

MANUFACTURING WHITE PAPER

Understanding the Manufacturing Carbon Footprint of Thermoset Materials

How PLENCO measures
manufacturing emissions
across its product categories



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Introduction

Sustainability information is becoming increasingly important across the manufacturing industry as customers look for a better understanding of the environmental impact associated with the materials they use.

In response to growing customer interest, PLENCO developed a structured method for measuring and allocating manufacturing emissions across its primary product categories.

This white paper examines:

- **PLENCO's gate-to-gate assessment scope**, focused on manufacturing and storage.
- **Scope 1 and Scope 2 emissions**, using utility data and recognized emissions factors.
- **Emission allocation across product categories**, based on production and operational data.
- **How this information can support customer sustainability efforts**, including emissions reporting and material evaluation.

The goal is to provide a clearer understanding of the manufacturing emissions associated with PLENCO thermoset materials while supporting future sustainability initiatives and continued improvement.



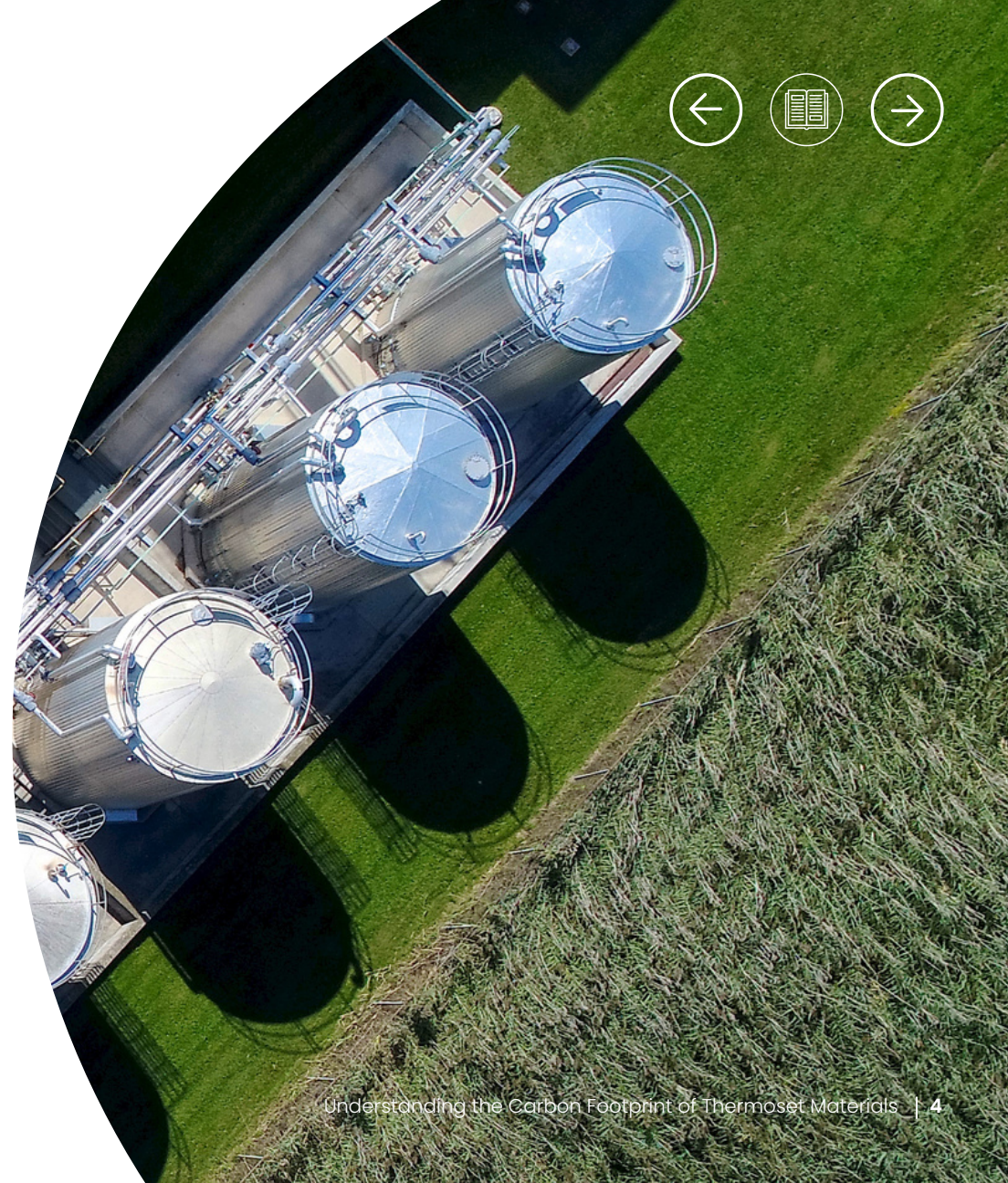
Why manufacturing emissions matter

Customers are placing greater emphasis on sustainability, carbon reporting, and understanding the environmental impact associated with the materials used in their products. This is increasing the need for manufacturers to provide clear and consistent emissions information that can support purchasing decisions, reporting requirements, and broader environmental goals.

