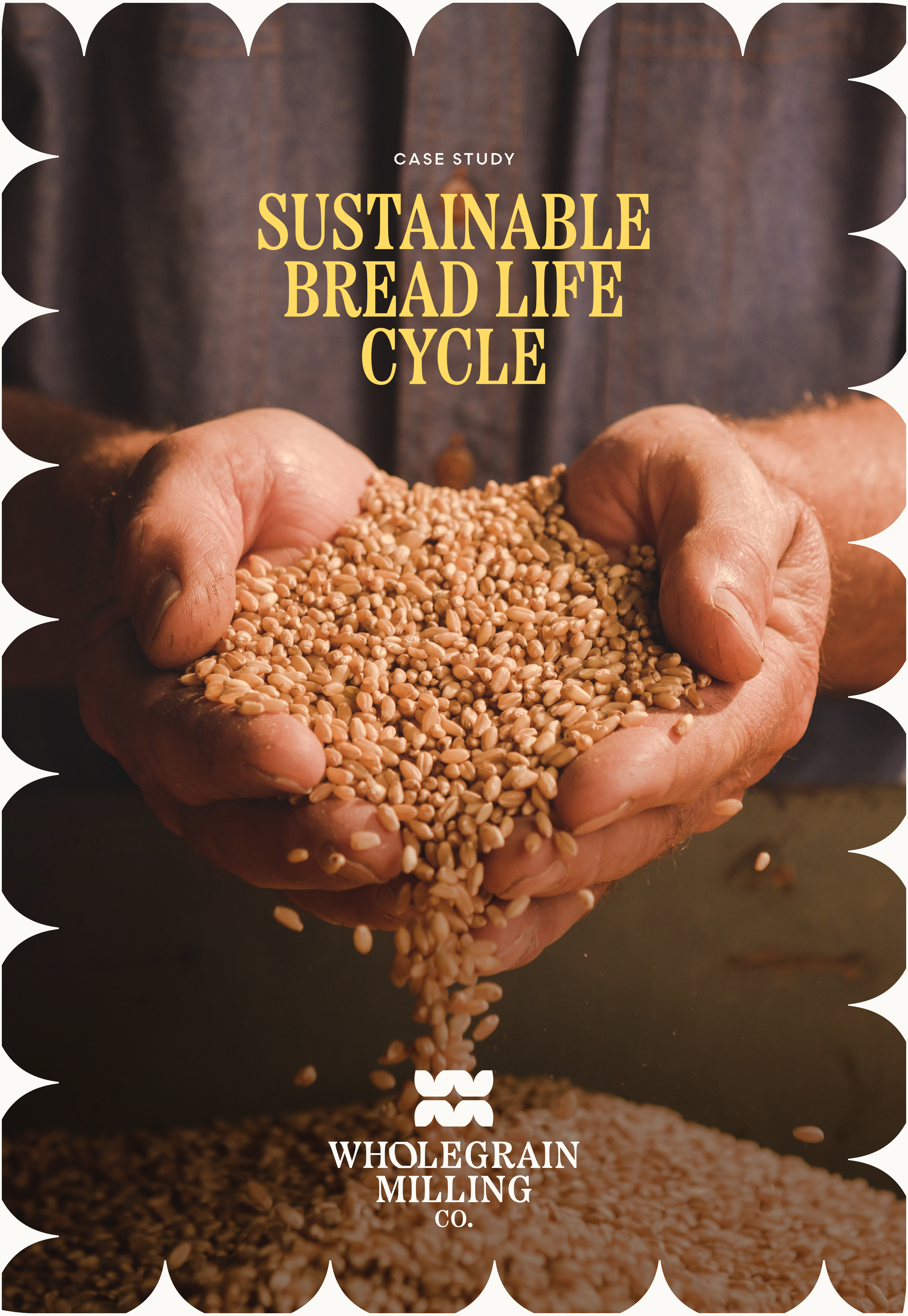
CASE STUDY

SUSTAINABLE BREAD LIFE CYCLE



WHOLEGRAIN MILLING CO.

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INTRODUCTION

Bread, one of the most ubiquitous food staples, has taken on a profound new role in addressing global sustainability challenges.

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The completion of a pioneering Research and Development project led by Certified Sustainable Ltd, Deakin University and Wholegrain Milling Co has redefined how we think about agriculture and its potential to drive meaningful change. This initiative aimed not only to produce a more sustainable loaf of bread but also to empower consumers as key players in the transition to a healthier planet. By combining cutting-edge science, collaboration and education, this project has set a precedent for innovation and leadership in sustainable food production.

Central to this ambitious effort was the Sustainable Bread Life Cycle Case Study, conducted in partnership with two of Australia's leading artisan bakeries. This case study was groundbreaking in its scope, as it meticulously evaluated the 'Farm to Consumer' greenhouse gas (GHG) emissions footprint of bread, using methodologies rooted in scientific precision. Individual audited crop and grain emissions footprints, complemented by PICCC GHG emissions calculations incorporating the most recent IPCC and NGGI data, provided the foundation for assessing bread's environmental impact. The findings highlighted agriculture's unique ability to function not as a contributor to climate change, but as a powerful solution.

The vision driving this initiative was as ambitious asit was transformative: to ensure that every loaf of bread produced in Australia uses Certified Sustainable Flour provides a positive contribution to the 2035 emissions reduction targets between 22-26% per loaf. At the heart of this vision was a fundamental hypothesis: that utilising Certified SustainableFlour in bread production would result in substantial reductions in emissions, affirming bread's potential to be a leader in sustainability.

This case study was not merely a technical examination but a narrative of possibility and empowerment. Equally important was its focus on consumer education, equipping everyday Australians with the tools to make informed choices that align with their health and environmental values.

As the project concludes, its achievements resonate far beyond the confines of food production. Bread, once an overlooked staple, now stands as a symbol of innovation and hope. Certified Sustainable Ltd, Deakin University, Wholegrain Milling Co and their artisan bakery partners have collectively demonstrated that sustainability is not just a lofty ideal but an attainable reality. This case study is a testament to what can be achieved when collaboration, transparency, and scientific rigor come together to tackle the pressing challenges of our time.

THE SUSTAINABLE BREAD LIFE CYCLE CASE STUDY WORKING GROUP

Certified Sustainable

Certified Sustainable is a not-for-profit certification driven by a mission to guide, promote, and connect sustainable practices and choices across all sectors and with consumers. The purpose behind its establishment is to protect the natural environment & support sustainable development. Its approach delivers credibility and rigour to the certification process, a verification seal that brings with it trust and confidence.

Centre for Regional and Rural Futures (CeRRF) at Deakin University

Deakin University's research institutes and centers strive to create positive change by translating high-quality research into impactful solutions and policies. The Centre for Regional and Rural Futures (CeRRF) at Deakin leads in water, climate adaptation, soil science, and innovative agriculture, collaborating across sectors to deliver innovative sustainable research solutions to regional and rural communities.

Wholegrain Milling Co.

Wholegrain Milling is at the forefront of supporting sustainable and regenerative farmers, sourcing quality grains from Australian farmers dedicated to the long-term health of the land and ecosystem. By supplying likeminded bakeries with consistent, high-quality, nutritious, and chemical-free flour, their extensive range has positioned them as Australia's largest and most trusted source of responsibly grown artisan flour.

Infinity Bakery

Since the 1990s, Sydney-based Infinity Bakery has been dedicated to using local produce and sustainable practices. We partner with the best suppliers in the business, including Wholegrain Milling for our Certified Sustainable Flour.
We are happiest when providing the community with wholesome and delicious baked goods... and it's as simple as that.

Rustica Bakery

Established in 2012 in Melbourne, Rustica Bakery is renowned for its commitment to crafting artisan bread and pastries using high-quality, locally sourced ingredients. With a passion for traditional baking methods and a dedication to sustainability, Rustica Bakery prides itself on supporting sustainable and regenerative farmers across Australia.

The Sustainable Bread Life Cycle Case Study was designed with a series of ambitious and transformative objectives, reflecting a commitment to environmental leadership, innovation, and consumer empowerment.

