TEG Insights: Transitioning to a sustainable manufacturing industry

A Queensland Perspective

Author

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THE ECO EFFICIENCY GROUP

Acknowledgements & Disclaimer

Acknowledgements

The Ecoefficiency Group acknowledges the Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development for subsidising the delivery of the Queensland Manufacturers Sustainability Benchmark Program.

Disclaimer

This review presents data from undertaking Sustainability Benchmark Assessments for 50 manufacturing companies in Queensland. Due to the significant variation in the size and type of companies, comparisons should be taken with care. This data is a snapshot of the 50 companies and gives an indication of the resource use, emissions generation and the opportunities for improved efficiency and emission reduction available to these companies.

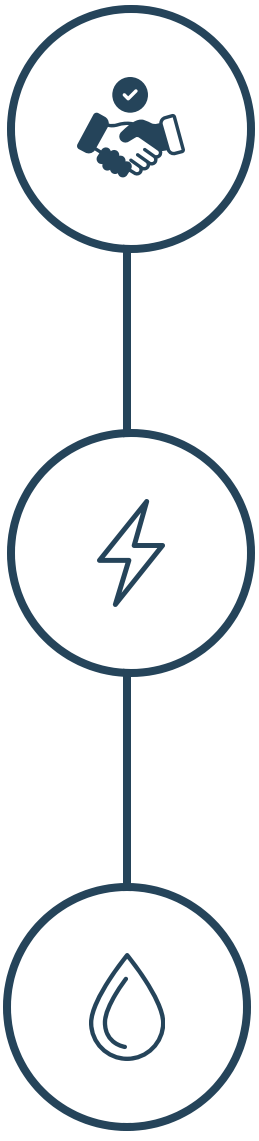
Acknowledgement of Country

We acknowledge the Traditional Owners of the lands across Queensland on which this work has been developed, and in particular the Turrbal and Jagera peoples, the Traditional Custodians of the land where our Brisbane office is based. We pay our respects to Elders past, present and emerging and recognise the ongoing connection that Aboriginal and Torres Strait Islander peoples have to Country, culture, and community.

Executive Summary

The Queensland Manufacturers Sustainability Benchmark Program provides a comprehensive assessment of sustainability performance across 50 manufacturing companies in Queensland, covering energy, water, waste, and greenhouse gas emissions. The program has enabled participating companies to gain insight into their operational footprint, identify opportunities for cost savings, and strengthen their position against their competitors, in tendering and with grant applications.

Key Insights



Sustainability Commitment and Culture

- 95% of participants reported full senior management commitment to sustainability.
- Despite this, 82% of participants are at the early stages of integrating sustainability into day-to-day operations.
- Less than half of participants have a formal sustainability policy, fewer than a third have sustainability actions in job descriptions, and under 30% have quantitative sustainability goals.
- Only 12% of participants have formed dedicated sustainability teams, highlighting an area for future investment and capability building.

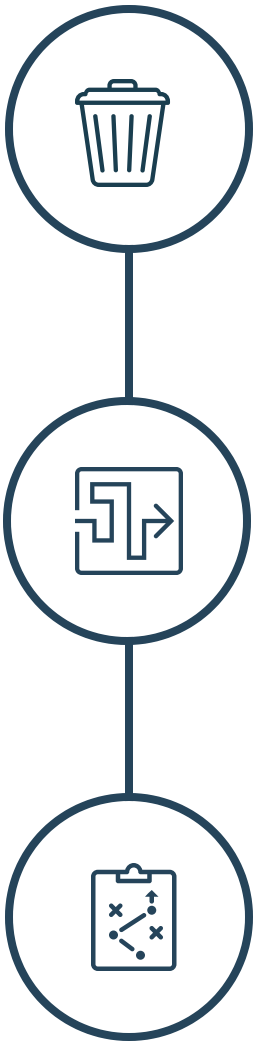
Energy Use and Management

- Energy is a major operating cost of participants, with annual electricity consumption ranging from 40–3,600 MWh and expenditure from $15,000 to $740,000, excluding one Food and Beverage manufacturer exceeding 16,000 MWh and $2 million per year.
- Electricity costs are higher in regional areas, up to 56% more than Southeast Queensland for participants.
- Whilst 90% of participant companies have installed energy-efficient LED lighting, there are still ‘low hanging’ efficiency gains to be made such as engaging staff to conserve energy.
- Only 13% of participants companies have sub-metering or real-time monitoring,
- Scope 1 emissions reaching up to 2,500 tCO_2e, and Scope 2 up to 2,800 tCO_2e with offsetting costs potentially exceeding $14,500 per year for a typical Engineering/Fabrication company.

Water Use and Management

- Water usage varies significantly by sector, with Food and Beverage companies consuming the largest volumes and expenditure ranging from a few hundred dollars to as high as $2.4 million per year.
- Average water charges across regions range from $1.60 to $7.60 per kL, with additional service and infrastructure costs often exceeding consumption costs.
- Opportunities exist for closer monitoring, efficiency upgrades, water reuse, and advanced water stewardship, particularly in high-use or drought-prone areas.

Executive Summary



Waste Generation and Recycling

- Landfill disposal costs ranged from $10,400 to $80,000 per year, with one large Engineering/Fabrication company exceeding $500,000.
- Recycling costs are generally lower, though volumes and practices vary widely.
- Only 60% of companies recycle cardboard and paper, 40% separate cans and bottles, and very few separate plastics, organic waste, or batteries.
- Visual inspections indicate widespread contamination of general waste bins, highlighting opportunities to improve waste separation and recycling.

Challenges

- Participants struggled to provide the data easily and often had not understood their bills past the cost.
- There were limited and often no sector-specific benchmarks available which were useful for comparison, particularly in Engineering/Fabrication.
- There were difficulties in defining representative KPIs for companies producing multiple or diverse products due to the lack of sub-metering.
- Having available resources (time and funds) for implementation along with competing priorities continues to be a barrier.
- Companies expressed the need for further implementation support via cost effective tools for the ongoing measurement of resource use and emissions.

Strategic Benefits

Participation in the program enables manufacturers to:

- Understand their resource costs and make informed decisions based on data.
- Identify cost-saving opportunities through improved energy, water, and waste management.
- Demonstrate sustainability performance to regulators, customers, and investors.
- Strengthen supply chain engagement and enhance social licence to operate.
- Prepare for mandatory climate-related reporting under ESG frameworks such as TCFD and ISSB.

Conclusion

The Queensland Manufacturers Sustainability Benchmark Program demonstrates that data-driven sustainability assessment is both practical and strategic. By understanding their resource use and operational footprint, manufacturers can make informed decisions, improve efficiency, reduce costs, and position themselves competitively, while contributing to a more sustainable and resilient manufacturing sector in Queensland.

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Introduction

The Ecoefficiency Group's involvement in the Queensland Manufacturers Sustainability Benchmark Program over the last four years has provided small, medium and large manufacturers across the state with tailored assessments of their resource use and environmental performance.

This Insights Paper presents the outcomes of the program. It explores how Queensland manufacturers are currently performing in energy, water, waste and emissions management, identifies common challenges, and highlights opportunities for improvement. The paper not only provide valuable insights for individual businesses but also presents findings that the broader industry and its stakeholders can use to set priorities and identify where further support is needed.

For manufacturers, the message is clear: improving sustainability is not just about reducing environmental impacts. It is also about cutting costs, building operational resilience, and ensuring the sector is well positioned in a low-carbon economy. This paper provides manufacturers, industry bodies, and policymakers with a snapshot of the sector's current position and the support required to drive its next steps.

Manufacturing in Queensland

$26.8B
contributed in value-add to the state economy.

180,000
people are employed in the industry.

50%
of businesses are in regional areas.

~9,700
manufacturing businesses in the state.

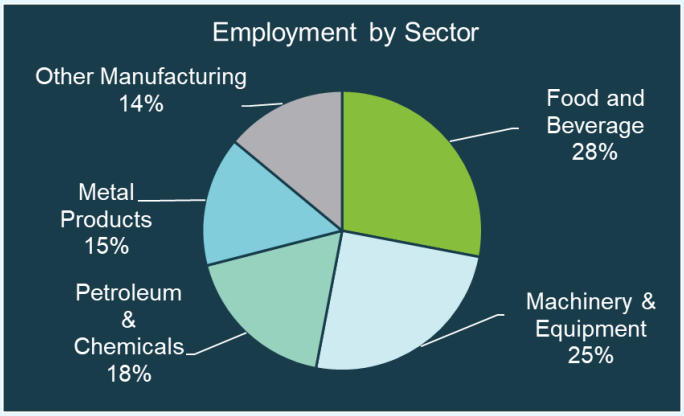
Small & Micro Businesses
86%
of businesses are classed as micro or small enterprises.

6.1% of the state's workforce is in manufacturing.

Growth

opportunities in energy, minerals, and circular economy.

5.2%
of Gross State Product is from manufacturing.