Manufacturing emissions are influenced by several factors, including electricity and natural gas consumption, production activity, facility usage, and the processes required to manufacture different product categories. Without a structured method for allocating these emissions, it can be difficult to understand how manufacturing activity contributes to the carbon footprint of individual materials.

PLENCO developed an emissions allocation methodology to create a consistent way to evaluate manufacturing-related emissions across its primary product categories. This provides a clearer basis for comparing emissions across individual material categories.

[EPA Scope 1 and Scope 2 Inventory Guidance](#)



Defining the assessment scope

PLENCO's emissions assessment uses a gate-to-gate boundary, focusing on the manufacturing and storage activities that occur within company operations.

The current model includes Scope 1 and Scope 2 emissions, primarily from natural gas and purchased electricity used across production and facility operations.

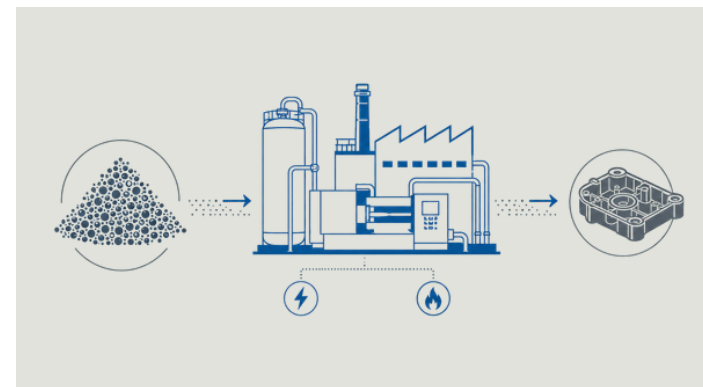


Figure 1. (a) PLENCO manufacturing operations; (b) gate-to-gate assessment boundary.

The assessment does not include upstream raw material production, transportation, customer processing, product use, or end-of-life impacts.

These upstream and downstream life-cycle stages, including Scope 3 emissions, are outside the assessment boundary.

This defined boundary allows manufacturing emissions to be evaluated consistently across PLENCO's primary product categories.

By focusing on emissions generated within PLENCO operations, the model provides a clear framework for customer reporting and future sustainability analysis.

PLENCO's gate-to-gate methodology

PLENCO's methodology evaluates manufacturing-related emissions across five primary product categories: Kettle Resins, Pastilles/Flaked Resins, Ground Product, Molding Compound, and Bulk Molding Compound.

Purchased electricity and natural gas used throughout manufacturing, storage, and facility operations are converted into carbon dioxide equivalent emissions using recognized emissions factors.

Electricity emissions use geographically relevant EPA-based factors, while natural gas consumption is converted using DOE VERIFI.

PLENCO's gate-to-gate assessment is based on principles outlined in ISO 14040 and ISO 14044.

Note: Emissions figures are based on internal PLENCO calculations and have not undergone third-party verification or assurance.

The resulting Scope 1 and Scope 2 emissions are then assigned to PLENCO's product categories through the allocation process described on the following page.

Results are expressed as:

kg CO₂e per kg of product manufactured over a one-year period

This provides a consistent basis for evaluating manufacturing emissions across PLENCO product categories and tracking changes over time.