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THESE GOALS SERVED AS THE GUIDING FRAMEWORK FOR EVERY ASPECT OF THE PROJECT:

Evaluate the Full 'Farm to Consumer' Emissions Footprint

A core objective of the study was to conduct the most comprehensive analysis to date of bread's greenhouse gas (GHG) emissions footprint. By leveraging cutting-edge methodologies, including individual audited crop and grain emissions assessments and advanced PICCC GHG emissions calculations, the study aimed to uncover the true environmental impact of bread production across every stage of its life cycle.

Demonstrate the Potential of Certified Sustainable Flour

The project sought to validate the hypothesis that using Certified Sustainable Flour in bread production would result in a significant reduction in emissions. This objective was grounded in the belief that sustainable agricultural practices could transform bread into a key driver of climate action, proving that everyday food staples can be part of the solution.

Support Australia's Emissions Reduction Targets

Aligned with the Australian Government's greenhouse gas emissions reduction target of 62-70% below 2005 levels by 2035, the case study aimed to demonstrate that bread, when produced with Certified Sustainable Flour, could surpass these benchmarks. This objective reflected a larger vision of positioning agriculture as a vital contributor to national and global sustainability goals.

Empower Consumers as Sustainability Champions

Central to the initiative was the goal of educating and inspiring consumers to make informed, sustainable choices. By highlighting bread as a vehicle for meaningful climate action, the project aimed to position consumers as the heroes of the story, showcasing the power of individual decisions in driving systemic change.

Promote Leadership Without Greenwashing

The study was committed to maintaining transparency and scientific rigor, avoiding any perception of greenwashing. It sought to present agriculture and food production as genuine solutions to pressing environmental challenges, establishing a credible, data-driven narrative of hope and possibility.

Highlight Agriculture as a Climate Solution

Beyond bread itself, the project aspired to showcase the broader potential of sustainable agricultural practices. It aimed to reposition agriculture from being viewed as a contributor to environmental harm to a proactive leader in climate solutions, driving widespread awareness of its pivotal role in combating climate change.

These objectives collectively underscored the transformative scope of the Sustainable Bread Life Cycle Case Study. They were designed not only to produce actionable insights but to serve as a call to action for businesses, governments, and individuals alike, demonstrating that meaningful climate solutions can be achieved through innovation, collaboration, and informed choices.


wholegrain milling company

This study employed a comprehensive, multi-scope lifecycle design to rigorously assess and validate the environmental benefits of Certified Sustainable Bread production.

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The analysis encompassed the entire value chain—from on-farm grain cultivation, milling, through to baking, packaging, and sale to consumers. The approach was designed to capture both quantitative environmental outcomes and qualitative operational improvements, using a robust methodological framework underpinned by scientifically validated emissions modelling, audit-based verification, and comparative benchmarking.

At its core, the methodology was founded on a quantitative lifecycle emissions analysis incorporating Scope 1 (direct on-site emissions such as fuel combustion and operational activities), Scope 2 (indirect emissions from purchased electricity), and Scope 3 (indirect upstream and downstream emissions including raw material production, transport, packaging, and waste). Emissions were calculated using the Primary Industries Climate Challenges Centre (PICCC) GHG emissions calculator, with all data aligned to current Australian National Greenhouse Gas Inventory (NGGI) guidelines.

For each activity, emission factors were sourced from the Department of Climate Change, Energy, the Environment and Water (2023–2024), and other internationally recognised sources.

To ensure the credibility of data inputs and the traceability of sustainability claims, the study incorporated audit-based verification at each critical supply chain stage. All grain producers were certified under the Certified Sustainable Producer Standard (V15.1), which requires the implementation of at least ten regenerative land management practices. These practices were verified through on-farm audits conducted and assessed under the Certified Sustainable Ltd compliance system. Wholegrain Milling Co, the processing partner, and participating bakeries (Rustica and Infinity) were certified under the Certified Sustainable Processor Standard (V3.3), ensuring verified compliance with sustainability protocols across milling, packaging, energy use, and traceability, (aligned with the Australian Guide to Implementing Food Traceability).

The study also employed a comparative benchmarking process to contextualise and quantify the environmental benefits of certified production. Emissions data from Certified Sustainable supply chains were compared against established national and international baselines.

Importantly, the methodology was designed in alignment with the Greenhouse Gas Protocol Corporate Standard and conformed to emissions reporting requirements under the Australian Government's National Greenhouse and Energy Reporting (NGER) scheme. This ensured that the data and findings could be used credibly within both public policy settings and corporate ESG frameworks. All calculations were further supported by disclosure practices recommended in the GHG Protocol Scope 3 Calculation Guidance and ESG performance frameworks.

By integrating lifecycle emissions accounting, third-party certification, and comparative benchmarking, this study not only quantified GHG reductions with scientific precision but also illustrated the systemic transformation required to embed sustainability across Australia's food production ecosystem. The findings provide a replicable model for other sectors seeking to reduce emissions and build verified sustainability credentials through independent oversight and transparent reporting.

METHODOLOGY

Certification Requirements Across the Supply Chain

To ensure credible emissions reporting and full traceability, all participants in the Certified Sustainable Bread supply chain were independently audited and certified under the Certified Sustainable Ltd framework. This comprehensive certification model applied across the entire value chain—from grain producers to processors and artisan bakeries—ensuring verified alignment between sustainability practices and emissions outcomes.

Grain producers were certified under the Certified Sustainable Producer Standard (Version 15.1), a performance-based framework specifically designed for dryland agricultural systems. To achieve certification, producers were required to implement a minimum of ten regenerative land management practices that support soil health, water efficiency, biodiversity, and climate resilience. Compliance was verified through field audits and supporting documentation, such as satellite imagery, soil health test results, fertiliser and fuel application logs, and input usage records. These certified practices formed the baseline for calculating on-farm emissions and established the credibility of sustainability claims at the production level.

At the processing stage, Wholegrain Milling Co was certified under the Certified Sustainable Processor Standard (Version 3.3). This standard evaluates processors against a set of environmental and operational criteria, including energy efficiency, packaging sustainability, waste minimisation, product traceability, and full-scope emissions accounting. Certification confirmed that the mill's operations met strict environmental performance thresholds and maintained integrity in chain-of-custody procedures for Certified Sustainable flour.

Rustica and Infinity Bakeries were also certified under the Processor Standard, ensuring that Certified Sustainable flour was managed according to verified sustainability protocols. Certification for the bakeries covered responsible baking energy use, packaging material selection, waste reduction systems, and emissions tracking across Scope 1, 2, and 3. Their adherence to the standard demonstrated consistent environmental performance through to the final product stage.

This vertically integrated, independently audited certification framework ensured that sustainability claims could be confidently linked to real, measurable actions. By embedding consistent standards and verification mechanisms across all stages of the supply chain, the Certified Sustainable model offers a credible, replicable approach for reducing emissions and embedding sustainability within mainstream food systems, contributing meaningfully to national climate targets and global sustainable development goals.

Data Collection, Validation, and Analysis

This study employed a robust, multi-layered approach to data collection, validation, and analysis to ensure credibility, traceability, and comparability across the Certified Sustainable Bread supply chain. The methodology integrated audit documentation, lifecycle emissions modelling, comparative benchmarking, and third-party reporting, with final datasets undergoing expert peer review to align with established sustainability and emissions accounting standards.

At the foundation were audit and certification records generated through the Certified Sustainable Ltd framework. Grain producers, milling processors, and artisan bakeries were assessed against Producer and Processor Standards. Documentation included soil and input records, satellite imagery, crop rotation plans, fuel logs, and packaging inventories, confirming the implementation of certified regenerative practices and enabling emissions modelling inputs.

Emissions were calculated using the Primary Industries Climate Challenges Centre (PICCC) GHG calculator, aligned with NGGI, and the GHG Protocol's Scope 1, 2, and 3 categories. Scope 1 emissions covered direct fuel use (e.g., diesel, LPG), Scope 2 accounted for electricity consumption, and Scope 3 captured upstream and downstream impacts such as grain transport, packaging, supplier freight, administration, and materials.