Source: *Manufacturing Skills Queensland. THE STATE OF THE SECTOR 2025 Building the workforce for a growth future. msq.org.au/wp-content/uploads/2025/02/MSQ_State-of-the-Sector_2025_Single_Web.pdf*

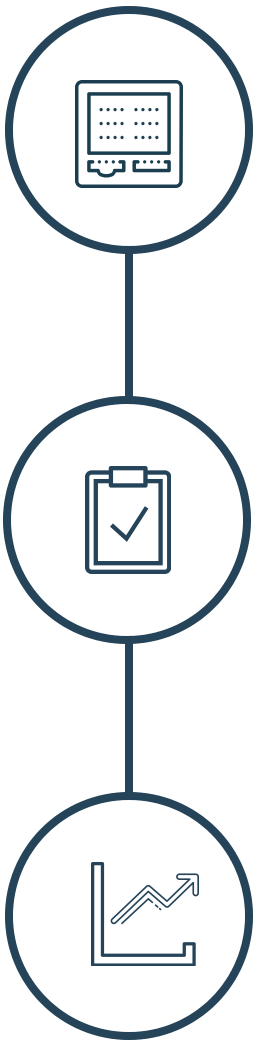
Project Overview

Objectives

The Sustainability Benchmark Program aimed to support the development of Queensland's manufacturing sector in line with the Queensland Government Advanced Manufacturing 10-year Roadmap and Action Plan. The benchmark service was developed by TEG to assist manufacturers to gauge their businesses against national and global manufacturers and understand their opportunities to further develop their business in a more sustainable way and take advantage of Industry 4.0 opportunities. Since 2022, the program has been a key initiative to help manufacturers understand their resource use, improve operational efficiency, and reduce their environmental footprint.

Program Design

The program is designed to assist manufacturers in transitioning to a sustainable future and meet growing sustainability expectations from supply chains. It is conducted in three stages:



Stage 1: Self-Assessment

Companies complete a self-assessment of their sustainability-related actions, aligned with the United Nations Sustainable Development Goals (SDGs). This stage evaluates the sustainability maturity of the business and identifies initial improvement opportunities.

Stage 2: Site-Based Assessment

TEG analyses 12 months of energy, water, and waste data to establish a baseline relative to production. Where available, industry benchmarks are identified for comparison. A site visit identifies opportunities to reduce energy and water use, waste generation and emissions. The outcome is a customised report that helps the company develop a sustainability strategy and emissions reduction plan and supports reporting within the supply chain.

Stage 3: Implementation and Tracking

TEG assists companies to implement their sustainability action plans using the GreenKPI tracking and action software. Through this structured process, the program provides manufacturers with data-driven insights, practical guidance, and tools to enhance efficiency, reduce environmental impact, and strengthen their competitive position in an increasingly sustainability-focused market.

Project Overview

Particpant Profile

Of 50 businesses included in the review, almost a third came from Southeast Queensland while the majority (68%) were located in regional areas (Figure 1). Toowoomba represented the largest share (30%), followed by Mackay (16%) .

The types of businesses involved reflect the diversity of the sector (Figure 2). Engineering and fabrication made up more than half of the participants. Food and beverage producers were next (18%), followed by agriculture and plastics, alongside a scattering of printers, healthcare, and other niche industries. The range of sectors indicates that the need for sustainability services is widespread through the manufacturing industry. The strong take up from the engineering and fabrication sector may be a result of very few having undertaken significant sustainability work in the past or not having the resources or expertise inhouse.

Most participating companies were small to medium enterprises (SME), with 66% employing between 20 and 100 staff, and 26% large businesses employing more than 100 (Figure 3).

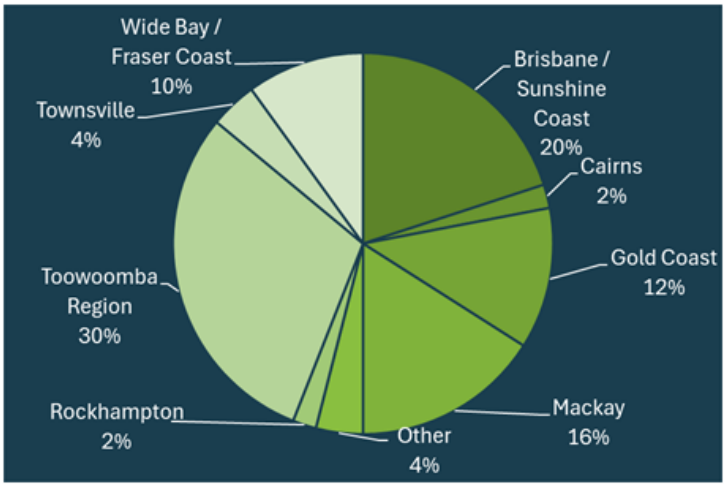


Figure 1: Participants by region

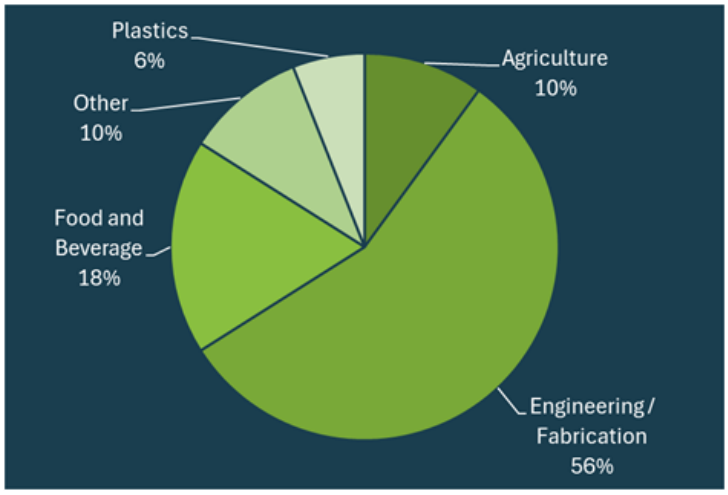


Figure 2: Participants by sector

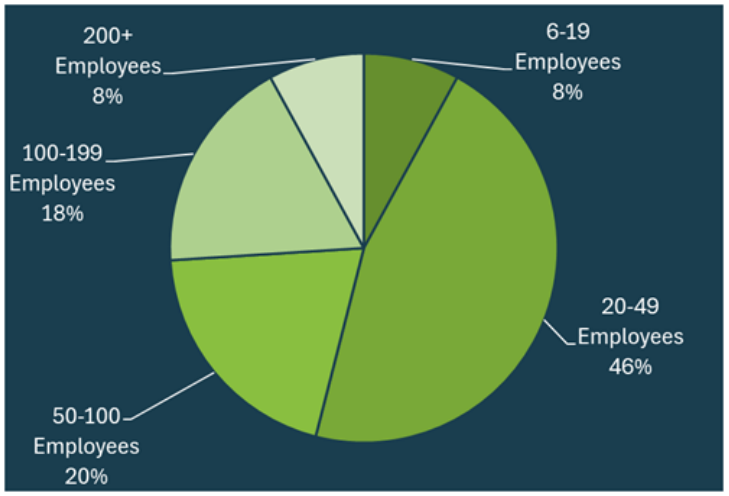


Figure 3: Participants by size

Strategy

Maturity

The manufacturer's sustainability strategy was assessed using TEG's Business Sustainability Assessment Tool (BSAT) which evaluates a company's sustainability maturity through responses to 60 questions across a set of key milestones and categories (Figure 4).

Of the 50 manufacturers included in this review, 95% reported strong senior management commitment to sustainability (Figure 5). However, for most companies, this commitment is not yet fully embedded into day-to-day operations. Over 80% indicated that sustainability is not yet integrated into their core business model, highlighting that while intent is clear, practical implementation remains at an early stage.

Less than 50% of manufacturers had a formal Sustainability Policy, either standalone or integrated within an Environmental Policy. Fewer than one-third included sustainability actions in job descriptions, and less than 30% had established formal sustainability goals or targets. Many of these goals were qualitative, for example, "reduce energy use," "conserve water," or "minimise waste", rather than quantitative and measurable, and only a small number had a comprehensive greenhouse gas (GHG) inventory with reduction targets.

The program also identified structural opportunities to strengthen sustainability outcomes. Only 12% of manufacturers had a dedicated green or sustainability team, despite the proven benefits of cross-functional groups in embedding sustainability across operations. Similarly, there is untapped potential in supply chain management, with only 22% of participants reporting a green or ethical procurement process.

Figure 4: BSAT Milestones and Categories

These findings indicate that, while leadership commitment is strong, Queensland manufacturers are at the early stages of their sustainability journey. There are clear opportunities to move from intent to action through structured policies, measurable targets, dedicated teams, and greater integration of sustainability into core business practices and supply chain management.

