ProCredit Bank

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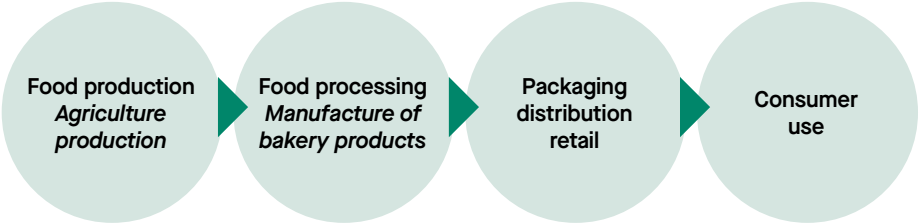
Manufacture of bakery products

CLIMATE & EFFICIENCY INVESTMENTS

Decarbonising food processing: A strategic imperative

By 2050, the global population is expected to approach 10 billion, increasing food demand by over 50%[1]. At the same time, the food sector contributes roughly 25%[2] of global CO_2 emissions while accounting for about 12% of global GDP and over 40% of employment[3]. This creates a critical challenge: meeting rising demand while reducing environmental impact. Food processing plays a key intermediary role in addressing this complex decarbonisation challenge. By adopting innovative technologies and sustainable practices, the sector can help drive the transition towards a net-zero future.



Manufacture of bakery products

Bakery manufacturing includes the manufacture of fresh, frozen or dry bakery products such as the industrial production of bread, biscuits, cakes, and other baked goods through a sequence of energy- and resource-intensive processes. The sector is characterised by continuous operations, a high demand for energy, and stringent product quality requirements.

1 Creating a Sustainable Food Future | World Resources Report
2 Reducing food's environmental impacts through producers and consumers | Science
3 Here's how we can protect food systems against global shocks | World Economic Forum

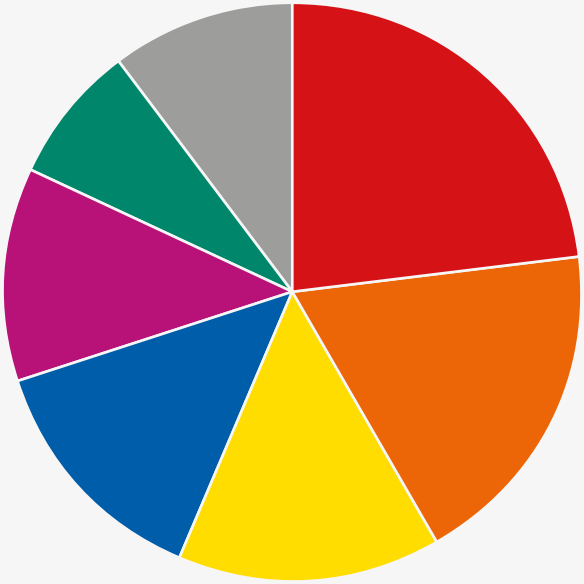
From a greenhouse gas perspective, bakery manufacturing generates emissions across **Scope 1 and Scope 2**, necessitating an integrated decarbonisation approach.

Key emissions drivers in the manufacture of bakery products

Scope 1 – Direct emissions
Scope 1 emissions primarily arise from the on-site combustion of fossil fuels, notably natural gas used in ovens, boilers, and proofers. Smaller contributions may come from fuel used in on-site vehicles or backup generators.

Scope 2 – Indirect emissions
Scope 2 emissions are associated with purchased electricity used for mixing, refrigeration, cooling, compressed air systems, lighting, and packaging lines. These processes and systems are critical to operational continuity and product quality.

Key CO_2 emissions drivers Food processing



Key emissions drivers[4]

- Machine drive 23.3%
- CHP and/or cogeneration process 18.8%
- Process heating 14.7%
- Process cooling and refrigeration 13.6%
- Conventional boiler use 12%
- Facility HVAC 7.7%
- Others 10.3%*

* Facility lighting 2.7%, Other facility support 2.5%, Other process use 2.0%, End use not reported 1.9%, Onsite transportation 0.6%, Other non-process use 0.3%, Electro-chemical processes 0.2%, Conventional electricity generation 0.1%

Why decarbonisation matters

Decarbonising on-site operations and energy use presents a powerful opportunity for bakery manufacturers to cut costs, reduce risk, and future-proof their operations. Bakery manufacturers rely heavily on fuel-fired ovens and electricity for production, making energy use one of the largest drivers of both emissions and operating expenses.

