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Report

Comparison of CO_2 Emissions of Reusable GN Containers Made of Stainless Steel, Green Steel and Plastic Disposable Packaging

Introduction

This report compares the CO_2 emissions of reusable GN containers made of stainless steel and Green Steel with conventional plastic disposable packaging. The results show which packaging solutions are more sustainable in the long term and how their environmental impact develops over several usage cycles. The aim is to provide a clear basis for decisions on the use of more environmentally friendly packaging in the food and catering sectors.

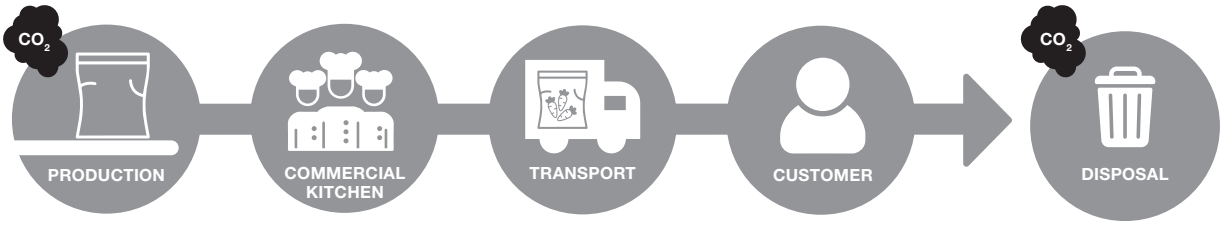
Emissions Assessment Approach

The CO_2 emissions were analyzed in the various phases of use:
Production, transport, cleaning process and disposal. The data on the production of the stainless steel containers is based on information from the material suppliers, which was validated according to ISO 14067. However, the analysis does not take into account the direct Scope 1 and 2 emissions from production. When calculating the emissions from the use of the GN containers, the "worst case" was assumed in order to use conservative estimates.

It should be noted that the life cycles of disposable and reusable systems differ fundamentally. In the reusable system in particular, the additional transport effort due to the higher weight and the rinsing process play a significant role. The following diagrams provide an overview of these differences before the individual phases of the life cycle are explained in detail and the respective differences are presented in terms of their ecological relevance.