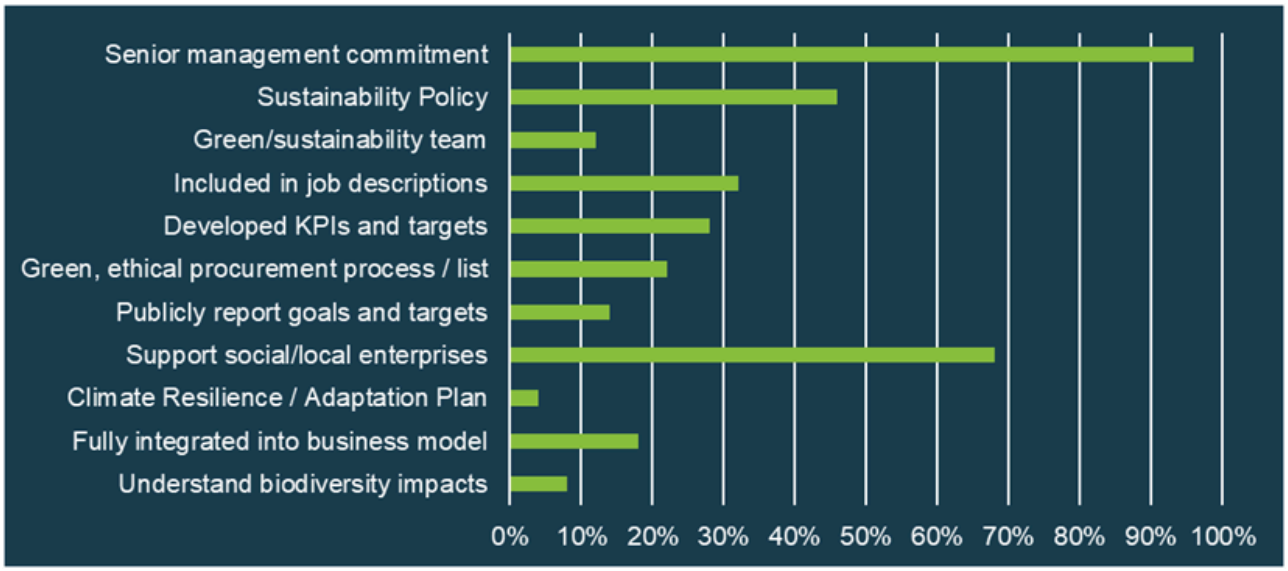


Figure 5: Sustainability Actions – a selection

Strategy

Social Sustainability

Midway through the program, the sustainability assessment tool was restructured to include the category of Positive Corporate Culture, broadening the focus to incorporate social sustainability objectives and key performance indicators (KPIs). This addition provided participating manufacturers with an opportunity to reflect on their practices beyond environmental performance and to consider the social dimensions of sustainability within their businesses.

Of the 21 companies assessed under the updated framework, 75% reported undertaking an evaluation of staff wellbeing, recognising its importance in workforce engagement and retention (Figure 6).

In Australia, companies with consolidated revenue above $100 million are required to maintain a Modern Slavery Policy. Notably, 42% of participants reported having such a policy, including many smaller companies below the reporting threshold that have voluntarily implemented one. This highlights a growing recognition within the sector of the importance of responsible supply chains.

The issue of the gender pay gap, the difference between the average median remuneration for men and women, is particularly relevant in male-dominated industries such as manufacturing. Thirty-three percent of participating companies reported undertaking a gender pay gap analysis, an important step towards addressing inequality in the workplace.

Finally, 38% of companies indicated they had established social sustainability KPIs, signalling a growing, though still emerging, trend of embedding social considerations alongside environmental and economic measures in corporate strategy.

These results suggest that while manufacturers are beginning to engage with social sustainability, there remains significant room for growth in embedding these practices into business models and supply chains.

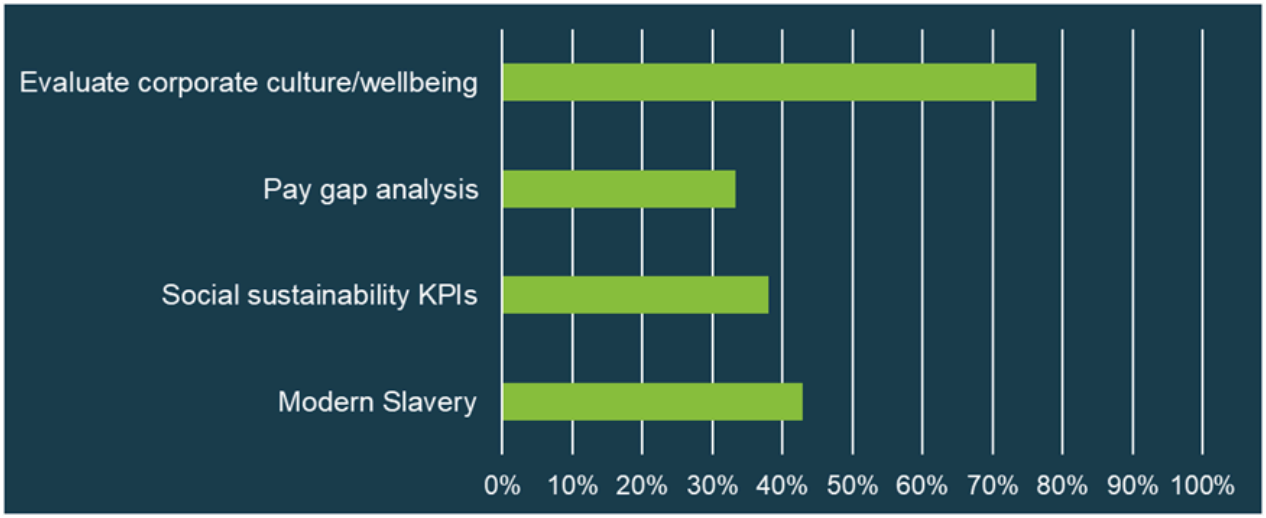


Figure 6: Social sustainability actions

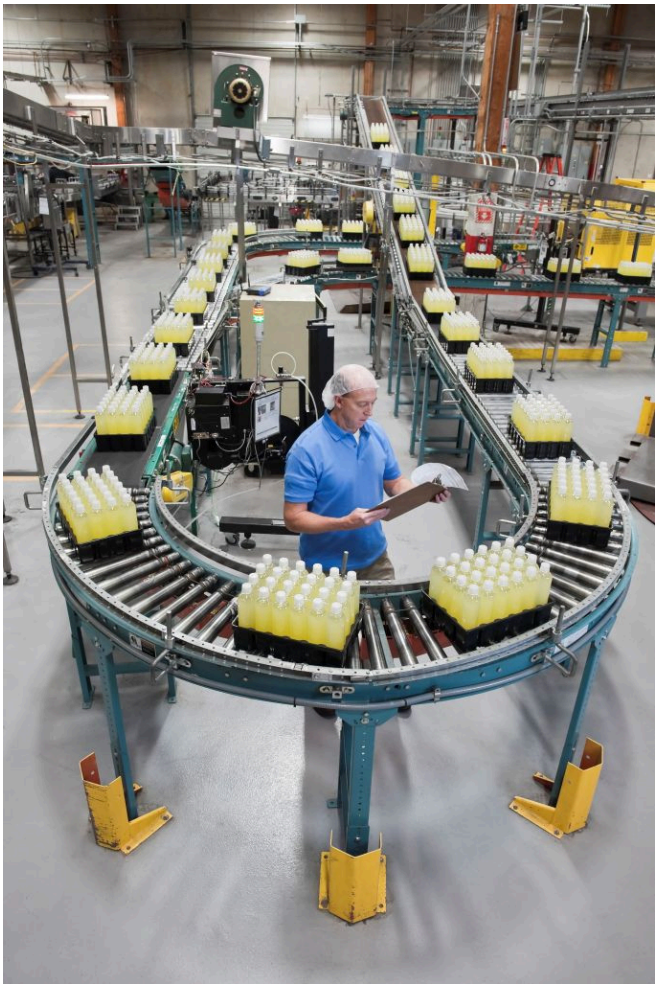
Strategy

Key Performance Indicators

Key Performance Indicators (KPIs) related to production or service units are critical for tracking resource productivity, waste and emissions. They enable companies to compare performance across similar operations e.g. a beverage manufacturer with multiple sites and producing comparable products, or different companies producing comparable products within the same sector.

Even for companies where products or services are not easily compared, KPIs remain valuable. They allow businesses to monitor internal performance over time, identifying trends, variations, and opportunities for improvement from one year to the next.

The program obtained production units from companies to develop site based KPIs and compared them against industry benchmarks where available.



Energy Insights

Energy Supply

Energy supply choices must consider cost, availability and also sustainability, in particular the ability for low or zero emissions energy now or in the future.

- All 50 manufacturers participating in the program sourced electricity from the grid, reflecting the sector's reliance on conventional energy supply.
- Nearly half (48%) reported supplementing grid electricity with on-site solar, typically meeting between 5–20% of their energy needs.
- A small number (2%) utilised other on-site renewable sources, such as biomass, while two manufacturers had installed battery storage, though these contributed only a minor portion of total energy demand.
- None of the manufacturers reported sourcing retail GreenPower or entering into wholesale power purchase agreements, indicating that large-scale renewable energy procurement remains largely untapped within the sector.

These findings suggest that while on-site solar adoption is gaining traction, there is considerable opportunity for Queensland manufacturers to explore broader renewable energy strategies, energy storage solutions, and alternative procurement models to reduce costs and emissions.

Energy Use and Cost

Energy represents a significant portion of operating costs for manufacturing companies, encompassing electricity for general plant operations, liquid fuels for vehicles or generators, and gaseous fuels for boilers, hot water systems, or forklifts.

- Across participating manufacturers, annual electricity consumption ranged widely, from 40–130 MWh at the low end to 3,600 MWh at the high end, with corresponding annual costs of $15,000–$740,000. The Food and Beverage sector was an outlier, with one manufacturer consuming over 16,000 MWh and spending almost $2 million annually.
- For liquid and gaseous fuels, average consumption varied by sector, from 627 GJ in Plastics to 12,458 GJ in Agriculture, with associated annual expenditures of $28,500 to $525,000. Maximum consumption across all sectors reached 28,500 GJ, with one Food and Beverage manufacturer using 41,000 GJ at a cost of $1.3 million per year.
- At the individual company level, one Engineering and Fabrication manufacturer with 100 employees consumed 634 MWh of electricity at a cost of $180,000 annually, alongside 2,031 GJ of fuels (diesel, petrol, LPG) costing $114,000 per year.