[ISO 14040:2006 Environmental management](#)

[ISO 14044:2006 Life cycle assessment](#)



Allocating emissions across product categories

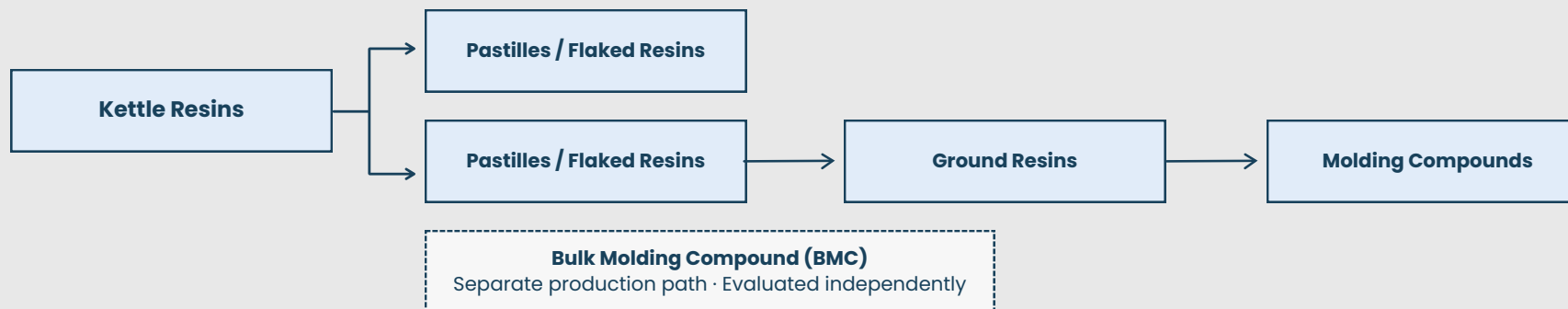
Electricity and natural gas emissions are first attributed to manufacturing and facility activities using production and operational data. Energy associated with individual processes is attributed to the related product category, while emissions from shared operations are distributed using established allocation factors.

For related product categories, emissions associated with earlier manufacturing stages are carried forward through production-weighted calculations. Kettle Resin emissions are incorporated into both Pastilles/Flaked Resins and Ground Product, while Molding Compound incorporates the emissions associated with the Ground Product pathway leading to the finished compound.

Bulk Molding Compound is evaluated independently because it follows a separate production path. This structure provides a more complete category-level estimate by accounting for both direct manufacturing activity and the supporting operations required throughout production.

Production Process Flow Diagram

Simplified process relationship for product category allocation





Understanding the results

Emissions intensity relates manufacturing emissions to the amount of product produced. This makes it possible to compare annual performance even when total production volume changes.

A decrease in total emissions does not always produce the same change in emissions intensity, and an increase in production does not necessarily indicate declining efficiency.

Results should therefore be reviewed alongside production volume, product mix, energy consumption, and other operational factors.

Annual emissions intensity can vary for several reasons, including production volume, energy consumption, product mix, facility activity, and changes in electricity emission factors.

A change in one of these areas can influence the calculated emissions associated with a product category, even when the underlying manufacturing process has not significantly changed.

For that reason, year-to-year results are reviewed in context rather than viewed as a single measure of operational performance.

PLENCO reviews results to identify trends, significant changes, and areas that may warrant further evaluation.

The data can help support manufacturing efficiency efforts, energy reduction initiatives, future sustainability planning, and customer requests for more detailed emissions information.

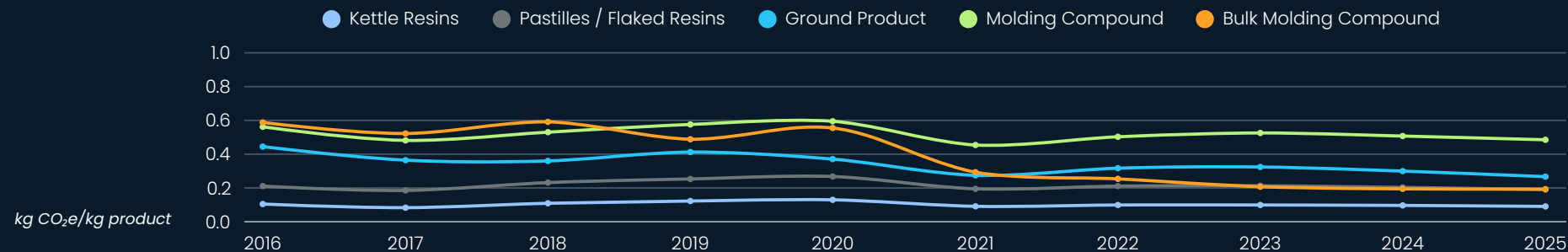
Over time, continued measurement also provides a stronger foundation for evaluating progress and identifying opportunities to improve the environmental performance of PLENCO's manufacturing operations.

Reported emissions do not incorporate carbon offsets, Renewable Energy Certificates (RECs), or other market-based instruments.