- For grain producers, Scope 1 and 3 emissions were modelled using on-farm data, including diesel consumption, fertiliser application, and carbon sequestration via cover cropping and remnant vegetation.
- At the processing stage, Wholegrain Milling Co's emissions were categorised by scope and reported in the Sustainable Impact Report (SIR) and Sustainability Action Report (SAR).
- For baking and packaging, Rustica and Infinity Bakeries provided data on oven fuel use, batch efficiency, packaging types, refrigeration, and logistics. Scope-specific inventories were mapped using traceability systems.

A Lifecycle Assessment (LCA) framework was applied across three key system boundaries: cradle-to-gate (farm to mill), gate-to-flour (milling), and flour-to-consumer (baking, packaging, distribution). This enabled consistent tracking of emissions across each stage and direct comparison with conventional systems. Benchmarking confirmed substantial emissions reductions for Certified Sustainable products:

- **Grain:** 71.9 kg CO_2e/t vs. 315 kg CO_2e/t (GRDC/CSIRO baseline)
- **Flour:** 222–227 kg CO_2e/t vs. 495 kg CO_2e/t (Shi et al., 2011)
- **Bread:** 1.43–1.50 kg CO_2e/kg vs. 1.93 kg CO_2e/kg (Nordic Gluten Free Bakery, 2023)

Scope attribution analysis identified emissions hotspots across the supply chain. At Wholegrain Milling Co, Scope 3 accounted for 58.2% of emissions, followed by Scope 2 at 38.2%, and Scope 1 at 3.6%. Similar distributions were seen at the bakery level, with packaging, logistics, and ingredient sourcing as major contributors. These insights informed reduction strategies such as energy optimisation, sustainable packaging, and low-emissions freight.

This integrated approach ensured that all findings were evidence-based, independently validated, and aligned with global best practices. It demonstrated that Certified Sustainable Bread provides a credible, transparent, and scalable model for emissions reduction and sustainability leadership in food production.

Justification of Methodology

The methodology adopted in this study was designed to balance scientific rigour, operational feasibility, and business relevance, ensuring that outcomes were robust, replicable, and useful for both technical and strategic applications. It served not only as a reliable framework for emissions accounting but also as a practical tool for organisations implementing sustainability improvements at scale.

A cornerstone of this approach was the use of independently verified audit-based data through the Certified Sustainable Ltd framework. This ensured that sustainability practices across farming, milling, and baking

were substantiated with objective evidence, including soil tests, fuel and fertiliser logs, satellite imagery, and traceable input records. Emissions calculations were conducted using the PICCC GHG calculator, aligned with NGGI protocols, reinforcing the scientific integrity of the results.

Aligned with the GHG Protocol Corporate Standard, the methodology categorised emissions by Scope 1, 2, and 3, with particular emphasis on Scope 3, which often accounts for the majority of emissions in food systems. For example, Scope 3 represented 58.2% of emissions at Wholegrain Milling Co, compared to 38.2% for Scope 2 and 3.6% for Scope 1—highlighting the importance of addressing upstream and downstream activities.

The integration of supply chain traceability with emissions metrics enabled clear links between specific certified practices and measurable outcomes, such as a 77% reduction in grain emissions, 55% reduction in flour emissions, and 22–26% lower emissions in bread products compared to conventional baselines.

This closed-loop accountability provided actionable insights into how interventions like low-tillage, cover cropping, and improved packaging reduce carbon footprints.

By highlighting these practice-outcome linkages, the methodology empowered stakeholders across the food sector to identify high-impact strategies aligned with regulatory reporting, ESG priorities, and the UN Sustainable Development Goals (SDGs). Incorporating lifecycle assessment (LCA) and third-party sustainability reporting tools—such as the Sustainability Action Report (SAR)—further supported its credibility and application in both policy and commercial settings.

In summary, this methodology went beyond emissions measurement to explain where, how, and why reductions occur. It offers a replicable and evidence-based model for achieving climate goals, enhancing traceability, and building long-term sustainability in agri-food systems.

The Certified Sustainable Bread Life Cycle Case Study produced clear, measurable evidence that certified regenerative practices, applied consistently across the bread supply chain, result in significant reductions in greenhouse gas (GHG) emissions.

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Through the integration of scientific emissions modelling, third-party certification, and lifecycle analysis, the study demonstrated that bread—when produced using Certified Sustainable Flour—can far exceed current environmental performance benchmarks and serve as a model for climate-smart food production.

One of the most compelling findings was the scale of emissions reductions achieved at each major stage of the supply chain. At the farm level, Certified Sustainable grain recorded an average emissions intensity of just 71.9 kg CO_2e per tonne, representing a 77% reduction compared to the national baseline of 315 kg CO_2e per tonne for conventional Australian grain production, as reported by GRDC and CSIRO. These savings were directly attributed to the implementation of regenerative land management practices mandated under the Certified Sustainable Producer Standard (V15.1). Practices such as low- or no-tillage, strategic crop rotations, cover cropping, biodiversity protection, and reduced synthetic input use significantly improved soil health, water retention, and carbon sequestration—translating into a material reduction in Scope 1 and Scope 3 emissions.

At the milling stage, Wholegrain Milling Co, certified under the Certified Sustainable Processor Standard (V3.3), achieved substantial performance improvements through energy-efficient operations, sustainable packaging choices, and full-scope emissions accounting. The emissions footprint of Certified Sustainable flour ranged from 222 to 227 kg CO_2e per tonne, far below the international benchmark of 495 kg CO_2e per tonne for conventional milling, as identified by Shi et al. (2011). These reductions were achieved without compromising quality or production efficiency, confirming that verified sustainability in processing can be both operationally feasible and environmentally impactful.

Further downstream, the results from the baking stage reinforced the systemic benefits of certification. Artisan bakeries Rustica and Infinity—both certified under the Processor Standard—produced loaves that significantly outperformed the industry average in emissions intensity. Rustica's White Casalinga Loaf recorded 1.50 kg CO_2e per kilogram, while Infinity's City White Sourdough achieved 1.43 kg CO_2e per kilogram, compared to a benchmark of 1.93 kg CO_2e per kilogram for conventional artisan bread, as provided by Nordic Gluten Free Bakery data. These outcomes represent a 22–26% reduction in emissions at the final product level, driven by efficient energy use, responsible packaging, and traceable use of Certified Sustainable Flour.

Lifecycle assessment (LCA) and emissions attribution across Scopes 1, 2, and 3 further illuminated where emissions occur and where the greatest opportunities for intervention lie. For example, at the milling stage, Scope 3 emissions accounted for 58.2% of the total, followed by Scope 2 at 38.2%, and Scope 1 at just 3.6%. A similar distribution was observed in bakery operations, where indirect emissions from packaging, transport, and ingredient sourcing dominated the emissions profile. These findings point to the importance of addressing not just on-site energy use, but the wider supply chain impacts embedded in food production. As such, the study reinforces the need for strong Scope 3 tracking in emissions reduction strategies.

The traceability enabled by the certification framework was critical in linking emissions outcomes to specific sustainability interventions. Independent audits confirmed that all certified entities had implemented a minimum threshold of sustainability practices, and this standardisation ensured that emissions modelling was based on evidence rather than assumptions. Each tonne of Certified Sustainable grain and each loaf of Certified Sustainable Bread could be traced back to its origin, with assurance that it had passed through a certified, compliant, and independently verified supply chain. This level of transparency lends critical integrity to environmental claims and distinguishes the Certified Sustainable model from less rigorous sustainability programs that may rely on self-reporting or partial verification.

Finally, the benchmarking exercise provided policy-relevant insights. The emissions reductions achieved throughout the Certified Sustainable Bread supply chain align closely with, and in many cases exceed, Australia's 2035 emissions reduction targets of 62-70% below 2005 levels. The success of the case study illustrates how certified regenerative agriculture, coupled with sustainable processing and packaging, can serve as a blueprint for climate-resilient food systems. Moreover, it highlights bread—not traditionally seen as an environmental issue—as a powerful entry point for consumer education and national impact.

