**	**CO_2 recovery from fermentation**	**Biogas recovery from high-strength wastewater**

Site-specific options are best suited to larger operators with stable production or planned equipment upgrades

Wine Manufacturing

For WA wineries, energy and emissions reduction is both a sustainability and a business resilience opportunity. The Study indicates that many WA wineries are already taking action, particularly through site infrastructure upgrades, equipment improvements, operational changes and renewable energy. The most effective approach is likely to be practical, staged and aligned with each winery's production cycle, site configuration, visitor operations and investment capacity.

The first step is to **measure** energy use by establishing a simple Scope 1 and Scope 2 baseline. Businesses can track electricity, fuel and refrigerant use alongside operational measures such as tonnes of grapes crushed, litres produced, cases bottled or cellar door activity. Better energy visibility helps identify priority areas and build stronger business cases for future investments.

Once energy use is better understood, wineries can **optimise** existing systems through lower-cost operational improvements:

- Optimise refrigeration and cooling systems through improved temperature control and cooling practices
- Improve tank insulation, cool room management and pumping operations
- Reduce energy use associated with compressed air, lighting, hot water and HVAC systems
- Align cellar door lighting, refrigeration and climate control with trading hours
- Improve environmental performance through land regeneration, water stewardship, erosion control and biodiversity initiatives.

The next stage is to **upgrade** equipment and controls where there is a clear business case. Opportunities include:

- High-efficiency cooling and refrigeration systems, improved glycol controls and lower-impact refrigerants
- Efficient pumps, variable speed drives and alternative cold stabilisation technologies
- Energy management software, monitoring systems and automated controls
- Solar PV, battery storage and efficient hot water systems
- Upgraded bottling equipment, lightweight packaging and improved HVAC systems in hospitality and cellar door operations.

Over time, wineries can further **decarbonise** by transitioning to lower-emissions technologies where practical, including renewable electricity, heat pumps, electrification, battery storage, lower-impact refrigerants, lightweight packaging and lower-emissions transport options.

A full analysis of the subsector is available separately in the *Wine Manufacturing Sector Snapshot* report.

Wine Manufacturing

A practical pathway to efficient, resilient and lower-emissions wine 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 grapes crushed, litres produced, cases bottled, trading days, cellar door activity, irrigation activity
- **Track:** absolute emissions and emissions intensity over time
- **Tools:** sub-metering, energy management software

Step 2: optimise

Prioritise low-cost operational improvements first

Refrigeration and cooling	**Storage and process control**	**Compressed air and site services**	**Hospitality and cellar door**	**Environment conservation and biodiversity**

Fast, cost-effective improvements to boost reliability and reduce energy waste

Step 3: upgrade

Make targeted investments in equipment and controls

Cooling and refrigeration	**Process and utility systems**	**Digital and on-site energy**	**Packaging and site improvements**

Opportunities: production
Cooling, pumping, bottling, storage

Opportunities: wine sales / hospitality
HVAC, lighting, kitchen, refrigeration, visitor facilities

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

Step 4: decarbonise

Plan for longer-term decarbonisation opportunities

Renewable electricity	**Solar PV and battery storage**	**Electrification**	**Heat pumps**
Lower-impact refrigerants	**Electric vineyard equipment**	**Wastewater and organic waste recovery**	**Lower-emissions packaging and transport**

Site-specific options best suit wineries with suitable load profiles, planned equipment upgrades, or strong market drivers for lower-emissions production

Meat Processing and Manufacturing

For WA meat processors and manufacturers, energy and emissions reduction is both a sustainability and a business resilience opportunity. The most effective approach is likely to be practical, staged and aligned with each site's operating requirements, equipment profile, production schedules and investment capacity.

The first step is to **measure** energy use by establishing a simple Scope 1 and Scope 2 baseline. Businesses can track electricity, gas, fuel and refrigerant use alongside operational measures such as production volumes, cold storage activity, hot water use and wastewater treatment. Better energy visibility helps identify priority areas and build stronger business cases for future investments.

