How Companies are Growing Profits and Making Climate Progress: Case Studies

Environmental Defense Fund

In partnership with

Sustainable Public Affairs

Introduction

The climate crisis requires us to make significant greenhouse gas emissions cuts in the short term or risk irreversible harm to our societies. The European Union, like many other countries and businesses, has a long-term target for climate neutrality in 2050. Unfortunately, in most cases there is still a major gap between these targets and concrete action.

Environmental Defense Fund has a long track record of working successfully with companies to work towards sustainability while building businesses models ready to take on new challenges. This collection of case studies highlights concrete examples of European businesses already putting decarbonization strategies into action. It is our hope that these examples can provide inspiration and insight for our global Net Zero Action Accelerator (NZAA) and businesses around the world.

They are a selection of businesses actively working toward decarbonization with all of the constraints and trade-offs that they face on their journeys toward net-zero. Some are further along on their journeys than others, but all of them have made progress in reducing their emissions while operating successful and profitable businesses.

Businesses need the right supporting environment with consistent, long-term policy and investment signals in order to maximize their emissions reductions while remaining competitive.

The European Union and its Member States have been frontrunners in establishing ambitious climate policy. By 2022, the latest year we have data for, the EU had reduced greenhouse gas emissions by 34% compared to 1990 levels, with an increase in GDP of 54%. These years of policy development and experimentation have helped many businesses to start decarbonizing their value chains, take advantage of cleaner energy grids, and benefit from incentives for innovation and lower-carbon business strategies. An EU wide carbon price in key sectors, as well as national level carbon pricing policies, have provided clear market signals for business and helped finance investment in cleaner technologies.

Although there has been significant progress, more is still needed to reach the goals of the Paris Agreement, and the EU has significantly broadened and deepened the scope of its climate policy through the European Green Deal over the last four years. Businesses, including some featured in this report, have also helped to push forward this enhanced ambition, by anticipating the transition, acting ahead of official policies and leading by example. They have done this both in their own businesses but also through incentivizing positive changes and decarbonization in their value and supply chains, putting pressure on suppliers to also act. These critical supporting activities have helped to drive real action to meet our climate goals.

We are sharing these examples at a critical time for European decision makers and business leaders to chart the next steps in the continent's journey toward net zero emissions, showing evidence that businesses are leading the way to an innovative, prosperous, and cleaner future without compromising their economic dynamism.

"This collection of case studies highlights concrete examples of European businesses already putting decarbonization strategies into action. It is our hope that these examples provide inspiration and insight for our global Net Zero Action Accelerator and businesses around the world."

— Helen Spence-Jackson,
Executive Director,
Environmental Defense Fund Europe

Approach

The goal of this compendium is to present a set of examples of successful and sustainable business practices that have been used in Europe to reduce emissions, while making good business sense. The results presented should not be interpreted as a compilation of the most sustainable business cases in Europe. Instead, they provide a sample of innovative decarbonization measures, both technological and non-technological, that have allowed companies to reach concrete results in terms of CO_2 emissions reductions and profitability across the sectors considered. They are meant to inspire and illustrate that a range of options can be considered when wanting to take steps towards decarbonization.