These numbers highlight both the scale of energy use and the potential financial impact of efficiency improvements. For manufacturers, even modest reductions in energy consumption or fuel use can translate into significant cost savings, while also contributing to broader sustainability goals. However, capital expenditure on upgrades is a very important factor for most manufacturers with the decision to invest largely driven by overall productivity increases as opposed to increases in efficiency alone i.e., savings in resource costs and reasonable return on investment (<3-4 years) does not always transfer to investment and implementation.

Energy Insights

Supply charges and trends

Trends in electricity costs show regional variations.

- Analysis of average electricity costs (including retail and network charges) for the 50 participating manufacturers from 2021 to 2024 indicates a general upward trend over the four years (Figure 7). This trend is somewhat skewed by a single large Food and Beverage manufacturer in FY24, which benefited from lower average costs due to high-volume purchases.
- Location was a key factor in electricity pricing. Electricity costs were up to 56% higher in regional areas such as Mackay (36 c/kWh), Rockhampton (36 c/kWh), and Toowoomba (26 c/kWh) compared with SEQ (approximately 23 c/kWh). Some manufacturers in Toowoomba (FY24) and Mackay (FY23) faced costs as high as 42–44 c/kWh. These figures represent the average of all retail and network charges.

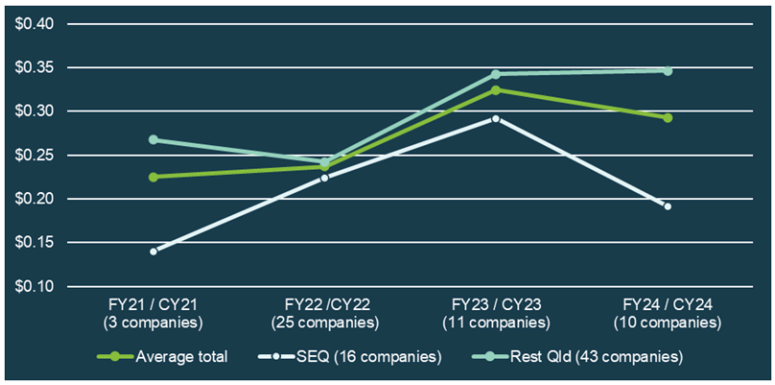


Figure 7: Average electricity cost per year and by region ($/kWh)

GHG Emissions

Scope 1 and Scope 2 greenhouse gas (GHG) emissions included in the benchmark assessment were from the use of fossil fuels (diesel, petrol, LPG and natural gas) and from grid electricity consumption. Other Scope 1 and Scope 3 emissions were not considered in this program.

Figure 8 illustrates the scale of emissions by participants, with Scope 1 emissions reaching up to 2,500 tCO_2e and Scope 2 emissions up to 2,800 tCO_2e, excluding one Food and Beverage manufacturer with Scope 2 emissions of 11,400 tCO_2e.

These numbers give an indication of the scale of emissions for the various sectors participating.

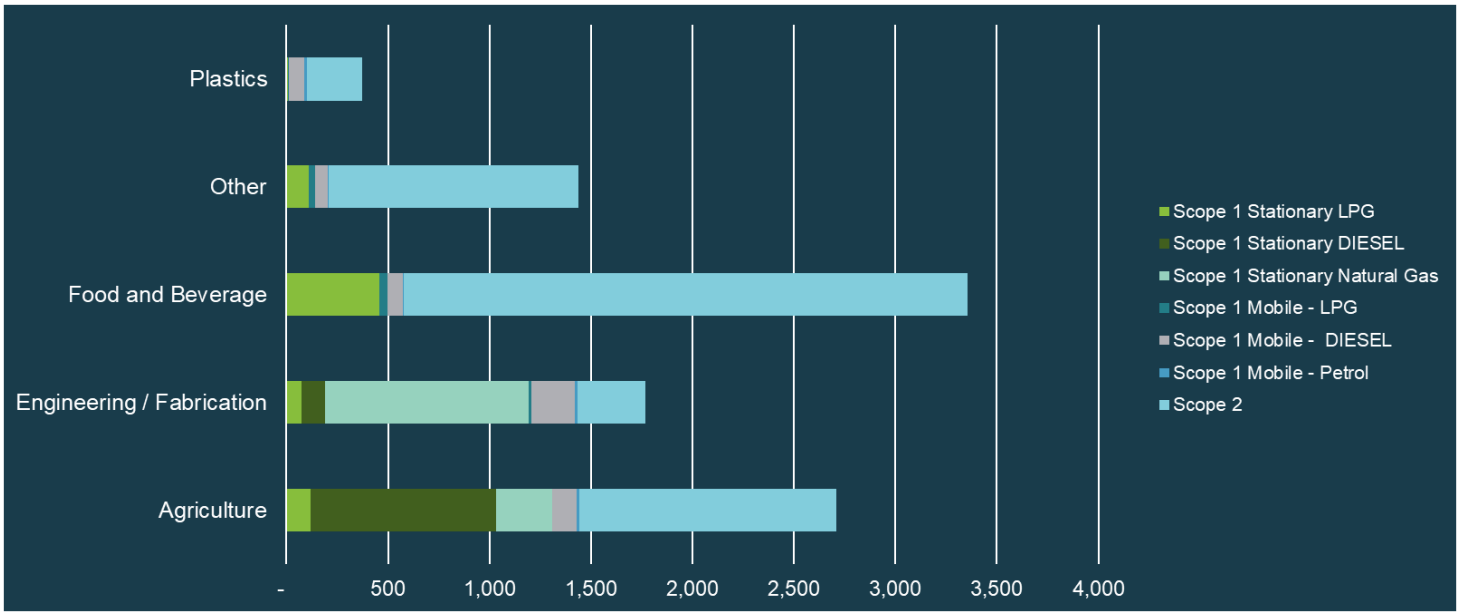


Figure 8: Scope 1 and 2 emissions by sector (tCO_2e)

Energy management and emission reduction

The program highlights ongoing opportunities for Queensland manufacturers to improve energy management, optimise efficiency, and reduce greenhouse gas emissions.

- Only 13% of companies reported using real-time energy monitoring and sub-metering to identify energy waste (Figure 9). Such initiatives have been shown to reduce energy consumption and costs by at least 10%, highlighting the potential impact of targeted energy management strategies.
- Active equipment management was also limited. Only 20% of companies had campaigns to ensure machinery, such as conveyor belts, was switched off when not in use, for example during production breaks.
- Investment in new equipment was varied: some companies had purchased air compressors or, in the Engineering/Fabrication sector, state-of-the-art CNC machines in the past five years, while many others continued to operate machinery which was over 10 years old, thereby not yet tapping into efficiency gains of new equipment. Capital expenditure and return on investment versus efficiency gains is a factor in this decision.
- On a positive note, the majority of manufacturers have addressed “low-hanging fruit” opportunities: over 90% of companies had installed high-bay LED lighting, demonstrating that simple, cost-effective energy efficiency measures are widely adopted.
- Among the 50 manufacturers participating in the program, most operated small vehicle fleets, primarily used by management or sales teams. Within the Engineering and Fabrication sector, some companies maintained a limited number of trucks, such as flatbeds for pickups and deliveries. Companies providing on-site services, for example at mine sites, operated larger fleets, with some in the order of 150 service vehicles (utes).
- Fuel use was predominantly diesel or petrol, with only 5% of companies incorporating hybrid or electric vehicles into their fleets. Barriers to wider uptake included the availability of suitably sized vehicles with the required capabilities, cost and return on investment relative to diesel equivalents, and, for regional businesses, challenges related to long travel distances and limited access to charging infrastructure.
- Adoption of electric forklifts was higher, with 12% of companies purchasing electric models in recent years, reflecting a practical pathway to reduce emissions in specific operational areas.

Collectively, these findings indicate that further investment in real-time monitoring, operational discipline and equipment upgrades could deliver significant energy and cost savings, while reducing emissions and enhancing operational resilience.

Electrification of mobile fleets is currently limited in the sector. However, there are opportunities for greater, targeted uptake depending on capability requirements of vehicles and as the market range of vehicles grows. Application in warehouse and low-level onsite material handling is likely to lead the uptake, where operational requirements and infrastructure support the transition.