Once energy use is better understood, processors and manufacturers can **optimise** existing systems through lower-cost operational improvements:

- Optimise refrigeration and cold storage systems through temperature control, maintenance and improved cool room management
- Improve the efficiency of heat, hot water and sanitation systems through boiler tuning, insulation and heat recovery
- Reduce energy use associated with cleaning, sanitation and compressed air systems
- Review pumps, motors and other equipment to reduce unnecessary runtime and energy waste
- Improve operational controls and shutting down idle equipment where practical.

The next stage is to **upgrade** equipment and controls where there is a clear business case. Opportunities include:

- High-efficiency refrigeration systems, refrigeration controls and lower-impact refrigerants
- Efficient hot water systems, boilers, burners and heat pumps
- Heat recovery from refrigeration and process systems
- Energy management software, sub-metering, automated controls, solar PV and battery storage
- Biogas recovery, wastewater treatment improvements and compressed air upgrades for larger facilities.

Over time, processors can further **decarbonise** by transitioning to lower-emissions technologies where practical, including renewable electricity, heat pumps, electric boilers, heat recovery, lower-impact refrigerants and fuel switching. Planning for electrification during normal equipment replacement and expansion cycles can also support future emissions reduction.

A full analysis of the subsector is available separately in the *Meat Processing and Manufacturing Sector Snapshot* report.

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

Dairy Processing

Energy management in dairy processing is unique to other food and beverage businesses because dairy sites must manage heating, cooling, refrigeration, cleaning and cold-chain requirements. At the same time, they must maintain strict food safety and product quality controls. Unlike some food and beverage businesses with one dominant energy hotspot, dairy processors often need an integrated approach across pasteurisation, boilers, refrigeration, compressed air, cleaning-in-place systems and wastewater.[20]

Before investing in major capital upgrades, dairy manufacturers can often achieve meaningful energy savings through practical **operational improvement**s. There are many opportunities for optimising existing equipment and processes to reduce energy use, improve efficiency and lower operating costs, including:

Refrigeration and cooling

- Review temperature set points and reducing overcooling
- Maintain refrigeration equipment and optimising chilled water and glycol systems
- Improve the performance of one of the largest energy users on many dairy processing sites.

Heat, hot water and steam

- Improve insulation and reducing heat losses
- Tune boilers and burners to improve efficiency
- Optimise hot water and steam systems, which are critical for pasteurisation, cleaning and processing activities.

Cleaning and water management

- Optimise cleaning-in-place (CIP) processes
- Reduce excessive hot water use
- Improve water management practices to reduce both energy and water consumption.

Operational controls

- Shut down idle equipment when not required
- Schedule washdown and defrost cycles efficiently
- Align production runs to minimise start-up and shutdown losses and improve overall plant efficiency.

Further energy savings can be achieved through targeted **equipment upgrades**, improved process controls and investment in on-site energy solutions. Opportunities include:

- High-efficiency refrigeration systems, variable speed drives, efficient motors and pumps
- Boiler upgrades, heat recovery systems, condensate recovery and enhanced insulation
- Energy management software, automated controls and solar PV to improve monitoring and reduce electricity costs
- Improvements to cool rooms, compressed air systems, HVAC equipment and wastewater pumping infrastructure.

20 Australian Food and Grocery Council, *Electrification Fact Sheet*, 21.

Dairy Processing

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

Step 1: measure

Establish simple and repeatable baseline data

- **Capture energy and emissions:** electricity, natural gas, LPG, diesel, petrol, refrigerants
- **Capture activity:** litres of milk produced, tonnes of product, production hours, cold-room loads, boiler hours, wastewater volumes
- **Track:** both absolute emissions and emissions intensity over time
- **Tools:** sub-metering (interval data, energy management software)

Step 2: optimise

Prioritise low-cost operational improvements first

Refrigeration and cooling	**Heat and hot water / steam**	**Cleaning and water**	**Operational controls**