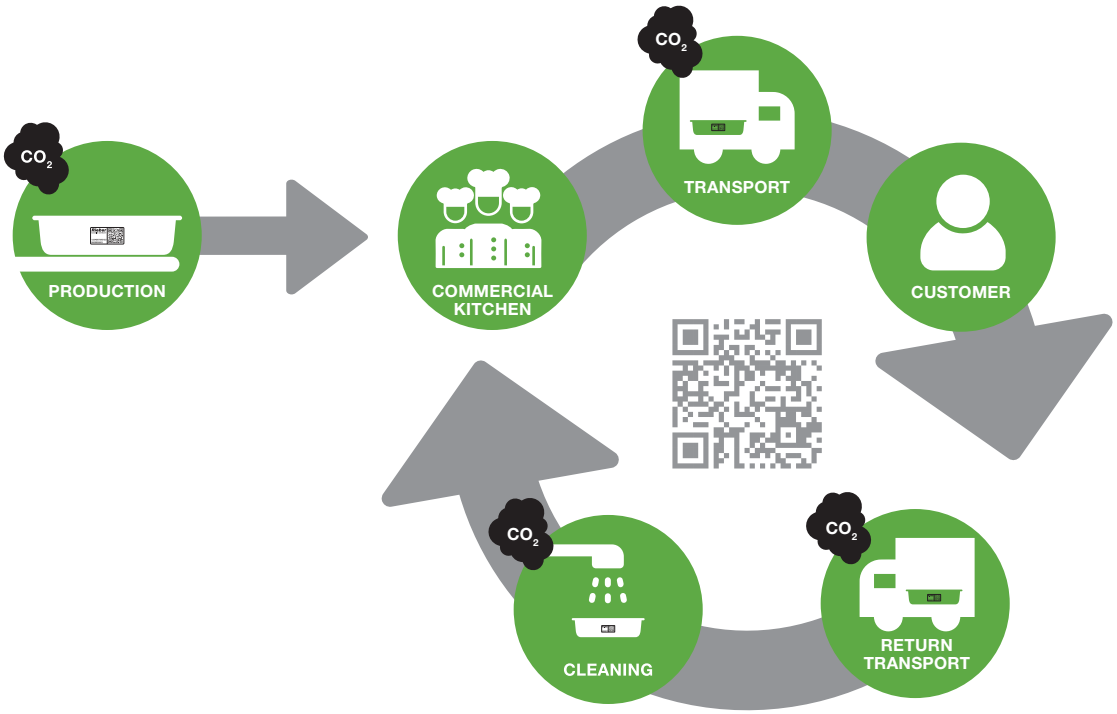
Life Cycle of Disposable Packaging

Plastic packaging is **disposed of after one-time use** and **replaced with newly** produced packaging.

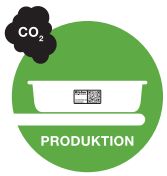


Life Cycle of the Reusable System

GN containers are only manufactured **once**.
Additional **transport emissions** are **caused by the extra weight** and the **cleaning process**.



Production Phase
Emissions from Production



Manufacturing is one of the phases with the highest emissions, especially for the durable GN containers made of stainless steel and Green Steel. Since these containers are designed for multiple use, higher emissions are initially generated during production. In contrast, single-use plastic packaging must be manufactured again after each use.

Plastic

Four plastic bags of 2.5 l correspond to the capacity of **a GN 1/1 container with a depth of 200 mm.** These four bags generate a total of **0.26 kg CO_2-e** when used once (0.11 kg during production and 0.15 kg during disposal).

Stainless Steel

The production of a **GN 1/1 stainless steel container** with a **depth of 200 mm** and a matching GN plug-in lid causes **4.55 kg CO_2-e,** which only arise during the purchase.

Green Steel

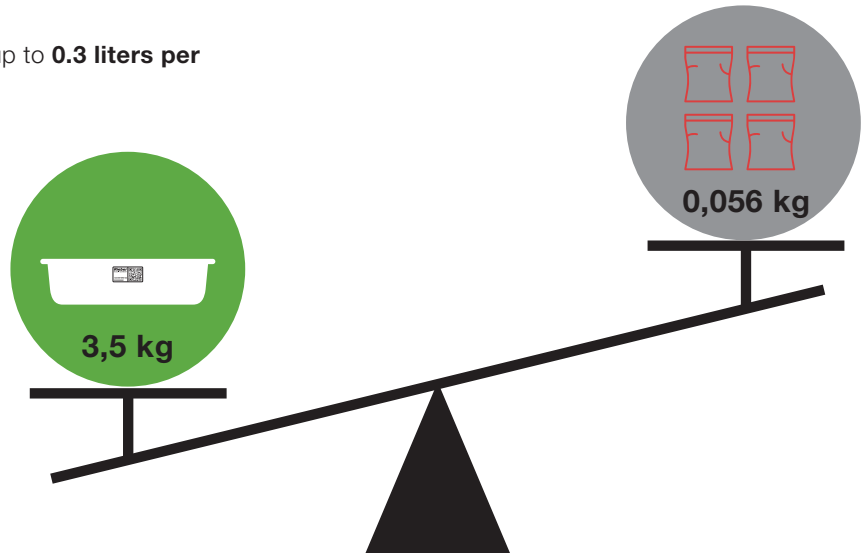
With **1.75 kg CO_2-e per container**, Green Steel offers a more environmentally friendly alternative in the same size, as emissions are **reduced by up to 70%** compared to conventional stainless steel.

Transport Phase
Emissionen Due to Excess Weight

Transport is an important factor when considering CO_2 emissions, especially for reusable packaging such as GN containers, which consume more fuel due to their higher weight. **Stainless steel GN containers weigh significantly more than plastic packaging**, which leads to additional emissions due to increased fuel consumption.