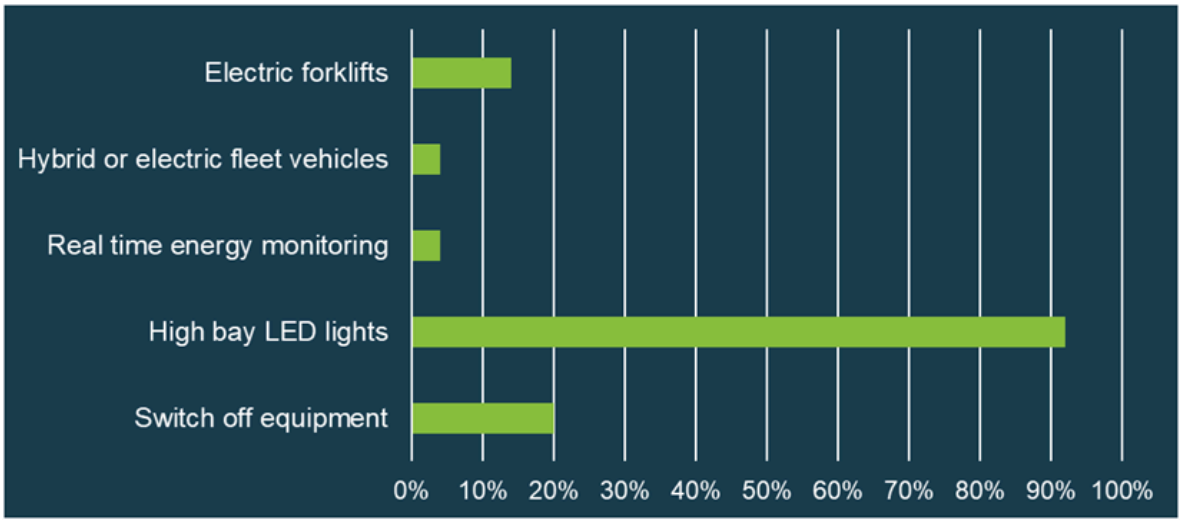


Figure 9: Common energy initiatives implemented

Energy Insights

Other Opportunities and Observations

The program identified a number of additional opportunities for manufacturers to improve energy management, emissions performance, and operational efficiency:

- **Lack of quantified KPIs and targets**: Most companies (72%) did not have measurable energy use or emission reduction targets. This limits their ability to make informed capital investment decisions and slows progress toward decarbonisation. For example, one company invested in a new gas boiler, whereas having emission reduction targets in place might have led to a decision to electrify and install more efficient, lower emission heat pump technology instead.
- **Climate-related reporting requirements**: Many participating companies were classified as Group 3 under mandatory climate reporting frameworks. However, as suppliers to Group 1 and 2 companies, they were often required to provide data for their customers' reporting, highlighting the importance of internal monitoring and tracking systems.
- **Cost of net zero**: The cost of offsetting emissions can be significant, particularly for larger companies. As an indication, one participant (an Engineering and Fabrication company) had total Scope 1 and Scope 2 emissions of 484 tCO_2e which would equate to an annual offset cost of approximately $14,500, assuming a rate of $30 per tonne. This estimate excludes Scope 3 emissions, which, depending on supply chain and other upstream activities, could potentially increase total emissions and offset costs by up to tenfold.
- **Energy tariffs and power factor**: Most manufacturers were on a demand tariff with usage over 100 MWh per year. Assessments helped them understand their energy charges and identify inefficiencies. Several companies had poor power factor (<0.8) that had not been addressed through correction measures, increasing demand charges by up to 30%.
- **Quality of power supply**: Power supply and quality were an issue for some manufacturers, particularly for a number in regional areas located at the end of supply transmission lines.
- **On-site solar monitoring**: Where companies had installed solar PV systems, monitoring was often minimal or absent, reducing the ability to ensure systems were operating at full capacity.
- **Solar feed-in and storage**: Feed-in tariffs for solar were generally very low or zero. For companies operating primarily during weekdays, battery storage could provide an opportunity to better utilise solar generation, though return on investment depends on system size and usage patterns.
- **Unnecessary fees and charges**: Assessments revealed examples of avoidable costs, including a $70/month fee for Energex 'Watchman' lights that were not required, and administration fees on unused fuel cards issued to employees.

Energy efficiency and emission reduction opportunities

Common emission reduction opportunities identified as part of this program:

Scope 1 emissions:

- Electrify e.g. switch out gas fired boilers/heating for heat pumps.
- Increase efficiency e.g. heat recovery for boilers, hot water systems.
- Prevent refrigeration leaks and choose low global warming potential refrigerants.
- Boiler optimisation.
- Transition vehicles to electric (preferred) or hybrid models (stepping stone).
- For fleets – efficient driving and monitoring (review logistics).

Scope 2 emissions:

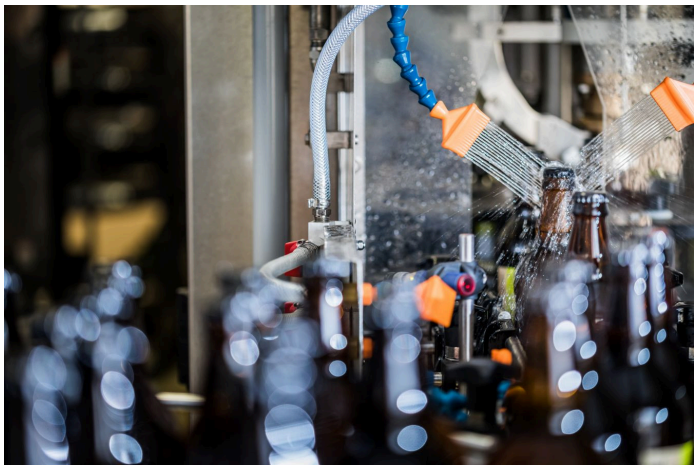
- Switch to renewables via onsite solar, purchase of Green Power or a power purchase agreement.
- Understand electricity use and demand (submetering and real time monitoring).
- Increase efficiency – switch off or turn down, equipment upgrades.
- Heat recovery - refrigeration systems.
- Purchase high efficiency motors including variable speed drives.
- Optimise compressed air systems and eliminate leaks.
- Optimise CNC machines.
- Evaluate heat pumps.
- Optimise refrigeration systems.
- High efficiency lighting throughout (including security lighting).
- Minimise air conditioning use.

Water Insights

Water Use and Cost

Water plays a critical role in manufacturing, serving both as a product ingredient and as a utility for operations such as cooling towers, boilers, and cleaning, as well as for employee consumption and amenities. The quantity of water used varies widely by sector and process.

- In the Food and Beverage industry, large volumes of water are essential for cleaning, hygiene, and food safety purposes. In contrast, metal manufacturing typically uses lower volumes for lubrication and high-pressure cleaning of parts. Agricultural participants in the program, producing primarily dry ingredients, required minimal water.
- Across all sectors, annual water costs ranged from a few hundred dollars to $50,000 for an Engineering and Fabrication company. Food and Beverage companies reported significantly higher expenditures, ranging from $100,000 to $2.4 million for one large food processor (non-beverage).



Supply Charges

It is difficult to compare manufacturers water costs as charging methods vary widely by provider. Some companies are billed separately for bulk water supply, while others receive a single combined charge where it is understood that bulk supply costs are included.

- Average water charges across Queensland regions ranged from $1.60 to $7.60 per kilolitre, with maximum rates between $2.30 and $13.70 per kilolitre (Figure 10).
- In many cases, service and infrastructure charges can far exceed the cost of actual water consumption. For example, one company used just over 1 ML per year of town water at a cost of $2,400 ($2.23 per kL) but incurred additional water supply charges of $22,500 per quarter.

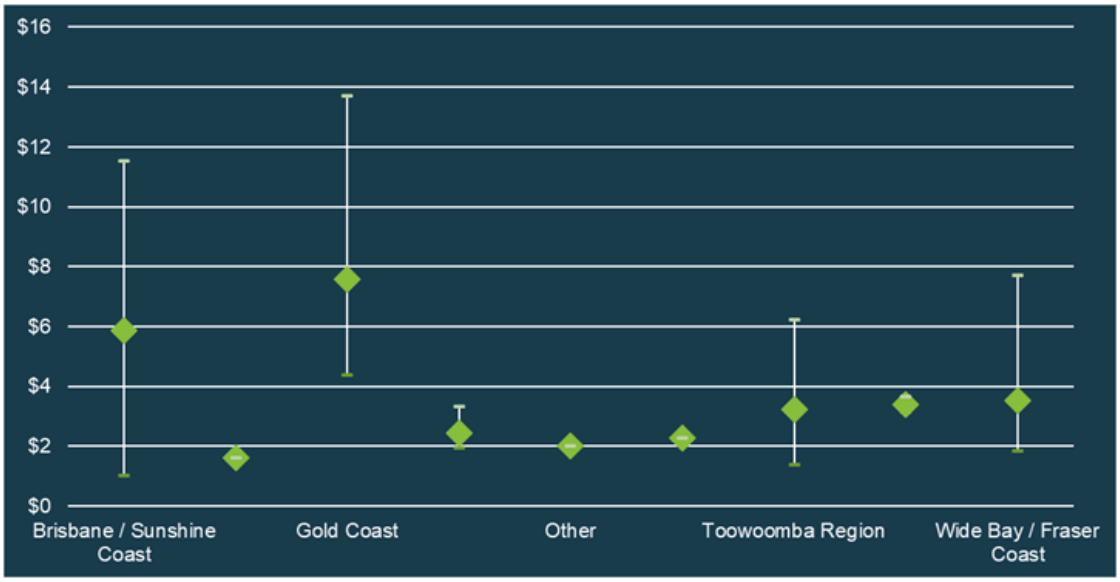


Figure 10: Water cost by region ($/kL)

Water management, efficiency and conservation

Interestingly, during the assessment period, (2022-2025), and for the 50 manufacturing companies that participated, water supply and security was generally not raised as a concern or a significant driver to conserve water. In the past, in Queensland, drought has been a significant driver for businesses, particularly manufacturers, to reduce water consumption.