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

Step 3: upgrade

Make targeted investments in equipment and controls

Heat and utility systems	**Digital and on-site energy**	**Cold chain and site opportunities**

Opportunities: milk and liquid dairy
Pasteurisation, refrigeration, hot water, packaging and wastewater treatment

Opportunities: cheese and yoghurt
Fermentation rooms, ageing or cold storage, compressed air and longer cleaning cycles

Develop a strong business case to support payback periods, hygiene requirements or production disruption

Step 4: decarbonise

Plan for longer-term decarbonisation opportunities

Renewable electricity procurement	**Battery storage**	**Heat pumps**	**Electric boilers**
Integrated heat recovery	**Electrification infrastructure**	**Low-GWP refrigerants e.g. R-290**	**Biogas or renewable energy from wastewater**

Site-specific options are best suited to larger operators, with steady thermal loads, or planned equipment upgrades

Seafood Processing

Energy management in seafood processing is different because energy use is split between **catching, handling, chilling, processing and storing** seafood, rather than occurring mainly within a fixed manufacturing site. For wild-catch operators, marine diesel, vessel efficiency, trip planning, ice and onboard refrigeration can dominate, while aquaculture and processing businesses may use more electricity for pumps, aeration, water circulation, refrigeration, cold rooms and processing equipment.[21]

In WA, energy intensity can also vary with seasonality, weather, quota management, species mix and catch volumes, making measurement and benchmarking more complex than in businesses with steadier production lines.

Before investing in major capital upgrades, fishing and seafood businesses can often reduce energy costs through practical operational improvements. There are many opportunities for improving fuel efficiency, optimising refrigeration and cold chain management, and enhancing day-to-day operational practices, including:

Fishing operations

- Improving trip planning and route optimisation
- Reducing vessel idling and unnecessary engine run time
- Maintaining hulls and propellers to improve fuel efficiency
- Optimising gear drag and engine loading to reduce fuel consumption.

Refrigeration and ice production

- Reviewing temperature set points and reducing overcooling
- Maintaining refrigeration equipment, condensers and seals
- Optimising ice production and storage systems
- Improving the efficiency of one of the largest energy users in seafood operations.

Processing and site operations

- Reducing hot water use and optimising washdown and cleaning processes
- Maintaining pumps, compressors, motors and other critical equipment
- Improving the efficiency of processing and handling activities.

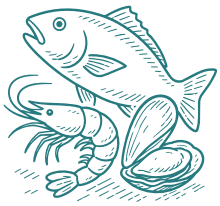
21 Robert A. Bell, *Energy Use and Carbon Emissions Assessments in the Australian Fishing and Aquaculture Sectors: Audit, Self-Assessment, and Guidance Tools for Footprint Reduction*, FRDC Project 2020/089 (Canberra: Fisheries Research and Development Corporation, 2022), 1, 18–20, https://www.frdc.com.au/sites/default/files/products/2020-089_DLD.pdf

Operational controls

- Shutting down idle equipment when not required
- Staggering large electrical loads
- Monitoring fuel and electricity use to identify improvement opportunities
- Implementing efficient start-up and shutdown procedures.

Further energy savings can be achieved through targeted **equipment upgrades and improved system controls**. Opportunities include:

- Engine efficiency improvements, upgraded hydraulic and winch systems, LED lighting and advanced navigation technologies
- High-efficiency refrigeration and cold chain equipment upgrades, including compressors, variable speed drives and lower-impact refrigerants
- Energy-efficient motors and pumps, energy management software, automated controls and solar PV for processing facilities
- More efficient aeration systems, pumps, recirculation systems, water treatment infrastructure and cold storage facilities for aquaculture and land-based operations.