In summary, the case study delivered compelling evidence that a fully certified, traceable, and independently audited supply chain can not only reduce emissions at scale but also shift public perception and industry standards. Certified Sustainable Bread is more than just a product; it is a proof of concept for climate leadership in everyday food choices, offering a replicable model for sustainability in both Australian and global contexts.

CHALLENGES AND OPPORTUNITIES

While the Certified Sustainable Bread Life Cycle Case Study demonstrated clear environmental and operational benefits, it also revealed several practical challenges and strategic opportunities across the supply chain.

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THESE INSIGHTS PROVIDE A FOUNDATION FOR CONTINUOUS IMPROVEMENT AND WIDER ADOPTION OF CERTIFIED SUSTAINABLE PRACTICES WITHIN AUSTRALIA'S FOOD SYSTEM.

Producer – Grain Farmer

The Certified Sustainable Bread Life Cycle Case Study revealed that for many producers, the transition to certified regenerative agriculture represented a substantial operational shift—one that required both technical adaptation and cultural change. Achieving certification under the Certified Sustainable Producer Standard (Version 15.1) meant committing to a performance-based framework that demanded the implementation of at least ten verified sustainable land management practices. While many producers were already trialling components of regenerative farming, formal certification required full integration, ongoing monitoring, and rigorous documentation.

Practices such as low- or no-tillage systems, strategic crop rotations, cover cropping, reduced synthetic input use, and remnant vegetation protection were required across the entire farming system. These were not minor tweaks; in dryland regions where rainfall is highly variable and margins are often slim, the changes represented both logistical and financial risk. Recalibrating or investing in equipment for conservation tillage, as well as adjusting planting timelines and weed management programs, often required rethinking long-standing production routines. Labour and machinery scheduling also had to be adjusted, creating further complexity during the early years of transition.

A particularly delicate challenge involved balancing input reduction with yield preservation. Many farmers were wary of reducing synthetic fertilisers and chemical controls in environments where soil nutrient profiles or weed pressures were already limiting. These concerns were valid, especially during the initial implementation phase. However, farmers who adopted biologically focused nutrient cycling and pest management strategies—alongside frequent soil testing and ecological monitoring—reported improved system resilience and a reduced reliance on chemical interventions over time.

Certification also introduced an administrative learning curve. Producers were required to maintain evidence of practice implementation, including fertiliser logs, satellite imagery, machinery operation records, and soil or tissue tests. While these tools helped sharpen management decisions and long-term planning, the need for digital recordkeeping and sustainability audits was initially seen as burdensome, particularly for small or less technologically equipped operations.

Yet the challenges were counterbalanced by significant and measurable benefits—one of the most impactful being cost savings due to reduced inputs and diesel consumption. Many certified producers reported that minimising tillage operations led to fewer machinery passes, directly lowering fuel usage and maintenance costs. Similarly, improved soil health and more effective nutrient cycling, supported by crop rotations and biological soil amendments, meant that reliance on synthetic fertilisers and pesticides was notably reduced.

These reductions translated into tangible financial savings. Some growers estimated thousands of dollars saved annually in fuel, chemical, and synthetic fertiliser costs—freeing up capital that could be reinvested in soil testing, precision agriculture, or farm infrastructure. These operational efficiencies, achieved through regenerative practice adoption, enhanced profitability and helped mitigate the financial risks of transition.

Additionally, certification opened new market pathways. By supplying Certified Sustainable grain to Wholegrain Milling Co and other value-aligned buyers, producers secured access to a premium supply chain—one that prioritised environmental integrity, traceability, and emissions accountability. This not only offered pricing stability and buyer loyalty but also improved brand identity and farm differentiation in a market increasingly driven by climate-conscious procurement.

Crucially, producers gained the ability to quantify and verify their climate impact. Using the PICCC GHG calculator, farmers could generate credible emissions profiles based on their audit-verified data, including emissions from fertiliser use, diesel consumption, and sequestration from cover cropping or remnant vegetation. These figures, aligned with Scope 1 and 3 emissions categories, enabled farmers to demonstrate real emissions reductions and engage in climate-related reporting, marketing, and potentially carbon market participation. In this way, environmental performance became a source of new, tangible economic value.

In summary, while the Certified Sustainable certification process demanded substantial changes to farm operations, data systems, and management strategies, the outcomes were clearly advantageous. Improved soil function, reduced input costs, stronger resilience to climate variability, and access to premium markets and emerging carbon opportunities positioned certified producers at the forefront of a new, sustainability-driven grain economy. The case study demonstrated that with the right tools, support, and market recognition, regenerative agriculture can deliver both environmental and financial returns—proving that climate-smart farming is not just aspirational, but highly achievable.

Processor – The Mill

As the central processing hub in the Certified Sustainable Bread supply chain, Wholegrain Milling Co played a critical role in translating certified grain into traceable, low-emissions flour. However, integrating high standards of environmental performance into an already complex and high throughput milling operation presented notable challenges. Chief among these was the management of Scope 3 emissions, which accounted for 58.2% of the mill's total emissions footprint. These included indirect emissions associated with upstream packaging material production, grain transport, supplier freight, and other supply chain inputs—many of which fell outside the company's direct operational control. Effectively managing and reducing Scope 3 emissions required collaboration with multiple third parties, integration of emissions data from diverse sources, and the development of consistent supplier reporting protocols—all of which introduced logistical and administrative complexity.

Balancing operational efficiency with sustainability goals was another area of challenge. The mill was required to maintain a high level of production consistency and throughput while also ensuring the traceability and segregation of Certified Sustainable grain, minimising processing waste, and transitioning to more environmentally friendly packaging systems. This balancing act demanded innovation across multiple fronts—ranging from equipment optimisation and staff training, to packaging material trials and redesigns. In many cases, the most sustainable option was not always the most commercially convenient or cost-effective, requiring a long-term commitment to incremental improvement and systems change.

A further challenge lay in comprehensive emissions reporting, particularly in accurately disaggregating and attributing emissions across Scope 1 (on-site fuel use), Scope 2 (purchased electricity), and Scope 3 (supply chain and distribution activities). To meet the reporting obligations under the Certified Sustainable Processor Standard, the mill had to implement sophisticated inventory and tracking systems capable of capturing detailed emissions data and linking it to specific operational activities. This required ongoing internal training to ensure data accuracy, consistency, and compliance with lifecycle accounting standards such as those set by the GHG Protocol.

Despite these challenges, Wholegrain Milling Co leveraged its role as a certified sustainable processor to secure multiple strategic advantages. First and foremost, the mill's production of Certified Sustainable Flour positioned it as a market leader in climate-conscious ingredient supply. This distinction helped build trust and long-term relationships with sustainability-focused bakeries and opened opportunities to expand into other environmentally aligned food product markets. Furthermore, the implementation of energy-efficient systems and traceability technologies led to broader operational improvements. Reductions in material waste, optimisation of logistics, and improved batch tracking yielded not only environmental gains but also cost efficiencies and risk mitigation.

Perhaps most importantly, the mill's commitment to full-scope carbon accounting provided a clear understanding of its emissions profile and informed proactive mitigation planning. By identifying emissions hotspots—particularly in logistics and packaging—the company was able to prioritise reduction strategies and explore partnerships with lower-emissions suppliers and freight operators. This level of carbon transparency enhanced the mill's readiness for emerging regulatory and market pressures, including corporate emissions disclosures, carbon pricing mechanisms, and sustainable finance criteria.

Wholegrain Milling Co demonstrated that sustainability integration within a processing operation is complex but achievable, particularly when supported by a certified framework and strong internal systems. Its experience highlights both the challenges of aligning high-volume operations with climate goals and the long-term value of investing in sustainable innovation. Through its role in the Certified Sustainable Bread project, the mill established itself not only as a technical enabler of emissions reduction but also as a key link in a transparent, science-based, and scalable climate solution for the broader food industry.