The review showed that only 50% of participants collected and utilised rainwater and less than 20% recycled or reused water on site (Figure 11). Both of these initiatives present potential opportunities for many manufacturers – all based on water quality and fitness for purpose.

Most manufacturers have opportunities to improve water management. A straightforward example is through closer monitoring of consumption. While water costs are often minor relative to other operating expenses, infrequent monitoring, such as relying solely on quarterly or six-monthly invoices, can allow leaks or inefficiencies to go undetected, including in underground pipework.

Simple improvements to better manage and conserve water include reviewing the efficiency of water fittings (taps, toilets and showers), installing trigger hoses, reviewing tank cleaning processes, and using high-pressure cleaning methods. Even small adjustments can lead to meaningful savings.

For manufacturers where water is critical to production, more sophisticated approaches are recommended such as:

- Installation of sub-meters and development of water balances to track consumption by process.
- Identifying end uses and fitness-for-purpose, which creates opportunities for water conservation, reuse, and recycling. For example, using final rinse water for the first rinse of the next cycle and optimising clean-in-place systems, particularly for the Food and Beverage sector.
- Where significant water volumes are used, or where water security and social licence are important, implementing Water Stewardship practices may be appropriate.

For manufacturers with mostly “dry processes” and low water use, a general benchmark is approximately 100 litres per employee per day. Companies exceeding this benchmark should review water using activities.

These approaches demonstrate that effective water management is achievable at all scales, from simple monitoring and minor retrofits to full-scale stewardship programs, and can contribute to cost savings, process efficiency, and sustainable resource use.

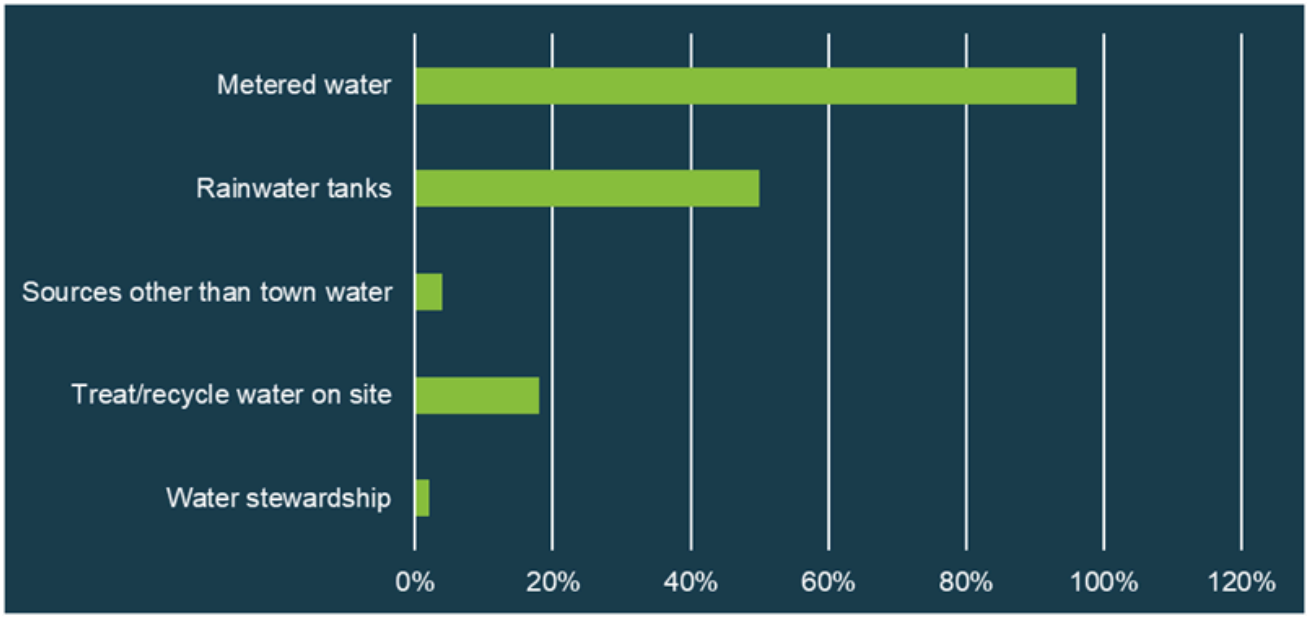


Figure 11: Water related initiatives

Water Insights

Water Stewardship

Water stewardship is the practice of using water in a manner that is socially equitable, environmentally sustainable, and economically beneficial. It is particularly important for manufacturers that rely on large volumes of water for production or cleaning processes, and for those located in regions prone to drought, flood, or water scarcity.

Effective stewardship begins with a thorough understanding of site-specific water use, including both operational consumption and any impacts on local water resources. From there, water stewardship is achieved through a stakeholder-inclusive approach, which considers both site-level and catchment-level actions. This approach can help ensure sustainable water use, support community and environmental interests, and strengthen a site's licence to operate.

The Australian organisation Water Stewardship Asia Pacific outlines a structured process for developing a water stewardship plan, including assessment, target setting, implementation, monitoring, and reporting. By adopting such a framework, manufacturers can proactively manage water risks, improve resource efficiency, and demonstrate leadership in sustainable water management. waterstewardship.org.au/.

Waste Insights

Waste Generated and Disposal cost

Waste management can be a significant cost for manufacturers:

- For the 50 manufacturers assessed, the annual cost of waste disposal to landfill ranged from approximately $10,400 to almost $80,000 per company. One large Engineering and Fabrication company reported a cost exceeding $500,000 per year.
- Recycling costs were typically much lower. For some companies, recycling was included in council rates, costing as little as $250 per year, while others paid up to $7,000 for volumes of 30-1,000 m³. At the high end, one Food and Beverage company spent over $50,000 for 7,600 m³ of recycled material, predominantly cardboard.
- Figure 12 illustrates waste disposal costs per m³ by region, excluding companies billed by tonnage due to conversion inaccuracies. Average disposal charges ranged between $30 and $62 per m³, with maximum rates reaching $90 per m³.
- Waste quantities to landfill ranged from 34 m³ to 15,000 m³ per year.

Most manufacturers are charged based on bin volumes and number of collection services, while only about 20% of companies measure waste by tonnage. Measuring by tonnage is more accurate, as volume-based billing assumes bins are always full, which can significantly overstate actual waste quantities. This variability makes it challenging to compare waste generation between companies measuring in tonnes versus volume, even when using conversion factors (tonne/m³), due to the inherent inaccuracies in such estimates.

These findings highlight both the financial significance of waste management for manufacturers and the variability in charges and reporting methods, which can make benchmarking and performance comparisons challenging.

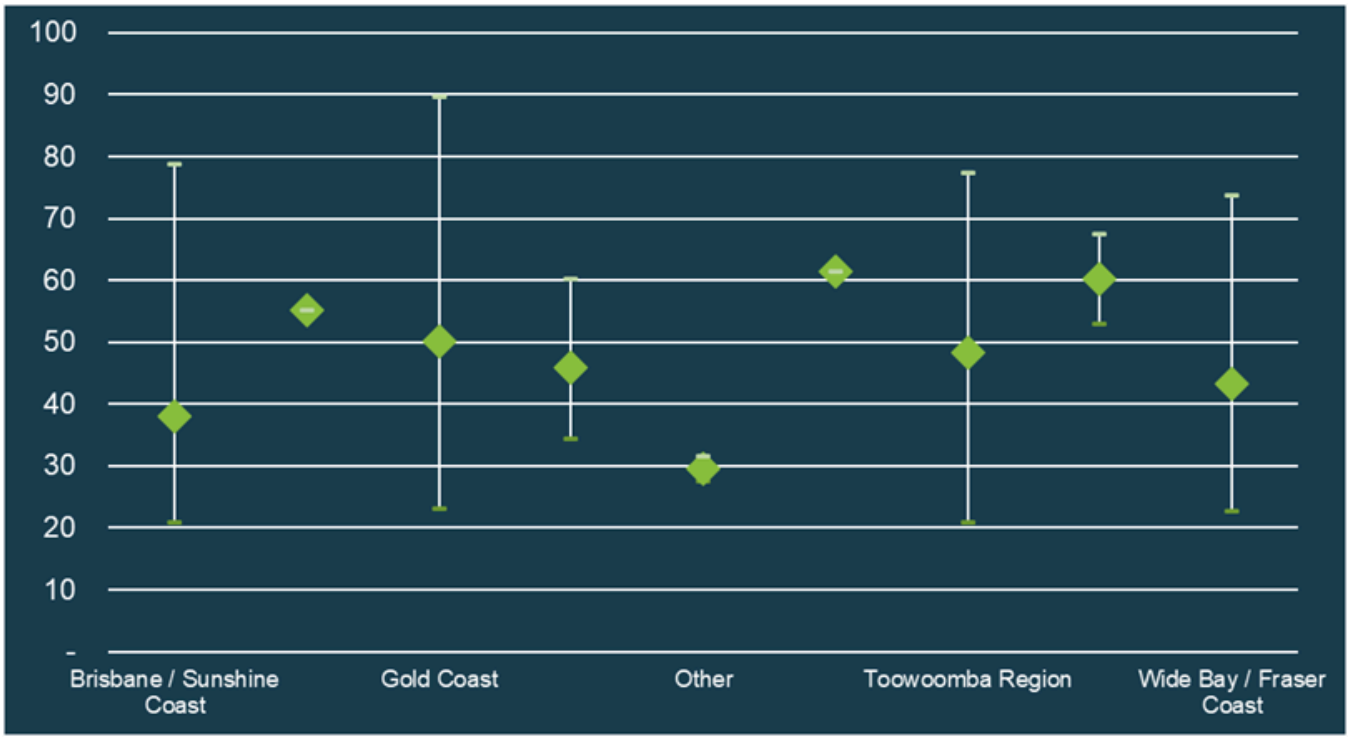


Figure 12: Waste to landfill costs by region, $/m3

Waste Insights

Waste Reduction

Figure 13 illustrates the types of waste management services used by participating manufacturers and highlights opportunities to reduce waste to landfill.