Seafood Processing

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

Step 1: measure

Establish simple and repeatable baseline data

- **Capture energy and emissions:** marine diesel, electricity, LPG, refrigerants and other fuels
- **Capture activity:** fishing days, engine hours, catch volume, tonnes processed, cold storage use
- **Track:** both absolute emissions and emissions intensity over time
- **Tools:** fuel monitoring, vessel logs, sub-metering, energy management software

Step 2: optimise

Prioritise low-cost operational improvements first

Fishing operations	**Refrigeration and ice**	**Processing and cleaning**	**Operational controls**

Fast, low disruption, cost-effective improvements to boost reliability and reduce avoidable fuel and energy use

Step 3: upgrade

Make targeted investments in equipment and controls

Vessel and harvest systems	**Cold chain and refrigeration**	**Processing and site energy**	**Aquaculture and land-based systems**

Opportunities: wild-catch seafood
Vessel fuel use, refrigeration, ice, cold storage and logistics

Opportunities: processing and aquaculture
Pumps, aeration, water circulation, HVAC and site energy

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

Step 4: decarbonise

Plan for longer-term decarbonisation opportunities

Renewable electricity procurement	**Battery storage**	**Hybrid / electric-ready vessels**	**Low-emissions fuels**	**Heat pumps**
Natural refrigerants	**Integrated heat recovery**	**Electrification infrastructure**	**Waste-to-energy from seafood waste**	

Site-specific/fleet-specific options best suit larger operators, land-based aquaculture, processors, or when planning equipment upgrades

Fruit and Vegetable Processing

Energy management in WA fruit and vegetable processing is complex due to the subsector's diverse operations, from fresh and chilled produce to frozen, preserves, canned, dehydrated and ready-meal products.

Fresh packing and cold storage increase electricity demand. Cooking, blanching, drying and canning increase heat loads. Seasonality, crop mix and product perishability also influence energy consumption. As a result, energy use can vary significantly across the subsector, depending on the business's primary focus.[22]

Before investing in major capital upgrades, meaningful energy and water savings can often be achieved through practical operational improvements. There are many opportunities for improving refrigeration performance, reducing water and heat waste, and optimising production processes to improve resource efficiency and lower operating costs, including:

Refrigeration and cooling

- Reviewing temperature set points and reducing overcooling
- Maintaining refrigeration equipment to improve performance and reliability
- Improving the efficiency of cold rooms, storage areas and cooling systems.

Water and washing processes

- Reducing hot water waste
- Optimising washing operations and cleaning cycles
- Identifying and repairing leaks to reduce unnecessary water and energy use.

Processing and drying operations

- Improving production scheduling and batch planning
- Reducing equipment idle time
- Maintaining key processing equipment to improve efficiency and performance
- Optimising drying and processing operations to reduce energy intensity.

Operational controls

- Shutting down idle equipment when not in use
- Staggering large energy loads where practical
- Monitoring energy and water use to identify improvement opportunities
- Implementing efficient start-up and shutdown procedures.

22 Australian Food and Grocery Council, *Electrification Fact Sheet*, 22.

Further energy savings can be achieved through targeted equipment **upgrades**, improved process controls and investment in efficient plant and infrastructure. Opportunities include:

- High-efficiency refrigeration systems, compressors, variable speed drives and lower-impact refrigerants
- Improved cold rooms and storage facilities
- Efficient heat systems, including upgraded burners, insulation, heat recovery technologies and hot water systems
- Energy-efficient motors, pumps, conveyors and packaging equipment
- Energy management software, automated controls and solar PV to improve monitoring and reduce electricity costs
- Efficient dehydrators, freezing systems, compressed air equipment and specialised processing technologies.

Fruit and Vegetable Processing

A practical pathway to efficient, resilient and lower emissions fruit and vegetable processing

Step 1: measure

Establish simple and repeatable baseline data

- **Capture energy and emissions:** electricity, natural gas, LPG, diesel, refrigerants
- **Capture activity:** tonnes processed, cold storage use, packing volumes, hours of operation, water use
- **Track:** both absolute emissions and emissions intensity over time
- **Tools:** sub-metering, utility tracking, energy management software

Step 2: optimise

Prioritise low-cost operational improvements first

Refrigeration and cooling	**Washing and water use**	**Processing and drying**	**Operational controls**