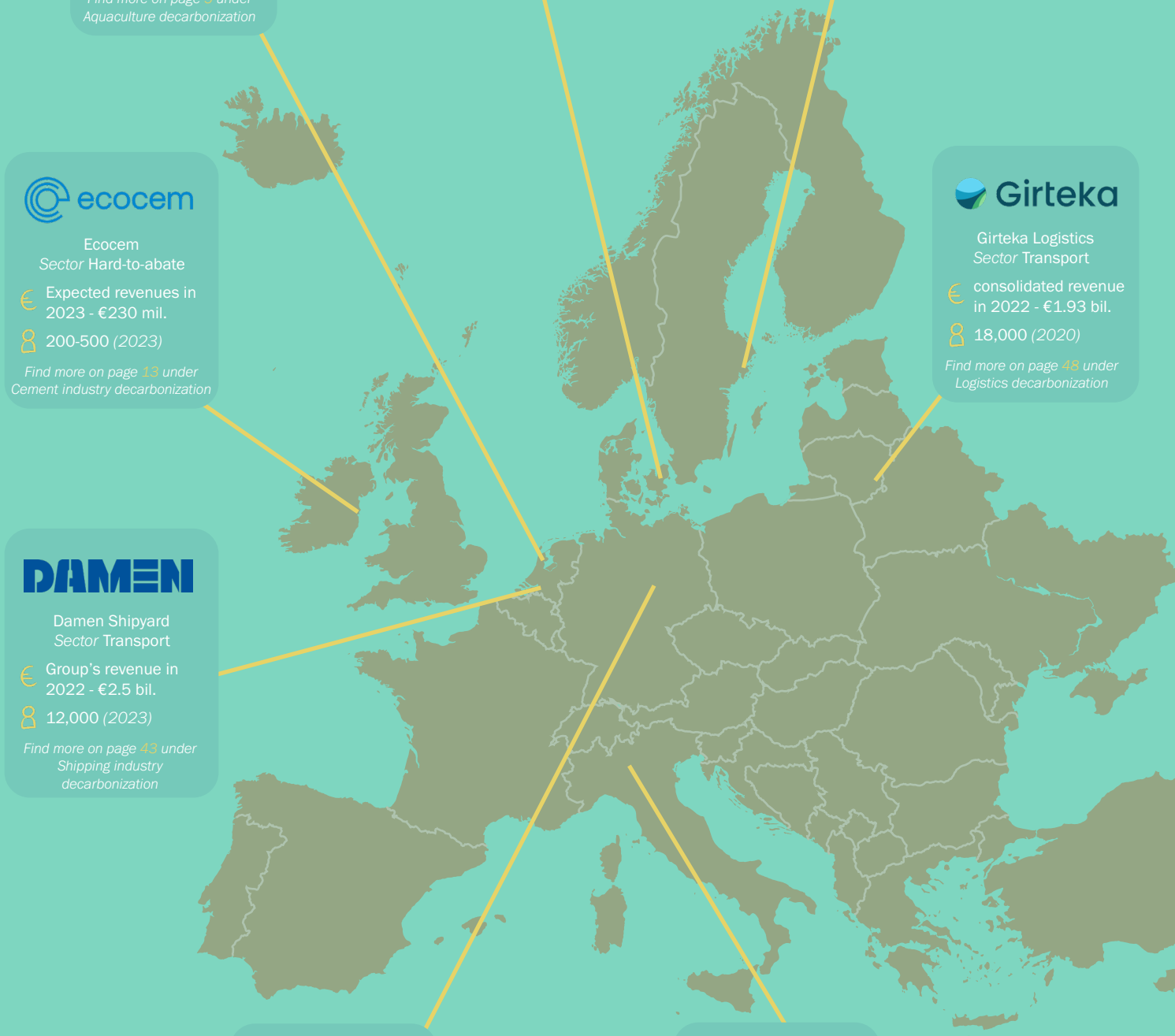
The examples have been selected based on several criteria that served as guiding principles for the first assessment of the business cases. Criteria include, among others, size of the business and geographical distribution, recognition by a carbon accounting mechanism, type of innovation, scope of CO_2 emissions tackled, including a focus on Scope 3 emissions, resources saved or impacted, as well as replication potential. As a second step, interviews have been conducted with representatives of the companies to gain an in-depth understanding of the implementation of business innovations and to collect data on achieved results related to CO_2 emissions reductions and revenues. To complement this information, data have also been extracted from sustainability reports and financial statements of companies. Both qualitative and quantitative data have been analyzed, evaluated and presented in text sections, graphs and tables in the body of the compendium.

Structure of the compendium

The compendium collects good business practice examples from Europe across five sectors:

- Agriculture-food
- Hard-to-abate
- Packaging
- Retail
- Transport

When possible, the implementation of innovative decarbonization measures throughout the companies and products' value chain has been considered by also highlighting partnerships with relevant stakeholders. This approach has enabled us to show success in CO_2 emissions reductions and economic viability beyond a single step of the life cycle of products and processes. Please note that, unless stated otherwise, the metric system is used all across the compendium.



Corbion

Corbion
Sector Agriculture-Food

Net sales in 2022 - €1,457.9 mil.

2,601 *(2022)*

Find more on page 5 under Aquaculture decarbonization

flying tiger copenhagen

Flying Tiger Copenhagen
Sector Retail

Group's revenue in 2022 - €637 mil.

7,000 *(2022)*

Find more on page 37 under Retail industry decarbonization

OVAKO

Ovako
Sector Hard-to-abate

Group's revenue in 2019 - €921 mil.

2,900 *(2022)*

Find more on page 19 under Steel industry decarbonization

ecocem

Ecocem
Sector Hard-to-abate

Expected revenues in 2023 - €230 mil.

200-500 *(2023)*

Find more on page 13 under Cement industry decarbonization

Girteka

Girteka Logistics
Sector Transport

consolidated revenue in 2022 - €1.93 bil.

18,000 *(2020)*

Find more on page 48 under Logistics decarbonization

DAMEN

Damen Shipyard
Sector Transport

Group's revenue in 2022 - €2.5 bil.

12,000 *(2023)*

Find more on page 43 under Shipping industry decarbonization

Novelis

Novelis
Sector Packaging

Net sales in 2023 - €18.5 bil.