Processor – Artisan Bakeries

As the central processing hub in the Certified For artisan bakeries such as Rustica and Infinity, participating in the Certified Sustainable Bread Life Cycle Case Study presented a unique blend of challenges and transformative opportunities. Integrating sustainability into a high-pressure, customer-facing production environment required bakeries to rethink core aspects of their daily operations without compromising on product quality, speed, or customer service. One of the most immediate and ongoing challenges was energy consumption. Baking operations are inherently energy-intensive, with ovens, refrigeration units, and preparation equipment running throughout the day. Reducing Scope 1 (on-site fuel use) and Scope 2 (purchased electricity) emissions required investments in more efficient appliances, reconfiguration of baking schedules for better load optimisation, and, where possible, transitioning towards lower-emissions energy sources. While these adjustments held the promise of long-term environmental and cost benefits, they also demanded capital expenditure and time to implement effectively.

Packaging posed another significant hurdle. Bakeries had to strike a delicate balance between sustainability, brand identity, and practical functionality. Many environmentally friendly materials—such as compostable films or fully recyclable packaging—were not readily available in local supply chains, were more expensive, or did not meet the durability and freshness preservation needs of bakery products. Moreover, these alternatives often required adjustments to existing packaging equipment or processes. Ensuring that packaging choices aligned with both sustainability goals and customer expectations added further complexity, especially in competitive retail environments where appearance and usability are key.

A third major challenge was maintaining supply chain integrity and ensuring the traceability of Certified Sustainable Flour through all stages of baking. As certified processors, the bakeries were required to segregate certified ingredients, document all flour handling procedures, and maintain traceable batch records from delivery to final product. For operations using a mix of certified and non-certified ingredients, this introduced an additional layer of inventory management and staff training. Errors in handling or documentation could compromise certification and weaken consumer trust, making rigorous systems essential.

Yet, despite these operational constraints, both Rustica and Infinity Bakeries capitalised on several strategic opportunities that strengthened their business models. Foremost among these was the boost in brand value and consumer trust. Certification under the Certified Sustainable Processor Standard provided a credible, third-party-verified foundation for sustainability claims—an increasingly important consideration for environmentally conscious customers. This certification allowed each loaf of bread to serve not just as a product, but as a statement of environmental responsibility, enhancing brand loyalty and helping the bakeries stand out in a crowded artisan market.

In addition, the process of monitoring batch efficiency, energy use, and material waste led to operational improvements that translated into cost savings and process refinement. For example, detailed tracking of flour-to-loaf conversion rates and oven performance allowed bakeries to identify inefficiencies and optimise resource use without compromising quality. These insights proved valuable not only for sustainability reporting but also for day-to-day business performance.

Finally, by participating in the case study and committing to certified sustainable practices, Rustica and Infinity positioned themselves as early adopters and leaders in climate-smart baking. This leadership attracted customer goodwill and opened new channels with retailers and partners seeking to align their own brands with verified sustainability outcomes. Their work demonstrated that even within the time-sensitive and craftsmanship-driven world of artisan baking, measurable climate action is both possible and commercially advantageous.

While transitioning to Certified Sustainable standards required considerable effort, investment, and operational change across every level of the supply chain, the findings from the Certified Sustainable Bread Life Cycle Case Study clearly demonstrate that the long-term environmental, operational, and commercial benefits significantly outweighed the initial challenges. Farmers, millers, and bakers each faced unique hurdles in adapting to the rigorous standards of certification—ranging from implementing regenerative land management practices and refining emissions accounting systems, to reconfiguring production processes and sourcing sustainable packaging. Despite these complexities, each stakeholder group succeeded in embedding audited traceability, transparent data reporting, and full-scope emissions accountability into their operations. This cross-sector collaboration ensured that sustainability was not an abstract ideal but a measurable, verifiable reality at every stage of production—from soil health and grain cultivation, through milling, baking, packaging, and retail.

Crucially, the study confirmed that systemic change in agriculture and food manufacturing can be both scientifically credible and commercially viable when supported by independent verification frameworks and lifecycle-based methodologies. Through the integration of the Certified Sustainable Producer and Processor Standards, stakeholders were able to not only reduce their environmental footprint, but also improve operational efficiency, optimise resource use, and strengthen supply chain relationships. The certified model provided participants with a clear structure for sustainability performance—translating complex environmental goals into actionable and economically relevant outcomes. Verified emissions reductions of up to 77% at the grain level, 55% in flour processing, and up to 26% in final bread products offered hard evidence that certified supply chains can meaningfully contribute to national and global climate targets.

Furthermore, the case study showed that sustainability leadership opens new market pathways. Certification enhanced consumer trust, enabled brand differentiation, and allowed producers and processors to align more closely with buyers seeking low-emissions, traceable products. This positioned participants to capitalise on emerging carbon markets, ESG-linked incentives, and climate-aligned finance mechanisms, helping future-proof their operations in a rapidly evolving economic landscape. Just as importantly, the process fostered a culture of continuous improvement, innovation, and shared accountability, with each actor understanding how their decisions impacted broader system outcomes.

Ultimately, the Certified Sustainable Bread model proves that when sustainability is embedded with rigour and integrity across a value chain, it can drive measurable climate impact, economic opportunity, and sector-wide transformation. The case study is not just a proof of concept—it is a blueprint for how agriculture and food systems can lead in a carbon-conscious future, where regenerative practices, supply chain transparency, and data-driven accountability form the foundation of a resilient, ethical, and commercially competitive industry.

The Certified Sustainable Bread Life Cycle Case Study not only highlighted the achievements of certified sustainability across the supply chain but also illuminated key areas where further gains can be made.

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To build upon the momentum of this initiative and ensure long-term impact, tailored recommendations have been developed for each major actor: Producers/ farmers, the milling processor, and artisan bakeries. These recommendations are designed to address the practical challenges identified in the study while unlocking new opportunities for environmental leadership, operational efficiency, and market differentiation.

Producer – Grain Farmer

For producers, the transition to regenerative practices under the Certified Sustainable Producer Standard (Version 15.1) brought important environmental and economic benefits, but not without significant operational and knowledge-based challenges—particularly in dryland regions where rainfall is variable and agronomic infrastructure can be limited. To support successful and scalable adoption, it is recommended that producers have access to regionally tailored agronomic support services. These should go beyond generic training and focus on practical, location-specific guidance on core regenerative practices such as strategic cover cropping, biological nutrient cycling, weed management in low-input systems, and ecological system design. This kind of expert support could help optimise yields while enhancing long-term soil health and resilience.

Simplifying and digitising recordkeeping requirements is another key recommendation. Certification under the Producer Standard currently requires detailed documentation—including soil test results, fertiliser application records, input usage logs, satellite imagery, and paddock-level activity tracking. While this enhances traceability and audit credibility, it can be time-consuming and administratively burdensome for producers, especially those managing multiple enterprises or unfamiliar with digital platforms. Adoption of easy-to-use digital farm management software—integrated with mobile apps, satellite data, and cloud storage—would streamline compliance, reduce paperwork, and ensure readiness for audits without detracting from on-farm operations.

To further encourage learning and adoption, peer-to-peer knowledge exchange should be formalised and expanded through coordinated field days, demonstration trials, and regional grower networks. These initiatives allow producers to share practical insights, observe regenerative methods in action, and build confidence through shared experience rather than top-down instruction. Seeing the on-ground benefits—such as cost savings, yield performance, or biodiversity improvements—at other certified farms can significantly accelerate uptake of regenerative systems.

Finally, to ensure long-term viability and widespread engagement, producers should have access to sustainability-linked financial incentives. These could include participation in verified carbon credit markets, where farmers are rewarded for quantifiable emissions reductions; government grant programs to subsidise the costs of certification and practice implementation; or preferential loan structures through agricultural finance institutions tied to demonstrated environmental performance.

Linking verified regenerative outcomes to financial benefit will help shift sustainable farming from being an ethical ideal to a commercially compelling pathway.

Together, these recommendations reflect a holistic strategy to empower producers—not just to meet certification requirements, but to thrive within them. By aligning agronomic support, technology, peer learning, and financial incentives, the Certified Sustainable model can become a practical and scalable framework for Australia's grain sector to lead in climate-positive agriculture.