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

Step 3: upgrade

Make targeted investments in equipment and controls

Cold rooms and refrigeration	**Process heat systems**	**Packing and site energy**	**Drying, freezing and specialised systems**

Opportunities: produce and packing
Refrigeration, cold rooms, grading, packing and site energy

Opportunities: processing
Heat, blanching, cooking, drying, freezing, water heating and wastewater

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	**Battery storage**	**Heat pumps**	**Electric forklifts and mobile equipment**	**Low-emissions fuels**
Natural refrigerants	**Integrated heat recovery**	**Electrification infrastructure**	**Waste-to-energy from organic residues**	

Site-specific options are best suited to larger processors, cold storage operators, or when planning equipment upgrades

Beverage Manufacturing

Energy management in beverage manufacturing differs because the subsector combines businesses with very different operating profiles, including non-alcoholic beverage producers, bottlers and distilleries. Non-alcoholic drinks rely heavily on mixing, carbonation, pasteurisation, chilling, filling lines, compressed air and packaging, while distilleries have larger thermal loads from boilers, stills, hot water, cooling and bottling.[23]

Energy performance is shaped by the product type, production volume, packaging format, water use, cleaning requirements and whether the business is mainly managing cold processes, heat-intensive distillation, or both.

Before investing in major capital upgrades, energy savings can often be achieved through practical operational improvements. There are many opportunities for improving refrigeration performance, optimising heat generation and reducing energy use in cleaning and utility systems, including:

Refrigeration and cooling

- Optimising refrigeration and cooling systems
- Reviewing temperature set points and reducing overcooling
- Maintaining equipment to improve efficiency and reliability.

Heat and hot water

- Improving the efficiency of heat and hot water generation
- Reducing heat losses through improved insulation
- Optimising equipment scheduling and reducing unnecessary operating time.

Cleaning and utility systems

- Reducing energy use in cleaning operations
- Improving compressed air system performance
- Identifying and addressing inefficiencies through routine maintenance.

Operational controls

- Shutting down idle equipment when not in use
- Staggering large energy loads where practical
- Monitoring energy and water consumption to identify savings opportunities
- Improving start-up and shutdown procedures.

23 Australian Food and Grocery Council, *Electrification Fact Sheet*, 24; Distillers South Australia, *Introduction to Sustainability in Distilling: Module 6—Energy: Improving Energy and Resource Usage in Distilleries* (February 2025), 2–6, https://distillerssa.org.au/wp-content/uploads/2025/03/Introduction-to-Sustainability-in-Distilling-Module-6.pdf.

Further energy savings can be achieved through targeted equipment **upgrades** and improved process controls. Opportunities include:

- More efficient process heat and distillation systems, including upgraded boilers, heat recovery and condensate recovery
- High-efficiency refrigeration and utility systems, including variable speed drives
- Energy-efficient motors, pumps and packaging line equipment
- Energy management software, automated controls and solar PV
- Improvements to water treatment, cleaning systems, automation and compressed air equipment.

Beverage Manufacturing

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

Step 1: measure

Establish simple and repeatable baseline data

- **Capture energy and emissions:** electricity, natural gas, LPG, diesel, refrigerants
- **Capture activity:** litres produced, packaged volumes, operating hours, water use, cold storage use
- **Track:** both absolute emissions and emissions intensity over time
- **Tools:** sub-metering, utility tracking, energy management software

Step 2: optimise

Prioritise low-cost operational improvements first

Refrigeration and cooling	**Heat and hot water**	**Cleaning and compressed air**	**Operational controls**

Fast, cost-effective improvements to boost reliability and reduce energy waste

Step 3: upgrade

Make targeted investments in equipment and controls

Process heat and distillation	**Refrigeration and utilities**	**Packaging and site energy**	**Water and specialised systems**

Opportunities: non-alcoholic beverages
Packaging lines, refrigeration, compressed air, water treatment and site energy

Opportunities: distilleries and spirits
Heating, distillation, hot water, cooling, maturation storage and bottling

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

Step 4: decarbonise

Plan for longer-term decarbonisation opportunities

Renewable electricity	**Natural refrigerants**	**Battery storage**	**Integrated heat recovery**
Heat pumps	**Electrification infrastructure**	**Low-emissions fuels**	**Waste-to-energy from organics or residues**

Site-specific options are best suited to larger operators or if planning equipment upgrades

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Methodology

The Study used a mixed-methods approach to develop a broad picture of energy use and operational greenhouse gas emissions across WA's food and beverage manufacturing sector.