13,170 *(2023)*

Find more on page 31 under Decarbonization of the aluminum packaging sector

NOVAMONT
A Versalis Company

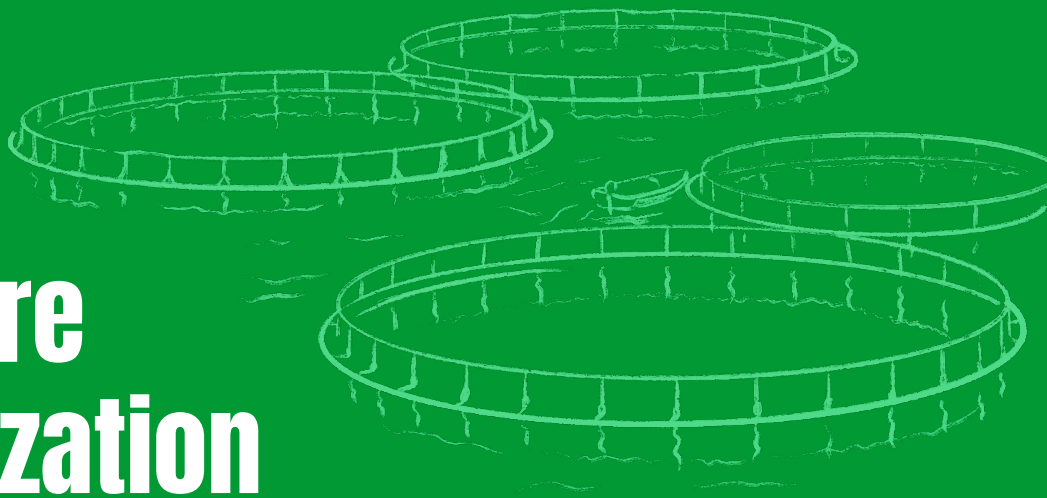
Novamont
Sector Packaging

Overall turnover in 2022 - €414 mil.

632 *(2021)*

Find more on page 25 under Decarbonization of the plastic packaging sector

Click on the logos to find more



Aquaculture decarbonization

In 2017, global emissions of aquaculture, which is the industry responsible for fish farming, amounted to 263 million tons (mt) CO_2. This number is expected to rise as experts estimate that human demand for "blue food", defined as aquatic organisms for human consumption, will roughly double by 2050. Total aquaculture production, which is key to assuring the availability of blue food, is foreseen to reach 106 mt representing an overall increase of 22% compared to 2020.

On average, feed production accounts for 57% of emissions from aquaculture globally. Switching to sustainable feed alternatives can therefore contribute to a significant reduction in the industry's total CO_2 emissions.

Key lessons:

- Greater decarbonization efforts can be achieved through innovative processes implementing the principles of circular economy.
- Partnerships and knowledge sharing are an essential step to accomplish sustainable results enabling companies to lead as an example to other players in the industry.
- Smaller players have the opportunity to facilitate new innovative solutions that can be tested on a small scale before becoming industry standards.

Corbion

39%

reduction in emissions per ton of product between 2016 and 2022.

Manufactures algae-based feed ingredients emitting

38%

less than fish oil.

€ Net sales in 2022 - €1,457.9 million

8 2,601 employees in 2022

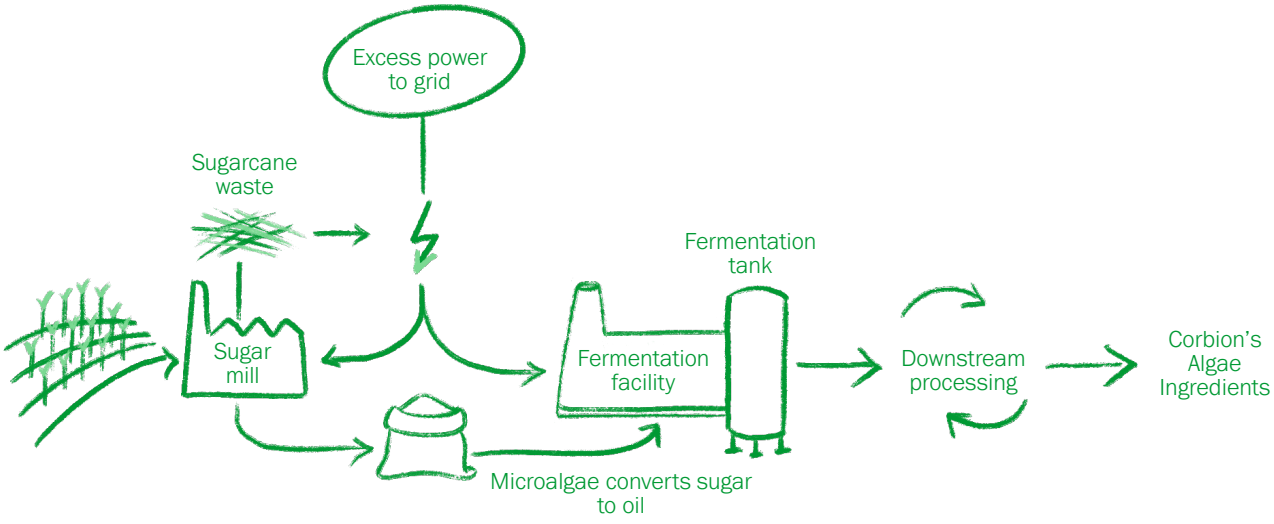
Decarbonizing feed for aquaculture

Corbion is a Dutch food and biochemicals company committed to lowering the emissions of the aquaculture sector by producing a sustainable feed alternative to fish oil for aquaculture species.