By reducing Scope 1 and 2 emissions, bakery manufacturers can

4 U.S. Energy Information Administration - EIA - Independent Statistics and Analysis

Decarbonisation Roadmap

Manufacture of bakery products				
Investment measure	**Energy cost savings (%)**	**Payback period (years)**	**CO_2 reduction potential**	**Benefits**
CHP combustion engine	20%	3 - 4	Medium	Combined heat and power (CHP) engines generate electricity and heat from a single fuel, boosting efficiency, reducing energy waste, and lowering emissions. When powered by low-carbon fuels like biogas or hydrogen, they further support a cleaner energy system.
CHP gas turbine	20%	3 - 4	High	CHP gas turbines support net-zero goals by generating electricity and capturing waste heat, boosting efficiency. Powered by low-carbon fuels like biogas or hydrogen, they reduce emissions while providing reliable power and heat.
CHP fuel cell	20%	3 - 4	High	CHP fuel cells support net-zero goals by generating electricity with high efficiency and supplying useful heat. Their low carbon intensity, quiet operation, and low maintenance enhance energy efficiency compared to conventional combustion systems.
Cooling and freezing chambers	20% - 30%	4 - 5	Low	Cooling and freezing chambers maintain precise low-temperature conditions essential for product quality and safety. Their efficient operation reduces energy use, promoting more sustainable temperature-controlled processes.
Battery electric vehicles (BEVs)	50%	5 - 6	Low	Electric vehicles offer higher energy efficiency through advanced battery systems and regenerative braking, reducing overall energy consumption during operation. They offer a clean solution for transporting products, reducing fuel costs, and improving operational sustainability.
Electric forklifts	50%	2 - 3	Low	Electric forklifts are battery-powered material-handling vehicles used to move ingredients and finished products within bakery facilities. They offer high energy efficiency by converting stored electrical energy directly into motion with minimal losses. This efficiency reduces fossil fuel costs and CO_2 emissions.

CO_2 reduction potential ● Very low ● Low ● Medium ✓ High

Decarbonisation Roadmap

Investment measure	Energy cost savings (%)	Payback period (years)	CO_2 reduction potential	Benefits
Electric ovens & smart baking systems	10% - 15%	8 - 9	High	Electric ovens and smart baking systems are advanced cooking appliances that use electricity and automated controls to bake products with precision. They offer high energy efficiency by optimising heat distribution and using programmable baking cycles. This efficiency reduces energy consumption and emissions.
Retarders	10% - 15%	4 - 5	Very low	Retarders are temperature-controlled units that slow down dough fermentation to optimise baking schedules and product quality. They provide high energy efficiency by maintaining stable, precise cooling with minimal energy waste. This efficiency reduces energy use and carbon emissions.
Packaging machine	20% - 30%	Case-specific	Medium	Packaging machines in bakery companies ensure precise, hygienic, and consistent filling and sealing of baked goods. They maintain product quality and safety while minimising material waste. Their energy-efficient operation reduces electricity use, promoting sustainable bakery production.
PV self-consumption	Up to 100% based on the system capacity and electricity demand	6 - 7	Medium	A PV (photovoltaic) system converts sunlight into electricity for on-site use. It provides clean, renewable energy to power production, refrigeration, and other operations, reducing reliance on grid electricity and lowering operational costs. Pairing a PV system with battery storage enables multi-shift companies to rely on renewable electricity while reducing exposure to electricity price volatility.
Li-ion batteries	Case-specific	4 - 8	Case Specific	Lithium-ion (Li-ion) batteries are energy storage systems that store electricity and release it when needed. Their energy-saving potential comes from maximising the use of on-site renewable electricity, reducing reliance on grid power during peak periods. This delivers tangible cost savings through improved energy management and lower operating expenses.
Industrial process chiller	20% - 30%	Over 10 years	Medium	Industrial process chillers provide precise temperature control to maintain product quality and protect equipment. Their efficient operation reduces energy consumption, promoting more sustainable operations.

CO_2 reduction potential ● Very low ● Low ● Medium ✓ High

Decarbonisation Roadmap

Investment measure	Energy cost savings (%)	Payback period (years)	CO_2 reduction potential	Benefits
High precision dough dividers	10% - 15%	Over 10 years	Low	High-precision dough dividers are machines that portion dough accurately for uniform product sizes. This efficiency lowers energy consumption and supports decarbonisation in bakery operations.
Water source heat pumps	20% - 30%	Over 10 years	Very low	Water source heat pumps are systems that use water as a medium to efficiently transfer heat for heating and cooling. They help companies reduce energy consumption and operational costs while lowering greenhouse gas emissions.
Air-to-air heat pumps	15% - 25%	Over 10 years	Very low	Air-to-air heat pumps provide efficient heating and cooling by transferring energy rather than generating it. Their high efficiency reduces electricity consumption, contributing to more sustainable building operations.
Air-to-water heat pumps	10% - 20%	Over 10 years	Very low	Air-to-water heat pumps are systems that extract heat from the air to provide efficient heating and hot water. They help companies reduce energy use, cut costs, and lower emissions.
Ground source heat pumps	15% - 25%	Over 10 years	Very low	Ground source heat pumps are systems that use the stable temperature of the ground to provide efficient heating and cooling. They help companies reduce energy consumption, lower costs, and cut greenhouse gas emissions.
Ventilation system	10% - 20%	Over 10 years	Very low	A ventilation system manages the flow of air by bringing in fresh air and expelling stale or contaminated air to maintain a healthy indoor environment. Contemporary systems are built for high energy efficiency and their intelligent controls reduce energy consumption.
Building insulation materials	50%	4 - 5	High	Building insulation reduces heating and cooling costs, boosts energy efficiency, and supports decarbonisation by lowering emissions and environmental impact.
LED lighting	5% - 10%	5 - 6	Low	LED lighting provides high-efficiency illumination with lower energy consumption compared to conventional lighting solutions. Its reduced electricity demand supports decarbonisation and enhances building performance.

For more detailed information on how to reduce costs and lower your CO_2 footprint, along with additional measures tailored for your business, contact the bank.

CO_2 reduction potential ● Very low ● Low ● Medium ✓ High

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