Processor – The Mill

For Wholegrain Milling Co, the central processing hub in the Certified Sustainable Bread supply chain, managing environmental performance within a high-throughput commercial environment presents both operational complexity and strategic opportunity—particularly in relation to Scope 3 emissions, which accounted for 58.2% of the mill's total footprint. These indirect emissions, which stem from activities such as grain transport, packaging production, logistics, and supply chain inputs, extend beyond the mill's immediate control and require coordinated, collaborative action. A key recommendation is to deepen engagement with upstream and downstream partners to co-design integrated emissions reduction strategies. This could involve working directly with logistics providers to map fuel usage, optimise routing, or transition to lower-emission transport options such as electric or hybrid vehicles. Likewise, the mill could establish sustainability performance benchmarks for key suppliers, using environmental criteria—such as recycled content, lifecycle emissions, or third-party certifications—as part of procurement decisions.

Sustainable packaging innovation represents another significant area for improvement and brand differentiation. The mill is encouraged to invest in the development and trialling of lower-impact packaging formats, including recyclable, compostable, or reduced-weight materials that still maintain food safety and shelf-life integrity. Collaborating with material scientists, packaging designers, or sustainability-focused startups could accelerate this process.

By reducing the embedded carbon of packaging, Wholegrain Milling Co would not only cut its own Scope 3 emissions but also support downstream partners—particularly artisan bakeries—in achieving their own sustainability goals and compliance obligations.

On the energy front, reducing Scope 2 emissions—which currently account for 38.2% of the mill's emissions profile—should remain a priority. Several viable options are available, including entering renewable energy purchase agreements (PPAs) with certified green electricity providers, or participating in community-based energy-sharing schemes that prioritise local decarbonisation. Each of these options offers the dual benefits of reducing emissions and providing long-term energy cost stability, which is particularly important in energy-intensive sectors like milling.

Beyond operational improvements, Wholegrain Milling Co is encouraged to strengthen its market leadership position by expanding education and marketing initiatives that promote Certified Sustainable Flour as a climate-smart ingredient. This includes articulating the mill's verified sustainability credentials in terms relevant to commercial buyers—such as alignment with ESG reporting frameworks, Scope 3 supply chain targets, and corporate climate disclosure requirements. Educational outreach to retailers, wholesalers, food service operators, and procurement managers could help expand the customer base while reinforcing the company's value proposition as a supplier of environmentally verified, low-emission inputs.

Ultimately, Wholegrain Milling Co sits at a critical junction in the food supply chain—where upstream farm-level sustainability efforts are translated into certified, traceable products for a wide range of food businesses. By continuing to innovate across energy, packaging, logistics, and stakeholder engagement, the mill can reinforce its role not only as a processor, but as a catalyst for climate action and sustainability leadership across the broader food system.

Processor – Artisan Bakeries

For artisan bakeries such as Rustica and Infinity, embedding sustainability into a high-output, customer-facing environment requires a combination of operational innovation, staff engagement, and clear communication. One of the most immediate areas for improvement is energy efficiency, as baking facilities rely heavily on gas ovens, electric refrigeration, and temperature-controlled proofing environments. It is recommended that bakeries conduct targeted energy audits to identify inefficiencies in equipment, scheduling, and facility layout. These audits can pinpoint opportunities to optimise oven batch loads, reduce preheating times, and upgrade to more efficient burners or insulation systems—resulting in tangible Scope 1 and 2 emissions reductions and cost savings.

Where viable, transitioning to low-emissions or renewable-powered equipment, such as electric ovens supported by green energy supply contracts, could further align bakery operations with certified sustainability goals.

On the packaging front, bakeries are encouraged to deepen collaboration with local packaging suppliers, sustainability consultants, and material innovators to test and implement low-impact packaging solutions. Compostable, recyclable, or reduced-weight materials should be evaluated through lifecycle assessments (LCAs) to ensure environmental benefit without compromising product integrity, shelf-life, or brand identity. Because packaging is a significant contributor to Scope 3 emissions—and a highly visible element of consumer perception—improvements in this area

offer both environmental and marketing returns. The use of eco-labels or sustainability icons, accompanied by QR codes linking to information on certified practices, could further enhance transparency and customer engagement.

Consumer education and brand communication are powerful tools for building trust and differentiating in a competitive artisan bakery market. Certified bakeries should be proactive in showcasing their commitment to sustainability through in-store signage, digital storytelling, and packaging design. Emphasising their use of Certified Sustainable Flour and climate-conscious baking methods can attract environmentally motivated consumers and reinforce brand loyalty. Additionally, bakery websites and social media platforms provide a valuable channel for explaining their certification, carbon reduction achievements, and community contributions—fostering deeper consumer connection and accountability.

Waste reduction is another critical focus area. Bakeries should implement systems to minimise spoilage and surplus through more accurate demand forecasting, dynamic inventory management, and flexible production runs. Where overproduction occurs, partnerships with local charities, composting facilities, or animal feed suppliers can ensure that food waste is diverted from landfill and repurposed in a circular economy model. Enhanced waste separation systems within the bakery—covering packaging, food scraps, and recyclables—should also be standard practice.

Finally, as early adopters of Certified Sustainable baking practices, Rustica and Infinity are uniquely positioned to lead by example within the artisan food sector. Their participation in industry forums, bakery associations, sustainability roundtables, and peer mentorship programs could help disseminate their learnings, influence sector standards, and expand uptake of certified approaches. By sharing data, tools, and stories of successful transitions, they can serve as sustainability ambassadors—demonstrating that regenerative, climate-aligned baking is both achievable and commercially advantageous.

These strategic recommendations provide a clear roadmap for enhancing the Certified Sustainable Bread model and supporting the continued evolution of Certified Sustainable bakeries as leaders in responsible production. They reflect the unique role each actor plays in driving measurable emissions reductions and broader food system transformation. By aligning with the rising demand for traceable, low-carbon, and socially conscious food products, these actions position the sector for long-term relevance and impact. Through ongoing investment in innovation, collaboration, and education, the Certified Sustainable framework can evolve from a successful case study into a scalable solution—one that supports national climate goals, empowers regenerative agriculture, and meets growing consumer expectations for transparency and integrity in food production.

CONCLUSIONS

The Certified Sustainable Bread Life Cycle Case Study offers compelling evidence that sustainability in food production is not only possible but can be achieved with scientific rigor, economic integrity, and meaningful environmental outcomes.

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From the first seed sown on certified regenerative farms to the final artisan loaf sold to consumers, the project demonstrated how coordinated, traceable action across a vertically integrated supply chain can drive substantial reductions in greenhouse gas emissions while improving soil health, resource efficiency, and market resilience.

At its core, this study validated the hypothesis that using Certified Sustainable Flour results in significantly lower emissions across every stage of the bread life cycle. Certified grain emissions were reduced by up to 77% compared to conventional benchmarks, flour emissions were cut by more than 50%, and final baked product emissions dropped by up to 26%. These reductions were not theoretical; they were calculated using audited on-farm practices, verified processor data, and Scope 1–3 emissions modelling aligned with Australian NGGI methodologies.

The success of this project hinged on more than emissions modelling—it was rooted in a systems-based transformation of how bread is produced and valued. Farmers committed to regenerative practices and saw tangible benefits: improved soil biology, greater resilience to climate stress, reduced input costs, and access to premium, sustainability-driven markets. Wholegrain Milling Co, as the processing backbone, tackled the complexities of Scope 3 emissions and chain-of-custody while positioning itself as a leader in low-carbon ingredients. Artisan bakeries like Rustica and Infinity proved that sustainable baking is not only feasible, but commercially advantageous —enhancing brand value, reducing waste, and earning consumer trust.

Crucially, this case study also revealed that sustainability transitions, while challenging, are achievable when underpinned by certification, collaboration, and transparency. The Certified Sustainable Ltd standards provided the structure necessary to ensure consistency and credibility across diverse operations. Independent verification gave legitimacy to claims. Most importantly the commitment of all participants—despite resource constraints, operational complexities, and shifting market conditions—showed that food producers are ready to be leaders in climate action.

This model offers far-reaching implications beyond the bread sector. It demonstrates that traceable, certified sustainability frameworks can be scaled across Australian food systems and integrated into emissions reduction strategies aligned with both national climate targets and global Sustainable Development Goals (SDGs). It also presents a replicable template for embedding Scope 3 accountability, unlocking new opportunities in ESG reporting, carbon markets, and sustainability-linked financing.