With an additional weight of 3.5 kg per GN container with lid, this results in additional consumption of around 0.01 liters of diesel per 100 km. The CO_2 emissions for diesel are around 2.68 kg CO_2-e per liter of diesel. With an additional consumption of 0.01 liters of diesel per 100 km, this leads to around **0.027 kg of additional CO_2 emissions per GN container including lid** per 100 km.

Additional fuel consumption is up to **0.3 liters per 100 kg** of additional weight.



Weight comparison: 1x stainless steel container vs. 4x plastic bags

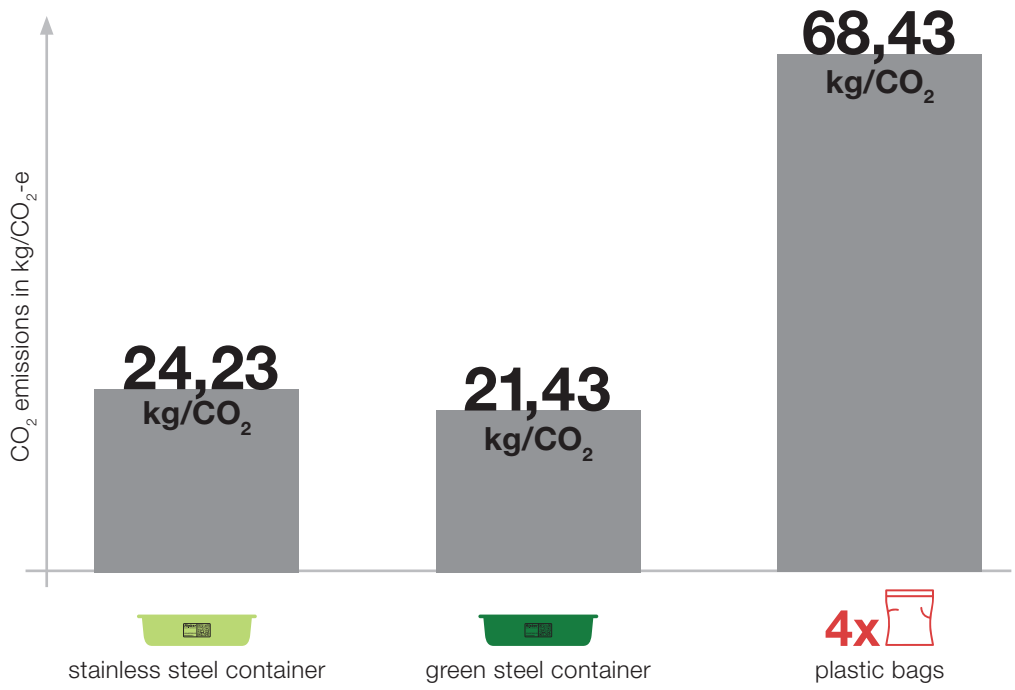
Cleaning Process
Emissions from Cleaning

GN containers **must be cleaned after each use**, which requires energy and resources. Emissions from the cleaning process only occur with reusable packaging and depend on the electricity consumption. CO_2 emissions from the cleaning agents required are not part of the consideration.