Since 2017, Corbion has been concentrating its investments and R&D efforts on producing a source of omega-3 for feed that does not rely on limited ocean resources and has a lower carbon footprint than fish oil.

As a result of these efforts, today Corbion is the first company to use industrial-scale fermentation and a circular production model to create sustainable nutrition by producing its algae-based feed ingredients, which are the source of long-chain omega-3 fatty acids derived from marine microalgae.

1/ Sustainable production of microalgae



Corbion's algae ingredients are produced sustainably using cane sugar, a significantly more productive source of sugar than wheat or corn, and renewable energy as feedstock.

Located in Brazil, Corbion's algae facility implements a fully circular approach: the farm is adjacent to sugarcane fields and a sugar mill and reutilizes sugarcane by-products not used in fermentation as source of renewable energy.

Thanks to this supply chain integration, in 2022, Corbion's algae plant circular model generated **greenhouse gases emissions reductions of 22 million kilograms (kg) CO_2.**

To support its decarbonization journey, Corbion is pursuing emissions reduction targets approved by the Science Based Targets initiative (SBTi)[1] and aligned with the ambition to limit average global temperature rise to 1.5°C.

[1] For confirmation of SBTi's validation of Corbion's target, please refer to the target dashboard here.

Specifically related to its Algae business, one of the key initiatives to achieve Scope 1 and 2 emissions reduction targets is the transition to renewable electricity. As a member of the global 'RE100' initiative to accelerate zero-carbon grids at scale, Corbion is committed to achieving 100% renewable electricity use by 2025.

Targeted Scope 3 reductions have been achieved through partnerships with raw material suppliers to better understand its material footprint and identify greenhouse gas reduction opportunities. In terms of logistics, Corbion has been reducing the number of empty trucks on the road in Brazil by optimizing the backhaul transport.

In 2022, Corbion achieved its 2030 target, aligned with a 2ºC pathway, by realizing **a 39% reduction in emissions per ton of product** compared to its 2016 baseline through the introduction of renewable electricity in some of its sites and energy saving projects, as well as the valorisation of lactic acid by-products.

In 2022, Corbion **reduced its absolute Scope 1 and 2 emissions by 8%,** and its **Scope 3 emissions by 17% per ton of product** compared to 2021. Corbion's climate action plan aims to reduce greenhouse gas emissions in line with a 1.5ºC pathway and achieve net zero by 2050. The plan covers a transition to renewable energy, radical process development and supplier engagement, among other initiatives.[2]

Increasing the ambition: from 2 °C to 1.5 °C pathway-alined targets

2030 emissions reduction targets based on 2016 baseline

2030 emissions reduction targets based on 2021 baseline

Since Corbion reached its 2 °C target in 2022, it decided to increase its ambitions and set new 1.5 °C targets, with the 2021 baseline.

2/ Lower impact on climate change of Corbion's algae omega-3 products as compared to fish oil

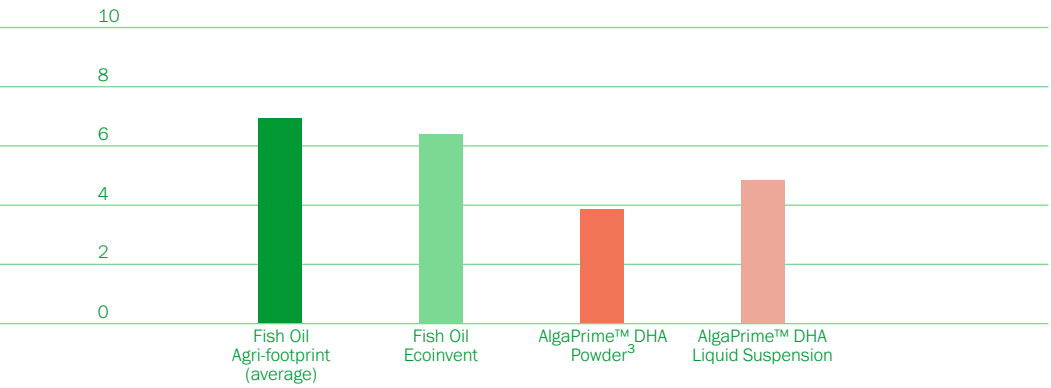


Figure 3. Carbon footprint (kg CO_{2eq}/kg Omega-3) [4]