Ultimately, the Certified Sustainable Bread Life Cycle Case Study repositions bread—not just as a staple food, but as a symbol of innovation, climate hope, and consumer empowerment. It stands as a testament to what's possible when environmental responsibility is embraced not as a marketing tool, but as a foundational value system. In a time of increasing climate urgency, this case study proves that with the right tools, partnerships, and vision, food production can nourish both people and planet.

THE SUSTAINABLE BREAD LIFE CYCLE CASE STUDY

GHG emissions cut across the bread supply chain, exceeding Australia's 2030 climate targets across the economy.

Flour milled from grain grown under sustainable practices dramatically reduces the carbon footprint of bread. Across farming, milling and baking, total emissions are significantly lower, with the grain component alone showing up to a **77% reduction** compared to conventional Australian grain benchmarks.

FROM FARM TO LOAF EMISSIONS REDUCTIONS

Bread produced in Australia using Certified Sustainable Flour results in substantial GHG emissions reductions from paddock to plate.

GRAIN	FLOUR	BREAD
71.9kg CO_2e Certified Sustainable GHG emissions per tonne	222-227kg CO_2e Certified Sustainable GHG emissions per tonne	1.42-1.50kg CO_2e Certified Sustainable GHG emissions per tonne
-77% REDUCTION	-55% REDUCTION	-22-26% REDUCTION
315kg CO_2e Conventional GHG emissions per tonne	495kg CO_2e Conventional GHG emissions per tonne	1.93kg CO_2e Conventional GHG emissions per tonne

THE SUPPLY CHAIN

All stages meet Certified Sustainable standards V15.1 for farm, V3.3 for mill and bakeries. Covers Scope 1, 2 & 3 emissions.

	FARM	MILL	BAKERY	RETAILER
Why it matters	Premium markets + emissions profile for carbon markets	Waste reduction, renewable energy, traceable low-carbon flour	Consumer loyalty, energy savings, verifiable sustainability claims	Meet regulatory and ESG reporting obligations

Independent audits ↑

NGER scheme compliant ↑

VERIFIED AND CREDIBLE DATA

↓ Aligned with GHG Protocol and ESG performance frameworks

↓ Real data: field audits, satellite imagery, fertiser logs, energy bills

BREAD AS A BENCHMARK

Reimagining Bread demonstrates that a humble staple like bread can support the most sophisticated layers of ESG strategy: audit-backed carbon accounting, supply chain decarbonisation and verifiable climate communication.

Sustainable Practices employed in this study

Sustainable Farming Practices

The Certified Sustainable certification promotes an innovative approach to farming that aligns environmental health, resource efficiency, and agricultural productivity. It champions the transition Check this is to a food system that not only protects but enriches natural ecosystems, laying a foundation for long-term sustainability. Central to this is the Certified Sustainable Producer Standard (V15.1), a rigorous framework designed to empower farms to adopt sustainable and eco-conscious practices.

This standard emphasises innovative land management strategies, targeting critical areas such as soil stability, water cycles, greenhouse gas emissions, and biodiversity. Participating producers embody these principles by integrating methods like ground cover maintenance, crop rotations, and low-tillage farming into their operations. These techniques not only make agricultural systems more resilient but also tackle pressing environmental issues such as soil degradation, water scarcity, and climate change.

What makes Certified Sustainable unique is its independent validation process, conducted by Australian Certified Organic (ACO). ACO's rigorous audits and assessments ensure transparency and confirm that producers meet the demanding requirements of the standard. This independent oversight provides consumers and stakeholders with confidence that the Certified Sustainable label reflects genuine verifiable environmental accountability and a commitment to meaningful change.

1 Maintaining Optimum Ground Cover

Ground cover is a cornerstone of sustainable farming, offering multiple benefits that enhance soil health and resilience. By keeping crops, mulch, or other vegetation covering the soil, evaporation rates are significantly reduced, preserving valuable moisture. This practice helps regulate soil temperature, preventing overheating during extreme weather conditions, and contributes to a microclimate that supports microbial life. Microorganisms thrive in such environments, cycling nutrients and stabilising soil structures, which ultimately leads to healthier crops and higher yields. Additionally, ground cover acts as a protective barrier against erosion, safeguarding topsoil and retaining organic matter that is vital for fertility.

Certified Sustainable producers actively maintain ground cover by planting cover crops, preserving natural vegetation, and implementing organic mulching systems. These practices are carefully monitored to ensure soil stability and microbial support, protecting the long-term health of their farmland. Producers also assess erosion-prone areas to implement targeted interventions that mitigate erosion and protect valuable topsoil.

This enabled consistent tracking of emissions across each stage and direct comparison with conventional systems.

2 Efficient Water Use and Safe Runoff Management

In dryland farming, where water scarcity is a constant challenge, efficient management of rainfall is critical for sustainability and crop viability. Strategies focus on maximising infiltration into the soil, ensuring crops benefit from every drop of precipitation without unnecessary loss through evaporation. Techniques such as contour farming and swales are particularly effective in dryland conditions, directing rainfall to soak evenly into the soil while minimising runoff. These methods not only enhance water retention but also prevent soil compaction, which is vital for maintaining soil health.

Managing water runoff is equally important, as uncontrolled runoff can lead to the loss of valuable topsoil and nutrients. Farms in dryland areas implement safe runoff systems that reduce sedimentation and prevent chemicals from entering nearby streams and waterways. This approach preserves local ecosystems and ensures that limited water resources remain clean and usable for multiple purposes.

Certified Sustainable producers optimise these practices by carefully designing runoff pathways tailored to dryland conditions. They focus on strategies that retain nutrients within the soil, preventing depletion while safeguarding aquatic habitats downstream. By adapting to the challenges of dryland farming, these producers demonstrate how sustainable techniques can support both productivity and environmental health.

3 Crop Rotations for Soil Health

The practice of crop rotation serves as both a preventive and restorative measure for soil health. By varying the crops planted each season, farmers break the life cycles of pests and diseases that thrive in monocultures. This reduces the need for chemical pesticides, thereby minimising environmental impact. Furthermore, certain crops in rotation, such as legumes, naturally replenish soil nutrients like nitrogen through symbiotic relationships with bacteria. This method also improves soil structure, increases organic matter, and promotes biodiversity both above and below ground, creating a thriving ecosystem that enhances long-term productivity.

Certified Sustainable producers design diverse and strategic crop rotation schedules tailored to their local soil conditions and environmental needs. Leguminous crops are often integrated to replenish nitrogen naturally, and seasonal rotations are planned to optimise soil fertility while minimising chemical inputs. Producers use data from soil assessments to ensure rotations maximise biodiversity and productivity.

4 Minimising Synthetic Inputs

The overuse of synthetic products in agriculture has led to significant environmental challenges, including waterway contamination, soil degradation, and biodiversity loss. By minimising these inputs, sustainable producers reduce their reliance on fossil fuels and lower GHG emissions across both Scopes 1 and 3. Techniques such as organic fertilisation, integrated pest management (IPM), and biological control methods not only combat these harmful effects but also enhance soil and crop quality. Additionally, adopting practices that foster natural resilience within ecosystems allows farms to reduce their dependence on artificial chemicals over time.

Certified Sustainable producers embrace environmentally conscious farming methods, such as composting, biological pest control, and crop diversity. They carefully monitor and limit synthetic inputs to meet sustainability standards, ensuring their practices promote healthier ecosystems while maintaining agricultural productivity.

This enabled consistent tracking of emissions across each stage and direct comparison with conventional systems.

5 Low-Tillage Practices

Excessive soil tillage disrupts natural soil processes, depletes organic matter, and releases carbon dioxide (CO_2) into the atmosphere, contributing to climate change. Sustainable farms adopt low-tillage or no-tillage methods to safeguard soil structure and support soil biology. By reducing disturbance, these approaches preserve higher levels of soil organic carbon, which play a critical role in retaining water and enhancing fertility. Moreover, minimising tillage protects microbial communities, allowing them to thrive and efficiently cycle nutrients, ultimately strengthening the soil's natural resilience.