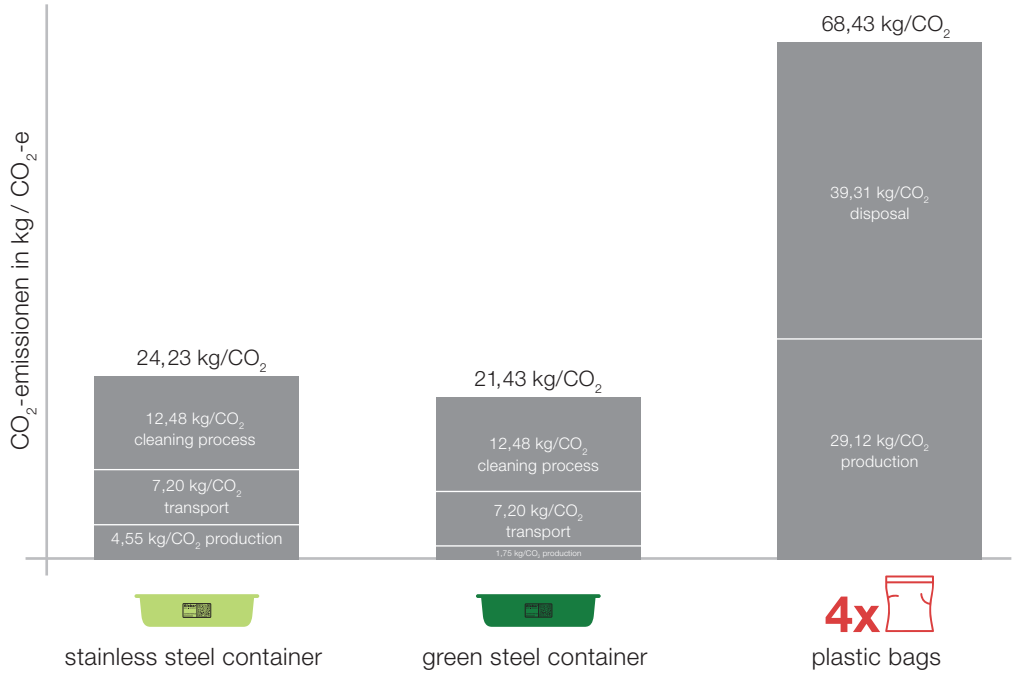
The washing process of 5,980 GN 1/1 stainless steel containers consumes an average of 751.51 kWh of electricity over 14.25 hours. With a CO_2 value of the German electricity mix of 0.380 kg CO_2-e/kWh, this results in total CO_2 emissions of around 285.57 kg CO_2-e. For each container cleaned, this results in a value of **0.048 kg CO_2-e per container.**

Comparison of Annual Emissions

Annual CO_2 emissions per container or per 4 plastic bags for daily travel of over 100 km and 260 working days.