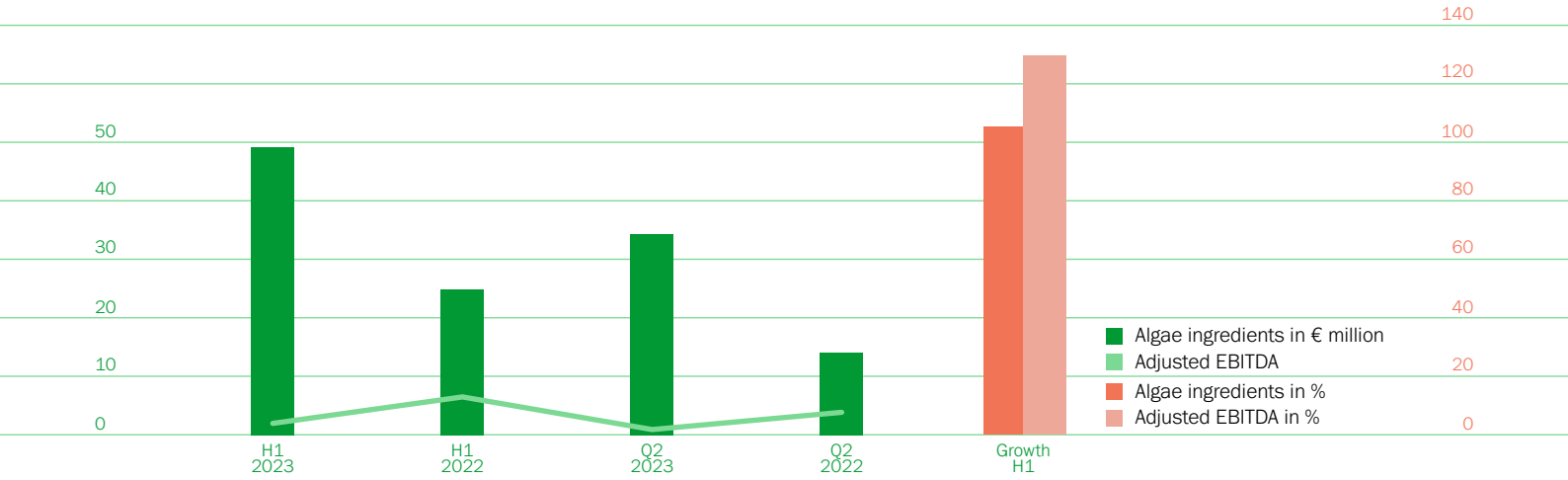
Algae-based omega-3 products manufactured by Corbion **emit 38% less CO_2 than fish oil.**

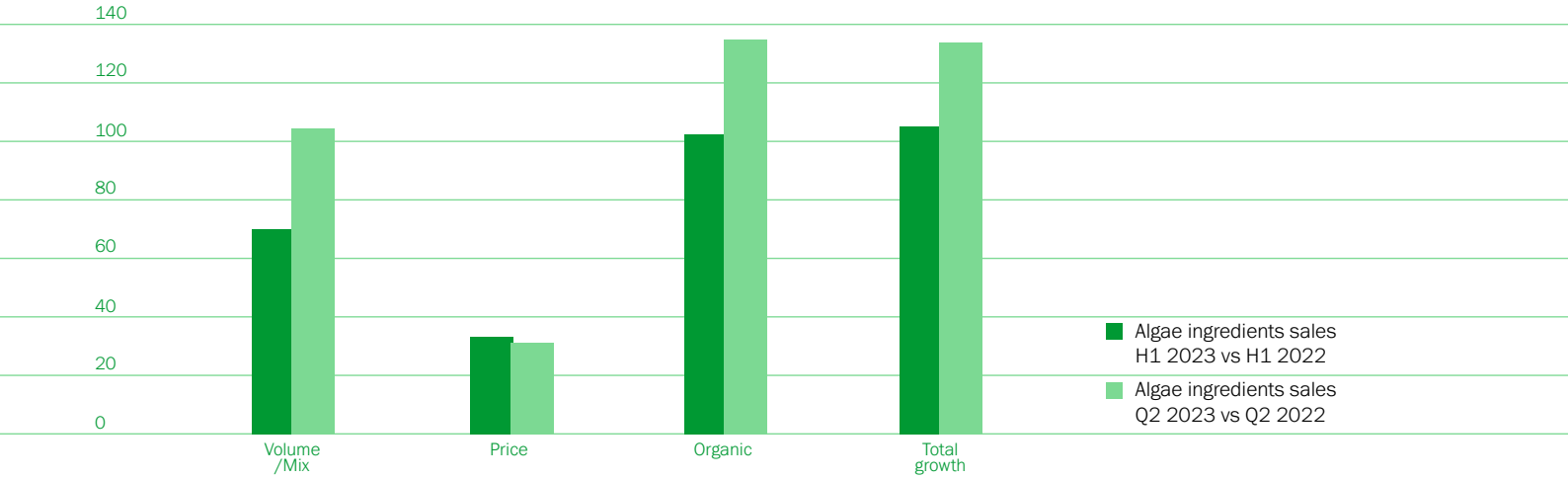
The climate impacts of fish oil production arise mostly from the fuel consumption of fishing vessels, which use diesel to both power and cool the engines, as well as the electricity and heat needed to operate the fishmeal and fish oil (FMFO) plant.

The use of renewable energy for algae omega-3 DHA production is one of the main factors contributing to a lower environmental footprint.