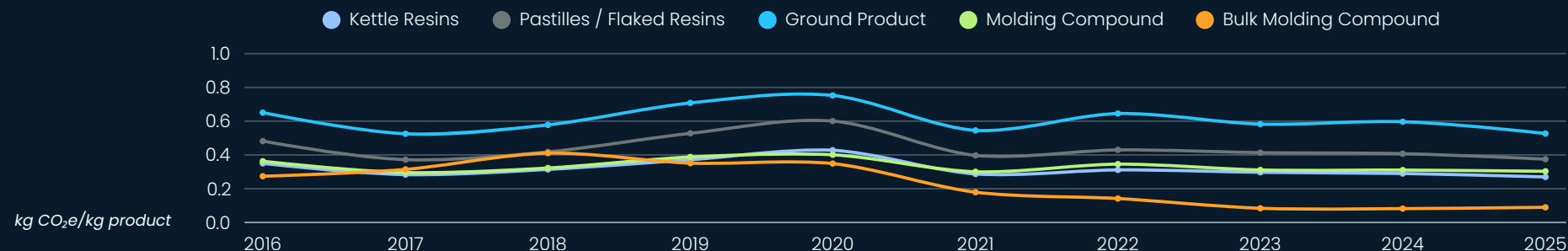


Emissions intensity trends

Electricity-related Scope 2 emissions intensity



Natural gas-related Scope 1 emissions intensity





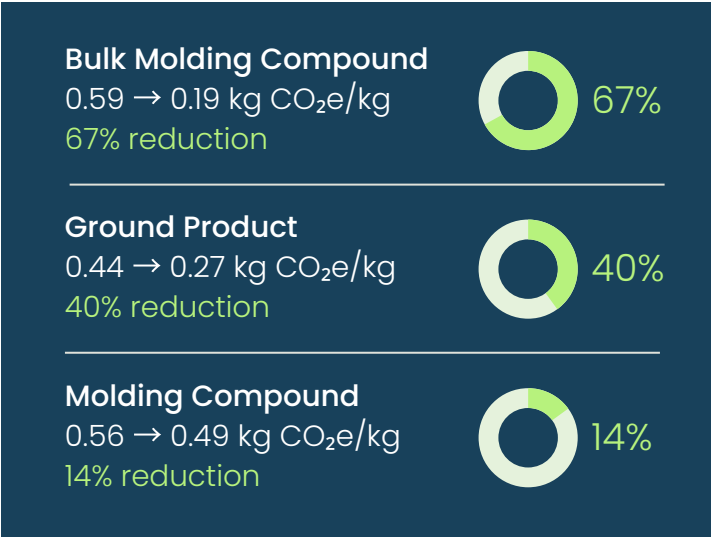
Electricity-related emission trends

Electricity-related Scope 2 emissions were evaluated across PLENCO’s five product categories from 2016 through 2025. The results show how emissions intensity changed within each category over the 10-year period.

The year-to-year pattern varied considerably by product category.

Together, the data provide a consistent view of long-term electricity-related emissions trends across PLENCO’s product categories.

2016 was selected as the baseline to provide a 10-year view of emissions intensity through 2025.

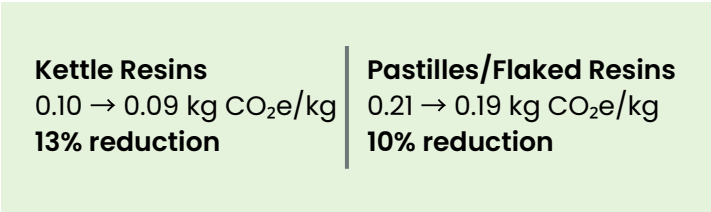


Bulk Molding Compound showed the largest decline in electricity-related emissions intensity, falling from approximately 0.59 kg CO₂e/kg in 2016 to 0.19 kg CO₂e/kg in 2025.

Ground Product also declined substantially over the period, while Molding Compound remained comparatively higher and showed greater year-to-year variation.

All five product categories showed lower electricity-related emissions intensity in 2025 than in 2016, although the magnitude of those reductions varied.

Additional 2016–2025 electricity results



Reductions calculated from unrounded values.