The Study combined:

- an industry survey covering energy use, practices, technology uptake, barriers and support needs
- focused engagement with participating businesses to collect more detailed energy, production and emissions information
- desktop research using government statistics, industry reports, production data, public company disclosures and other relevant benchmarks.

The survey received usable responses from businesses across 10 food and beverage subsectors. It was distributed through government and industry networks, supported by targeted outreach. As businesses were not selected through random sampling, the survey results should be understood as an indicative industry snapshot rather than a statistically representative measure of the entire sector. The survey was used primarily to understand industry practices, experiences and priorities; it did not, by itself, provide the detailed data required for quantitative emissions modelling.

More detailed emissions estimates were developed using 12-month electricity, fuel, refrigerant, production and other operational data obtained through focused business engagement. This data was supplemented with suitable public disclosures and industry benchmarks. Business data generally relates to the 2024–25 financial year, however some businesses utilised a calendar year where appropriate for their circumstances. Where matching industry data was unavailable, the most recent available year was used and differences between source years was given consideration when interpreting the results.

The emissions boundary covered manufacturing operations located in Western Australia within ANZSIC Subdivision 11, Food Product Manufacturing, and Group 121, Beverage Manufacturing, excluding tobacco manufacturing. The assessment included operational Scope 1 emissions, such as fuel use and refrigerant leakage, and location-based Scope 2 emissions from purchased electricity. Primary production, operations outside WA and Scope 3 emissions such as purchased ingredients, packaging supply chains and third-party freight were excluded where they could be separated.

Figure 8: Study classifications and corresponding ANZSIC codes

Some participating businesses combined manufacturing with farming, retail, hospitality or cellar-door activities at the same site. Where reliable information was unavailable to separate these activities, total site energy use was retained. The possible inclusion of non-manufacturing energy use is therefore a limitation of the analysis.

Emissions were calculated using the applicable Australian Government National Greenhouse Accounts Factors. Different scaling approaches were used for each subsector to reflect the available data and the way emissions relate to business activity. These included business-count scaling for bakeries, production-based models for breweries, wineries and meat processors and manufacturers, public processing benchmarks for dairy processing, and ABS turnover and employment indicators for other manufacturing industries. The whole-sector estimate combined these components and was compared with broader economic and energy-based benchmarks as a reasonableness check.

The quality of the underlying data was assessed using principles adapted from CSIRO's sector-level greenhouse gas accounting guidance.[24] The assessment considered data reliability, completeness, temporal correlation, geographic correlation and technological representativeness. Scores ranged from 1, representing the strongest data quality, to 5, representing the weakest. An emissions-weighted mean score of approximately 2.2 was calculated across the subsectors and interpreted by the study team as moderate overall data quality. The assessment was qualitative, did not alter the calculated emissions estimates and does not represent a percentage uncertainty or statistical confidence interval.

The results provide an indication of the likely scale and major sources of operational emissions across the sector. They are not complete business or industry inventories, statistical confidence intervals or lifecycle assessments. Estimates have been rounded and should be interpreted with consideration of sample coverage, differences between businesses, mixed-use sites, source years and the assumptions required to scale available data across each subsector.

24 Sevenster, M. et al. (2023), A Common Approach to Sector-Level Greenhouse-Gas Accounting for Australian Agriculture: Methods and Data Guidance, CSIRO, Australia.

Important disclaimer

The Chief Executive Officer of the Department of Primary Industries and Regional Development and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

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