[2] For additional inspiration, please refer to this document.
[3] 'AlgaPrime™ DHA' is Corbion's algae ingredient, developed in both liquid and powder form to meet differet feed manufacturing systems' needs.
[4] The comparison with fish oil was based on data available in the databases Agri-footprint v5 economic (arithmetic average of the datasets available for the seven different countries "Fish oil, at processing/countries Economic", countries = Denmark, Chile, Peru, Norway, Germany, Great Britain, The Netherlands) and Ecoinvent 3.6 (Fish oil, from anchovy {GLO}|APOS). For more information refer to: *Davis et al., Life cycle assessment of heterotrophic algae omega-3, Algal Research Volume 60, December 2021, 102494.*

3/ Demonstrating success: economic viability of algae omega-3 production





In the first half of 2023, Corbion's Algae Ingredients business delivered significant volume/mix growth in aquaculture. The department's organic sales growth was driven by excellent volume/mix growth (69.3%) and a positive price effect (33.6%).

Corbion continues to invest in its Algae Ingredients plant, with a view to further improving capacity and entering new markets such as pet food and human nutrition.

"At Corbion we unleash the power of algae fermentation to provide nutritional ingredients while preserving the world's limited resources."

— Ruud Peerbooms,
President Algae Ingredients,
Corbion

Kvarøy Arctic

50%

less carbon footprint in the feed recipe they have developed compared to standard feed.

Fish In/Fish Out (FIFO) ratio of

0.8

Decarbonizing an aquaculture farm

Founded in 1976 by Alf Olsen, **Kvarøy Arctic** is a Norwegian salmon farm based in the Arctic Circle. Following pledges to reduce the environmental and climate impacts of its farming activities and of the overall industry, the family business is now one of the world's most sustainable salmon producers.

Kvarøy Arctic has established partnerships with fellow industry players including Corbion to reduce the carbon footprint of salmon feed while preserving its nutritional quality.

The feed developed and utilized by Kvarøy Arctic combines Corbion's algae ingredient with marine ingredients derived from byproducts and natural colorants. Kvarøy Arctic has not patented its innovative recipe and openly shares it with other farmers in an effort to drive emissions reductions in the industry.

1/ Developing an innovative feed formula with a lower carbon footprint & lesser impact on biodiversity

Aquaculture can achieve CO_2 emissions reduction through the optimization of feed formulations. Kvarøy Arctic's experience shows that, to reduce the carbon footprint of its salmon farm, it is essential to use ingredients in fish feed that have a better environmental profile while also supplying vital nutrients to farmed populations.

In 2012, Kvarøy Arctic started collaborating with BioMar, a fish feed company, to develop a sustainable fish feed. Kvarøy's salmon feed consists of 75% plant-based ingredients and 25% marine ingredients only made from by-products from the North Atlantic fishing industry, and uses natural coloring agents instead of chemical alternatives.

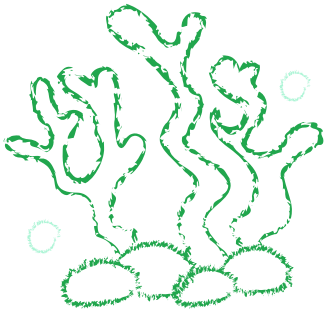
This responsibly sourced, clean feed contains innovative ingredients including Corbion's algae ingredients, which allow Kvarøy Arctic to sustainably cultivate salmon containing high omega-3s with one of the industry's lowest "Fish In/Fish Out" ratios.

"We have a clear vision for the future where sustainability is the driver for innovation. But we need companies that are willing to invest both time and resources together with us. For us, Kvarøy has had a leading role in aquaculture showing the world that this is possible"

— Vidar Gundersen,
Global Sustainable Director,
BioMar Group

Climate benefits of sustainable feed

A reduction in the carbon footprint from feed will have the greatest effect on the total carbon emissions from salmon production. By careful selection of feed raw materials, Kvarøy's salmon feed can be optimized to **reduce the carbon footprint compared to standard feed by up to 50%,** and at the same time reduce the overall environmental impact from feed.



Health and biodiversity benefits of sustainable feed

Thanks to the use of fermented microalgae in their feed, Kvarøy Arctic's salmon contains twice as much omega-3 as farmed alternatives, and the same amount as wild salmon.

The use of microalgae also helps to preserve wild fish stocks. The Fish In/Fish Out (FIFO) ratio represents how many fish are used for fish oil and fish meal needed to produce a farmed salmon.

Kvarøy Arctic wanted to improve the industry's gold standard of 1:1, equivalent to using one wild fish as feed in order to raise one farmed fish.

In 2021, it achieved a FIFO ratio of 0.8, and is now aiming for <0.4, meaning that less than half a fish will be used to produce a fully grown Kvarøy salmon.