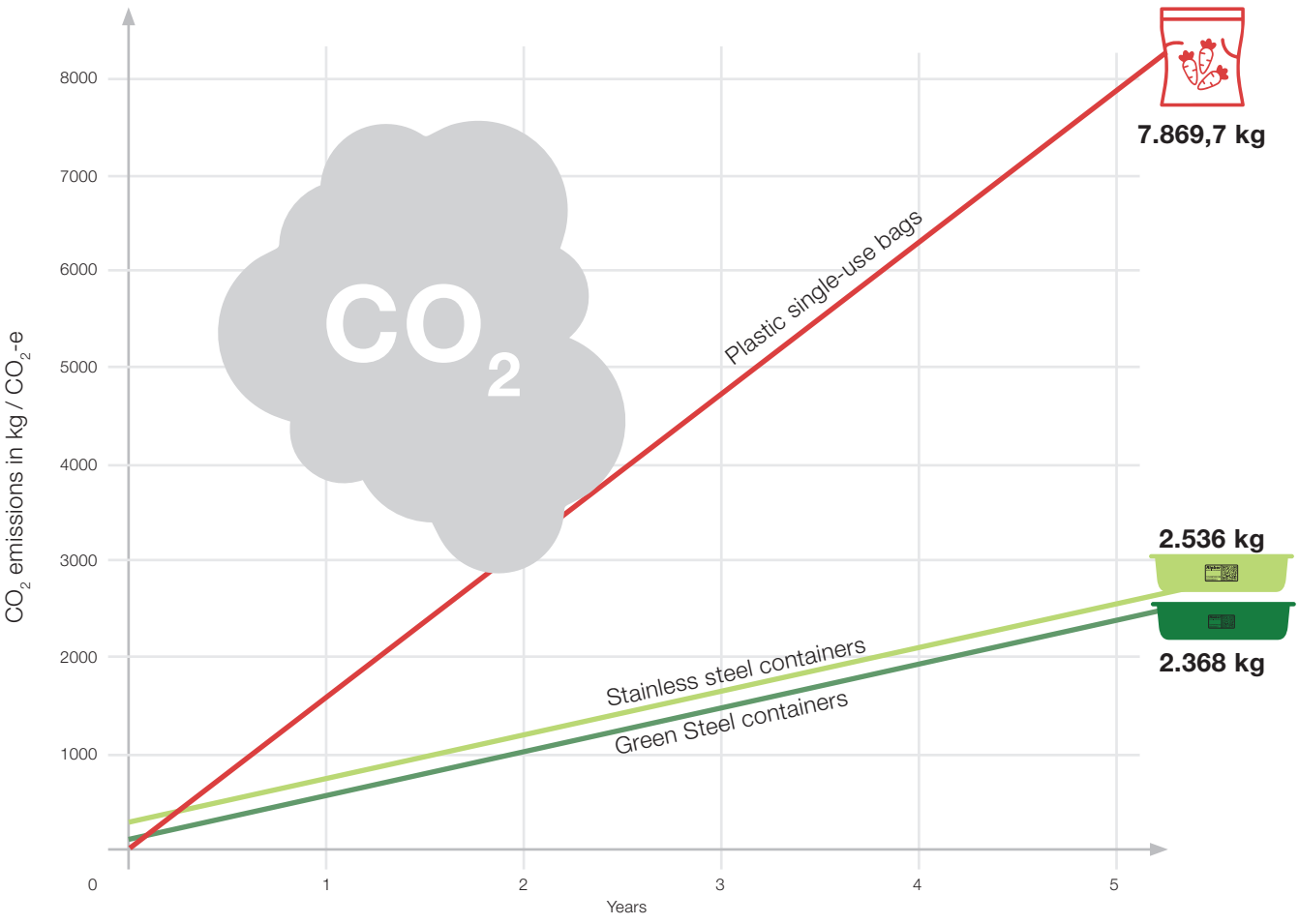
Cumulatively presented according to the individual phases, the breakdown shows how the emissions from production, transport, cleaning and disposal add up.



Comparison of CO_2 Emissions Over 5 Years
A Practical Example

In this scenario, we examine the daily transport of 23 GN containers (stainless steel or Green Steel) over a distance of 100 km (round trip). With an inventory of 60 containers and 260 working days per year, the CO_2 emissions from transport and cleaning are analyzed over a period of 5 years.

For comparison: When using plastic bags, with four bags equivalent to one GN container, a total of 92 bags are transported daily over the same distance. The calculations illustrate the CO_2 emissions and resource consumption of each packaging solution under the same conditions, highlighting the differences in environmental impact between reusable containers and single-use packaging.



The diagram clearly shows that Green Steel containers break even after 25 days, while stainless steel containers reach this point after 64 days.

Conclusion
Assessment of CO_2 Emissions

The report highlights that GN containers made of Green Steel and stainless steel are a more environmentally friendly choice in the long run compared to single-use plastic bags. While CO_2 emissions are initially higher due to the energy-intensive production of stainless steel and Green Steel, this is offset by multiple reuse cycles. In contrast, plastic bags may have lower emissions during production, but their continuous need for replacement after each use leads to a significant accumulation of emissions over time.

Green Steel proves to be particularly advantageous, as its production emissions are up to 70% lower than those of conventional stainless steel. The additional energy required for transport and cleaning of GN containers is offset over time by the benefit of multiple reuse cycles, whereas plastic bags generate new emissions with each use. Overall, the report demonstrates that reusable packaging significantly reduces environmental impact in the long term due to its repeated use.

By using stainless steel instead of plastic single-use packaging, CO_2 emissions saved over **five years** are equivalent to the amount that **533 trees** can absorb in one year.

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