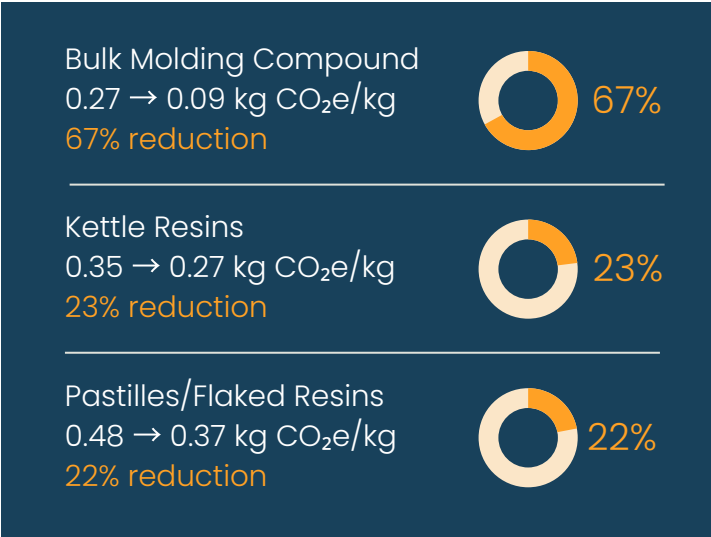
Natural gas-related emission trends

Natural gas-related Scope 1 emissions were evaluated across PLENCO’s five product categories from 2016 through 2025.

All five categories recorded lower emissions intensity in 2025 than in 2016, although the scale and timing of those reductions varied.

Unlike purchased electricity, natural gas use reflects both production activity and facility heating, which can create greater year-to-year variation in the results.

Additional context for the BMC emissions intensity reduction is provided on the Summary page.

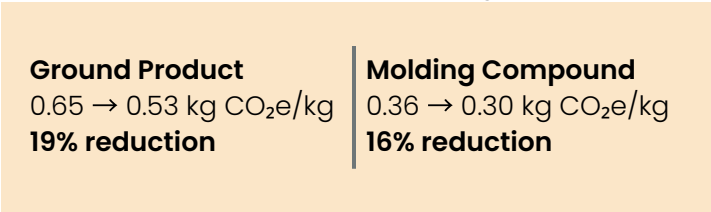


Bulk Molding Compound showed the largest overall reduction in natural gas-related emissions intensity over the reporting period, falling from approximately 0.27 kg CO₂e/kg in 2016 to 0.09 kg CO₂e/kg in 2025.

The remaining product categories were also below their 2016 levels, although several increased mid-period before declining.

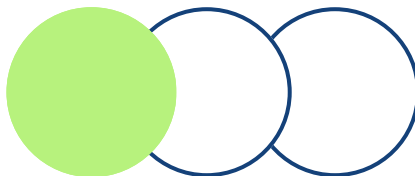
These changes reflect the combined influence of production demand, facility heating, seasonal variation, and other operational factors affecting natural gas use.

Additional 2016–2025 natural gas results



Reductions calculated from unrounded values.

Supporting customer sustainability goals



PLENCO's emissions data can help customers better understand the manufacturing-related environmental impact associated with the materials they purchase and use. This information can support internal reporting, supplier evaluations, sustainability initiatives, and broader environmental goals.

Customer emissions reporting — Product-category emissions data can provide customers with additional information for Scope 3 reporting, supplier sustainability assessments, and internal carbon accounting. By providing a consistent manufacturing emissions basis, PLENCO can help customers better understand the emissions associated with its operations and support requests for more detailed environmental information.

Material and supplier evaluation — Sustainability considerations are increasingly part of material selection and supplier qualification. PLENCO's emissions assessment provides an additional data point that customers can use alongside technical performance, quality, cost, and supply considerations when evaluating materials and sourcing strategies.

As reporting expectations continue to evolve, PLENCO can use this framework to support customer information requests and future sustainability-related assessments.





Summary

PLENCO developed a structured gate-to-gate approach to evaluate manufacturing-related Scope 1 and Scope 2 emissions across its primary product categories.

The assessment combines utility data, recognized emissions factors, production information, and category-specific allocation methods to measure emissions intensity over time.

From 2016 through 2025, all five product categories recorded lower electricity-related and natural gas-related emissions intensity. The drivers varied by category and included production volume, energy consumption, facility activity, and operational improvements.

For Bulk Molding Compound, the significant reduction in emissions intensity was driven primarily by increased production volume, which distributed fixed facility energy demands across more product.

PLENCO has also invested in energy efficiency at its North Avenue Plant, achieving a 25% reduction in energy intensity through participation in the U.S. Department of Energy Better Plants program.

Additional information is available in PLENCO's Corporate Sustainability Report, page XX.



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