Balancing the costs of sustainability

The economic viability of developing Kvarøy's feed recipe is strong due to the higher margins that Kvarøy is able to achieve by differentiating its sustainable salmon from "commodity salmon". In this manner, the cost of innovation is passed along the supply chain to the end consumer, who is willing and able to pay a higher price for a more sustainable and healthier product.

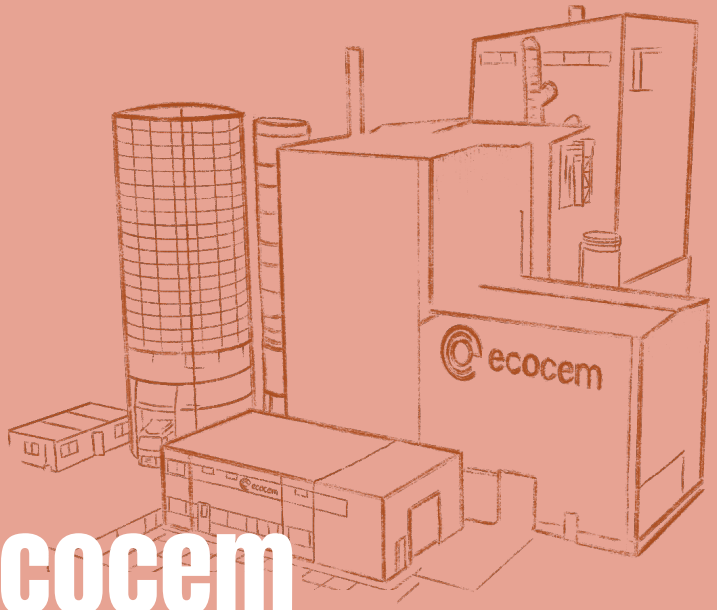
Cement industry decarbonization

The cement sector represents around 8% of global CO_2 emissions and since three-quarters of the infrastructure that will exist in 2050 has yet to be built, these emissions are expected to continue to rise due to increased urbanization and population growth. Approximately one-third of cement's CO_2 emissions come from energy use while two-thirds are process emissions, resulting from the chemical reaction of heating limestone to produce clinker, a critical ingredient in conventional cement. Representing around 10% of concrete's final mass on average, clinker is responsible for more than 90% of concrete's CO_2 footprint.

There are only two ways to reduce cement process emissions:

- Permanently capture and store the carbon (CCS)
- Reduce CO_2 emissions at the source by lowering the clinker ratio and avoiding producing process emissions.

The latest IPCC report highlights that CCS is still an immature technology for the cement industry and unlikely to have any material impact before 2030. The second, more readily available decarbonization pathway – reducing the clinker ratio through the deployment of innovative technologies – can instead deliver substantial CO_2 reductions by 2030.



Ecocem

Lessons learned:

- The development of an innovative, research-led culture and mindset within a company drives ambition upwards and delivers great results.
- Innovation is a continuous process which requires collaboration with a range of experts and academics. Facilitating their interactions is critical.
- Partnerships with value chain partners (CB Green, Cemex France, Saint Gobain, Arcelor Mittal and Vinci) are essential to delivering ambitious results at scale.
- Carbon disclosure to the Carbon Disclosure Project allows a company to act strategically in an increasingly unpredictable market.

16 Mt

of CO_2 saved since 2003 compared to equivalent traditional cement (CEMI)

3,382 t

of CO_2 saved on the Olympic Village construction site

30,748 t

of CO_2 saved from reusing wasted Blast Furnace Gas at Dunkirk production plant

€ Expected revenues in 2023 - €230 million

Expected 200-500 employees in 2023

Created in 2000, **Ecocem** is the European leader in low-carbon cement technologies.

Driven by a commitment to low carbon and an innovative mindset, Ecocem develops and delivers technologies focused on enabling rapid decarbonization. It does so by developing alternatives to clinker in the cement production process. Its latest solution is the result of a decade of research and investment, which maximizes the performance and decarbonization potential of abundantly available filler materials and locally sourced industrial and natural Supplementary Cementitious Materials (SCMs) that can reduce cement's emissions by up to 70%.

In addition, Ecocem works with the Carbon Disclosure Project (CDP) to understand its overall carbon footprint and takes decisions to decarbonize its activities.

As a founding member of the Alliance for Low-Carbon Cement and Concrete (ALCCC), a trade association which brings together many ambitious companies working on low- and no-clinker cement solutions, Ecocem proactively advocates for ambitious sectoral changes.

From innovation labs to the reality of the Paris 2024 Olympic Athletes Village and Le Grand Paris, Ecocem's decarbonization pathway is on a path to delivering material reductions in CO_2 by the end of the decade.

Decarbonization of cement production - key learnings

A forward-looking, innovative mindset across the company can enable breakthrough changes.

Detailed measurement of carbon footprint enables informed business decisions.

Value chain partnerships enable impactful sectoral changes.