- **Cardboard and paper**: 60% of companies had a separate cardboard and paper recycling service and an additional 13% of companies had co-mingled recycling that included cardboard and paper, leaving just under 30% of companies that could recycle this stream but did not.
- **Co-mingled waste**: Only 18% of companies had a separate co-mingled recycling service.
- **Cans and bottles**: 40% of companies separated cans and bottles for recycling, although in many cases there was no formal collection system, and individual staff members sometimes took items home for refunds.
- **Organic waste**: 18% percent of companies generated enough organic waste to warrant a separate collection service.
- **Plastics**: Only 8% of companies separated clean, soft plastics for recycling, although it is unclear whether these plastics were ultimately recycled.
- **Batteries**: Only 10% of companies reported a formal collection program for battery recycling.
- **Scrap metal**: 100% of companies recycled their scrap metal (is a source of income).

Anecdotally, the number of companies offering recycling and reuse services has increased overall, particularly in SEQ and, to a lesser extent, in regional areas. However, some regional locations, especially those distant from larger towns, still lack access to diverse recycling services. Some waste streams remain a challenge for many manufacturers to dispose of e.g. wood waste (broken pallets) and soft plastics. Many companies actively reuse cardboard boxes, and anecdotal evidence suggests a reduction in the use of polystyrene packaging and foam fillers.

Waste Streams and Recycling Opportunities

Opportunities for improvement in waste management include:

- Working with service providers to quantify waste generation in tonnes not volume. This is especially important for companies that need to develop their GHG emissions inventory to determine accurate Scope 3 emissions from waste.
- Most businesses need persistent staff engagement to use the correct bin. Visual inspections of general waste bins indicated frequent contamination with recyclable materials, suggesting further opportunities to improve waste separation practices.
- Most manufacturers would benefit from co-locating recycling bins next to general waste bins. Often staff will use the nearest bin so co-locating bins often leads to a better success rate.
- Working with supply chains to reduce packaging coming onto the manufacturers site as well as what is used for product packaging. Some frequent suppliers can consider returnable packaging.

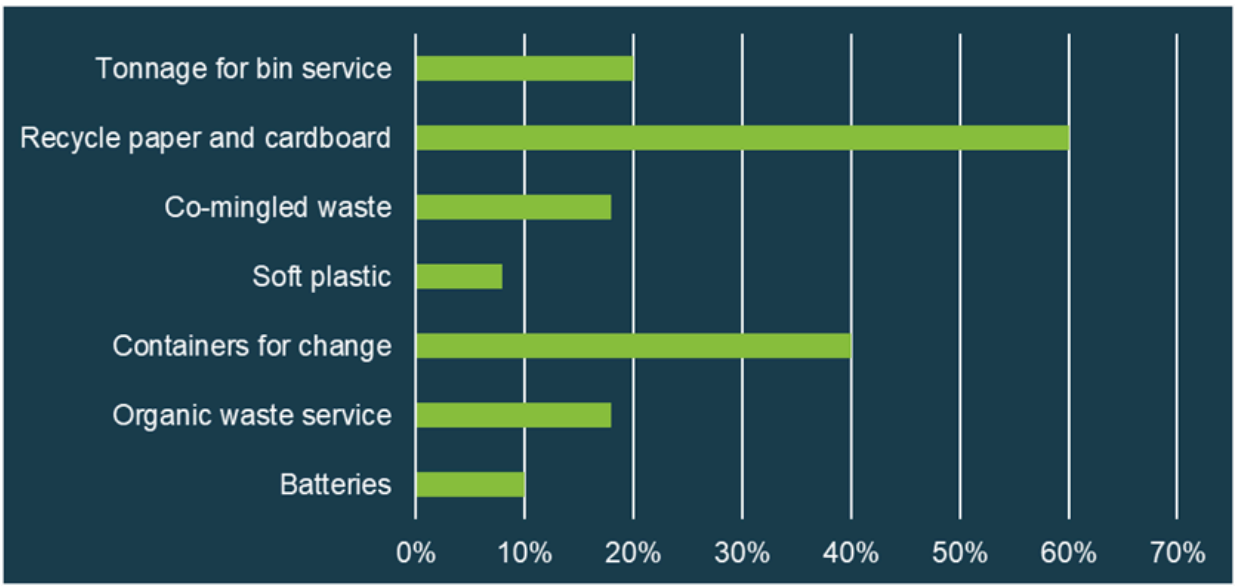


Figure 13: Waste Actions

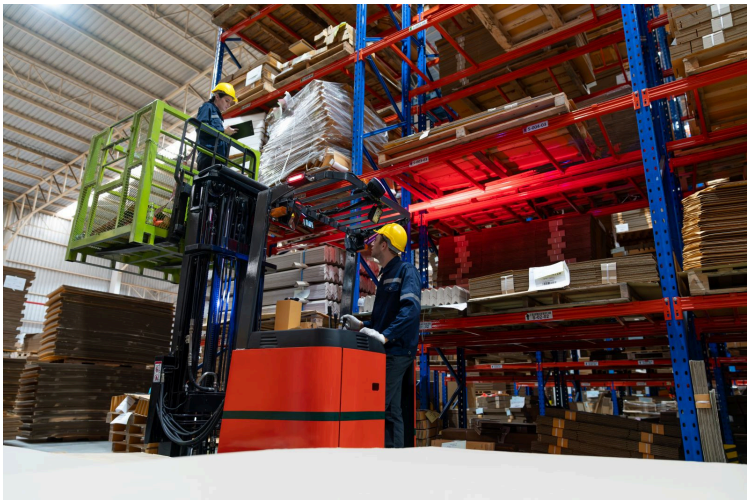
Challenges

Participants in the Queensland Manufacturers Sustainability Benchmark Program demonstrated a strong interest in understanding and improving their sustainability performance. Feedback consistently highlighted that the program was insightful and valuable, particularly in establishing a company-level baseline of resource use and emissions. For many, this was the first time that all resource costs had been consolidated into a single picture, often revealing the significant annual spend on energy, water, and waste. What had often been considered simply the “cost of doing business” became visible as a major area for efficiency gains and cost reduction.

The program enabled companies to make more informed, data-driven decisions about resource use. Site visits provided practical opportunities to discuss onsite issues and identify tailored solutions, while the assessments highlighted potential cost-saving opportunities across energy, water, and waste management. Several businesses used their results to strengthen successful grant applications, while others leveraged the assessments as a foundation for more advanced emissions reporting, including the development of comprehensive greenhouse gas inventories that account for Scope 3 emissions. Around 10% of participants have already returned for follow-up assessments, and many are actively working through recommended actions.

The program also surfaced several challenges in developing meaningful benchmarks:

- **Limited availability of industry benchmarks**: While sectors such as Food and Beverage have public data, Engineering and Fabrication companies have little comparable information. This program at least provides participants with a baseline to track their own year-to-year performance.
- **Defining suitable KPIs**: With diverse and complex product lines, allocating resource use (e.g., electricity or water) to products remains a challenge due to limited sub-metering.
- **Sub-metering gaps**: Many manufacturers lack sub-metering for energy and water, limiting their ability to benchmark individual process lines. High installation costs and competing investment priorities remain barriers.
- **Resource constraints**: Many companies struggle to dedicate the time, labour, and financial resources needed to prioritise and implement identified opportunities. The assessments offer valuable high-level guidance, but further support (time and funds) is needed to translate recommendations into actions.



- **Technology adoption**: Some participants showcased strong Industry 4.0 and 5.0 practices, such as the use of co-bots in engineering and fabrication or highly advanced automated systems in large food and beverage operations. However, broader adoption is limited due to the upfront investment required.
- **Circular economy integration**: Few companies had adopted cradle-to-grave product design or thinking. Integrating circular economy principles—where materials are reused, recycled, or repurposed—offers significant potential to reduce environmental impact, cut costs, and align with growing customer and regulatory expectations.
- **Waste services and recycling options**: Since the 2018 China National Sword Policy, the collection of soft plastics for possible recycle has collapsed with no real alternatives for manufacturers. The potential for greater waste recycling continues to be impacted by the ‘tyranny of distance’.

Overall, the program has proven effective in building awareness, providing a company level baseline, identifying potential savings, and creating a platform for continuous improvement. At the same time, it highlights the need for better sector-specific data, clear and relevant KPIs, and stronger implementation support. Continued guidance is critical to help manufacturers set objectives, establish measurable targets, access reliable information on costs, upgrades, and return on investment and implement efficient, low carbon improvements.