Certified Sustainable producers employ conservation tillage methods to reduce soil disturbance, relying on precision equipment designed to safeguard organic matter. They pair low-tillage practices with cover cropping to further enrich and protect the soil while reducing carbon emissions.

6 Cover Cropping

Cover crops are integral to regenerative farming, offering ecological benefits that extend beyond soil protection. These crops prevent erosion, suppress weeds, and regulate soil moisture, all while maintaining living roots in the soil. Over time, the biomass produced by cover crops decomposes, enriching the soil with organic material and nutrients. Cover crops also enhance soil aeration and improve water permeability, creating optimal conditions for subsequent plantings. Additionally, they foster biodiversity, attracting pollinators and beneficial insects that contribute to balanced ecosystems.

Certified Sustainable producers strategically implement cover cropping during off-seasons, planting species suited to local soil and climate conditions. These producers prioritise plant diversity to maximise the ecological benefits of cover crops and track their decomposition rates to ensure the soil remains nutrient-rich and biologically active.

7 Enhancing Soil Biology

Healthy soil biology is fundamental to sustainable agriculture, as microorganisms and other organisms play critical roles in nutrient cycling, carbon sequestration, and soil structure formation. Through practices that prioritise organic matter, ground cover, and minimal disturbance, producers encourage the proliferation of beneficial organisms such as fungi, bacteria, and earthworms. These organisms act as natural engineers, binding soil particles into aggregates that promote aeration and water retention. Enhanced soil biology also improves resilience against diseases, reduces reliance on synthetic additives, and supports long-term fertility.

Certified Sustainable producers regularly test soil biology to identify nutrient deficiencies and implement interventions that enhance microbial populations. Composting, organic fertilisation, and ground cover maintenance are central to their strategies for nurturing healthy soil ecosystems.

8 Technology-Assisted Input Applications

Precision agriculture harnesses the power of technology to optimise the application of inputs such as fertilisers, pesticides, and irrigation. Using GPS-guided machinery and sensors, farms can target specific areas of need, reducing waste and minimising potential environmental harm. This method ensures that resources are applied efficiently, avoiding excess runoff or contamination, while saving costs. The adoption of advanced technology enables farmers to continually refine their practices, ensuring sustainable outcomes.

Certified Sustainable producers invest in state-of-the-art technologies, including automated equipment and soil mapping systems, to maximise input efficiency. These technologies enable producers to address environmental challenges effectively while conserving valuable resources.

9 Responsible Resource Use

Sustainable producers conduct detailed assessments of resource usage, encompassing machinery, energy, and other inputs, to maximise efficiency and minimise their environmental footprint. By evaluating the lifespan of equipment and materials, they reduce waste and improve overall sustainability. Energy inputs are closely monitored to lower dependency on fossil fuels, with efforts directed towards adopting renewable energy alternatives. These producers actively calculate their Scope 1, 2, and 3 emissions, using the data to provide transparent reporting and make informed decisions.

Certified Sustainable producers apply lifecycle emissions metrics to all resources, ensuring accountability through evidence-based data. This approach not only facilitates the exploration of renewable energy sources and recycling strategies but also reinforces their commitment to responsible resource management and reducing unnecessary waste.

10 Remnant Vegetation Protection

Preservation of remnant vegetation is critical for maintaining biodiversity and ecological balance. Farms actively protect natural habitats such as wetlands, forests, and grasslands to support native species and prevent habitat loss. These efforts not only enhance environmental resilience but also serve as carbon sinks, offsetting emissions from agricultural activities. Remnant vegetation contributes to water retention, soil stabilisation, and pollination, all of which are essential for sustainable food production.

Certified Sustainable producers prioritise habitat conservation through land management plans that incorporate buffer zones and reforestation efforts. They collaborate with ecologists to ensure remnant vegetation thrives alongside agricultural operations, safeguarding biodiversity.

Sustainable Milling Practices

Under the Certified Sustainable Processor Standard, sustainable milling practices are central to reducing environmental impact and maintaining traceability and integrity throughout the food production chain. The standard requires processors to meet a set of clearly defined performance benchmarks across key operational areas, including energy use, emissions management, packaging, waste, and resource efficiency.

One of the core areas of compliance is energy efficiency, with certified milling operations expected to monitor and optimise electricity and fuel use across all processes. This includes investing in energy-efficient machinery, implementing smart energy management systems, and tracking electricity consumption to reduce Scope 2 emissions. Where applicable, processors are also encouraged to explore renewable energy sources and reduce reliance on fossil fuels to further minimise their carbon footprint.

Accounting for Scope 1, 2, and 3 emissions is another critical requirement under the standard. Certified processors must maintain detailed records of direct emissions from on-site fuel use (Scope 1), indirect emissions from purchased electricity (Scope 2), and a wide range of upstream and downstream emissions (Scope 3), including packaging material production, transport logistics, and supply chain services. This full-spectrum emissions tracking provides transparency and enables processors to identify hotspots and implement targeted reduction strategies.

The standard also emphasises resource conservation and waste minimisation. Certified mills are required to implement systems that reduce material waste and promote circular resource use, such as recycling by-products, reusing and recycling packaging, and minimising overproduction. In packaging, mills must demonstrate efforts to reduce environmental impact through responsible material selection—such as recyclable, compostable, or reduced-weight materials—and supply chain collaboration to minimise unnecessary packaging layers.

Traceability is another pillar of the Certified Sustainable Processor Standard. Mills must ensure that Certified Sustainable grain is clearly segregated, tracked, and processed in a manner that preserves its identity and sustainability credentials. This includes maintaining documentation that links each batch of flour back to certified producers and forward to verified bakeries or end users. Chain-of-custody systems are routinely audited to guarantee transparency and integrity throughout the process.

Collectively, these sustainable milling practices not only support emissions reductions and environmental compliance but also ensure that flour production contributes meaningfully to the broader goals of sustainable agriculture and food systems. By meeting the Certified Sustainable Processor Standard, mills such as Wholegrain Milling Co demonstrate leadership in responsible manufacturing and establish themselves as key enablers of verified climate-positive supply chains.

Sustainable Baking Practices

Sustainable baking practices are a key component of the Certified Sustainable Processor Standard, ensuring that environmental integrity is maintained through to the final stages of the food production process. Artisan bakeries certified under this standard—such as Rustica and Infinity—are required to demonstrate responsible management of energy, materials, emissions, and waste, with an emphasis on continuous improvement and traceability.

A central focus is on energy efficiency and emissions reduction within the baking environment. Certified bakeries must monitor and optimise the use of gas and electricity in ovens, refrigeration systems, and general operations. This includes the selection of energy-efficient equipment, adopting practices that improve batch consistency and exploring low-emissions or renewable energy alternatives where feasible. These measures contribute to reductions in Scope 1 (direct fuel use) and Scope 2 (purchased electricity) emissions.

Packaging sustainability is another critical aspect. Bakeries must evaluate and reduce the environmental impact of their packaging materials by using recyclable, compostable, or responsibly sourced alternatives. They are also required to avoid unnecessary over-packaging and implement systems for waste separation, recycling, and packaging material recovery. These practices reduce both material consumption and Scope 3 emissions associated with packaging lifecycle impacts.

Certified bakeries are also held to high standards in ingredient traceability and chain-of-custody compliance, particularly in relation to Certified Sustainable flour. This ensures that every loaf produced under the standard can be traced back to its sustainable origin, maintaining the transparency and credibility of the supply chain. Inventory systems, batch tracking, and documentation protocols are regularly audited to verify compliance and prevent cross-contamination with non-certified inputs, including mass-balance reconciliations.

Waste reduction plays a vital role in sustainable baking operations. Certified bakeries must implement systems to minimise production waste, overstocking, and spoilage. Where possible, food waste is redirected through donations, composting, or animal feed streams, supporting a more circular economy approach within the business.

By meeting the requirements of the Certified Sustainable Processor Standard, bakeries contribute to a lower-carbon, more responsible food system. These practices not only reduce environmental impact but also reflect the broader values of Certified Sustainable Bread—integrity, transparency, and measurable climate action at every stage of production.

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