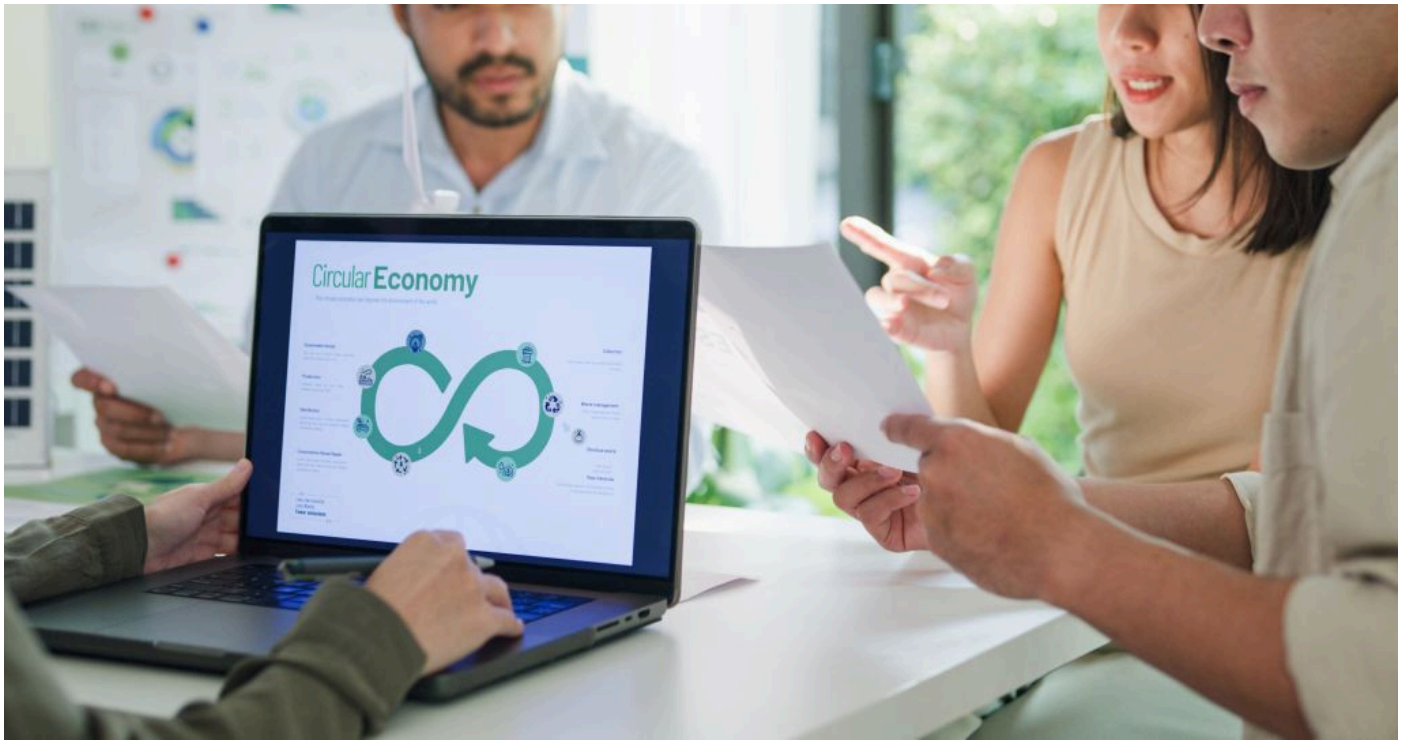
Challenges

Circular Economy

The Circular Economy model seeks to replicate natural ecosystems, where materials are continuously cycled rather than accumulating as waste. In this system, materials are deconstructed, recycled, or repurposed to create new products. This approach contrasts with the traditional linear economy, which follows a “take, make, dispose” model of production.

Key circular economy opportunities include:

- **Durability**: Design products to last as long as possible.
- **Repairability**: Standardise components so products can be easily repaired, even years after manufacture.
- **Re-manufacturability**: Enable products to be stripped down and reassembled, replacing components with recycled or non-virgin materials.
- **Recyclability**: Ensure products can be easily disassembled and recycled at the end of their life.
- **Packaging optimisation**: Reduce packaging materials through lightweighting.
- **Renewable energy**: Incorporate sustainable energy sources into production processes.
- **Water efficiency**: Use water responsibly throughout production.
- **Beneficial reuse of waste**: Transform production by-products into new inputs or secondary products.



Next steps

The Sustainability Benchmark Program has proven valuable in establishing baselines, identifying opportunities, and equipping businesses with the knowledge to act to embed sustainability into their business models. Extending the program to more companies will not only broaden its impact but also strengthen sector-wide resilience and competitiveness in transitioning to a low carbon economy through improved efficiencies and productivity. The Queensland manufacturing industry would benefit from continued and expanded support to help implement recommendations raised by the assessments.

To build on the success to date, the following recommendations are proposed:

Expand Program Reach

- Extend the Sustainability Benchmark Program to a larger number of manufacturers, particularly in underrepresented regions and sectors.
- Maintain regional champions and government support, which have proven effective in driving uptake and engagement.

Provide Implementation support

- Queensland Government to continue to provide implementation support in the form of grants and funding for resource efficiency upgrades.
- Queensland Government to continue provide training such as Lean Manufacturing and Decarbonisation Pathways.

Strengthen Business Value of Sustainability

- Future programs to provide guidance/support on developing sustainability strategies with measurable targets and KPIs to embed sustainability more firmly in operations and governance.
- Expand determination of key performance indicators to include resource productivity i.e. economic output per unit of resource. This will link with the Transforming Queensland Manufacturing Strategy 2025-2030.
- Highlight to manufacturers the benefits of the program in demonstrating sustainability performance to regulators, customers, investors, and within tender processes.

Enhance Supply Chain and Social Licence Benefits

- Support manufacturers to increase resilience through identifying risks and opportunities across their supply chains. This could be an extended option to a sustainability assessment.
- Support manufacturers to extend sustainability practices into their supply chains. This could be via an extended option to assess suppliers and encourage green procurement processes and supplier engagement.

Build Readiness for Emerging ESG Requirements

- Provide targeted resources and training to prepare manufacturers for mandatory climate-related reporting under frameworks such as the TCFD and ISSB. This should include identifying risks and opportunities across supply chains.
- Encourage early adoption of greenhouse gas inventories, including Scope 3 emissions, to ensure manufacturers are well-positioned for future reporting obligations.

By implementing these recommendations, Queensland manufacturers can move beyond baseline awareness towards structured, measurable, and value-adding sustainability practices. Continued investment in this program will deliver long-term benefits for industry competitiveness, regulatory compliance, and contribution to the state's transition to a low-carbon economy.

Conclusion

This review provides the results of Benchmark Assessments for 50 manufacturing companies across Queensland. By raising awareness of energy, water, and waste quantities and associated costs, organisations gain unprecedented insight into their operational footprint. This data-driven approach not only helps identify opportunities for cost savings through improved resource efficiency but also strengthens a company's competitive position when bidding for tenders or applying for grants, where accurate baseline data and demonstrable savings are increasingly required by regulators and customers.

Notably, while sustainability is on the radar for many manufacturers, it is often expressed through broad intentions rather than structured, measurable commitments. Moving towards clear, quantitative targets and formalised policies is essential for businesses to demonstrate progress, meet emerging reporting requirements, and build credibility with stakeholders. Further to this, there were challenges in developing benchmark figures that could be used to compare to other companies nationally and internationally. A more straightforward benefit is using the benchmark figures to help set goals and targets internally and make comparisons from year to year within the same company.

In recent years, there has been a shift towards mandatory climate-related reporting, both in Australia and globally. Companies are increasingly expected, by regulators, investors, and supply chain partners, to disclose their environmental impacts, including greenhouse gas emissions, energy consumption, water usage, and waste management practices. In addition, most government / large organisational tenders require information about a company's sustainability practices.

The Benchmark Program provides a starting point for organisations to meet these reporting obligations. Reliable baseline metrics and consistent tracking systems simplify the transition to mandatory reporting, minimise compliance risks, and build trust with customers, investors, and regulatory bodies. Preparedness in this area can be a key differentiator in competitive tendering, where transparent environmental performance is often a deciding factor. They are also generally better equipped to adapt and thrive in a rapidly evolving landscape.

In summary, embracing sustainability is not just an environmental imperative, it is a strategic business decision. It enables manufacturers to cut costs, win new business, engage stakeholders, and future-proof operations while delivering measurable environmental and social value.

The Ecoefficiency Group

The Ecoefficiency Group (TEG) is a specialist sustainability consultancy with over 20 years of experience helping businesses, governments, and industry bodies improve their environmental performance and competitiveness. We focus on practical, data-driven solutions that support manufacturers in reducing risk, increasing efficiency, and achieving measurable results across energy, water, waste, carbon, and ESG performance.

We partner with clients to design tailored sustainability pathways that align with operational goals, regulatory obligations, and stakeholder expectations. We provide customised reporting on greenhouse gas emissions, track performance, and identify actionable opportunities for improvement. With a personable and pragmatic approach, TEG helps manufacturers embed sustainability into business practices and supply chains, positioning them to meet rising compliance standards and stakeholder demands.

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