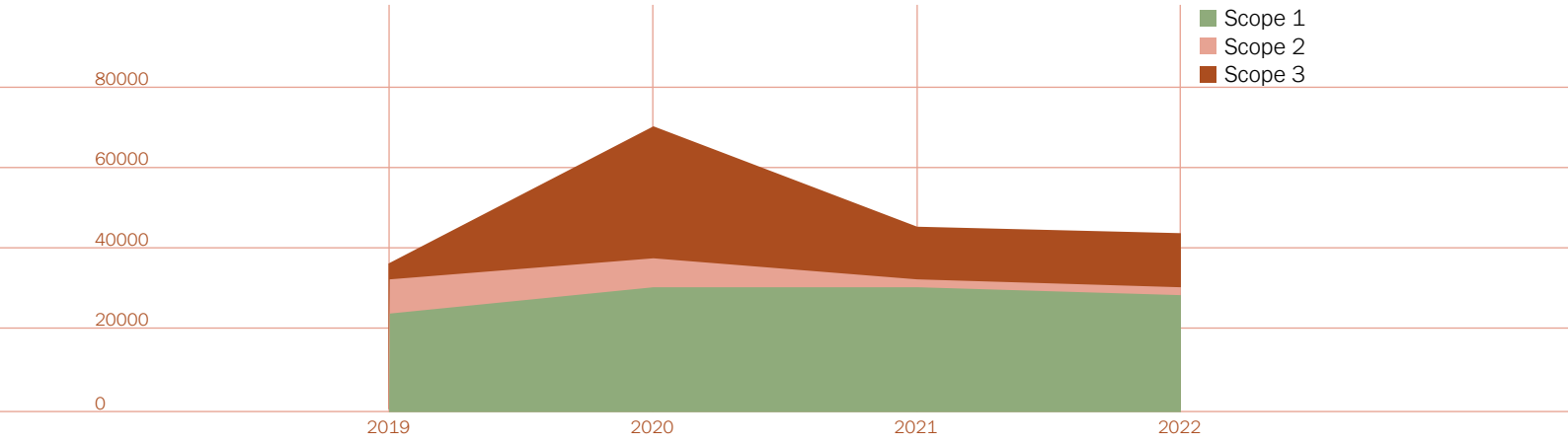


Figure 1. Ecocem's group emissions by Scope
The calculation methodology changed as of 2020, making comparison with 2019 numbers difficult. Scope 3 emissions peaked in 2020 due to long-distance shipping.

1/ A forward-looking innovative mindset across the company can enable breakthrough changes

The use of steel slags has long been recognized as a way of promoting circular economy and clinker reduction. Ecocem originally entered the market by greatly increasing the technological potential of these slags.

Since 2003, Ecocem's Ground Granulated Blast-furnace Slag (GGBS) produced 518,087 tons of CO_2 while 16,444,266 tons of CO_2 would have been produced by equivalent CEM I traditional cement production (Figure 3). As a result the use of Ecocem cement resulted in the avoidance of nearly 16 million tons of CO_2 from entering the atmosphere.

Between 2019 and 2022, Ecocem reduced its overall carbon footprint per ton of product by 51%, from 43kg CO_{2eq} to 22kg CO_{2eq} (Figure 2).

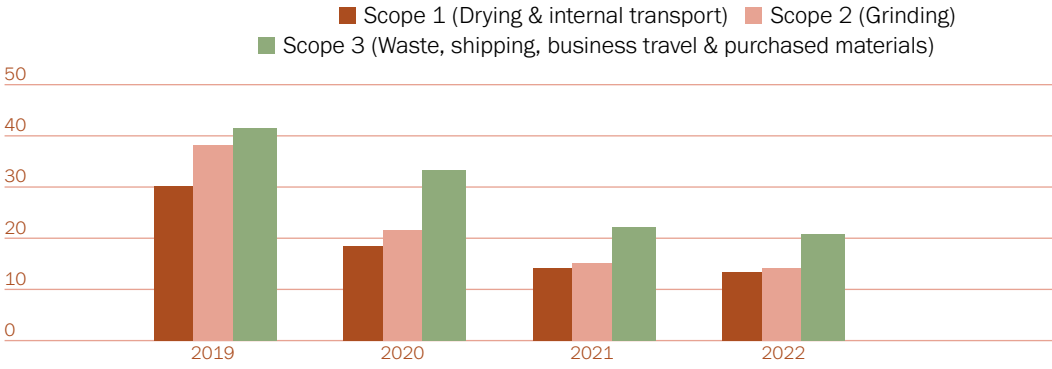


Figure 2. Group carbon footprint by ton of product

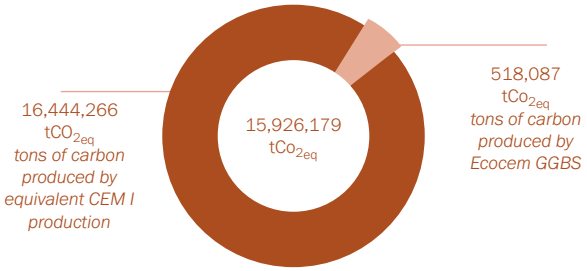


Figure 3. Ecocem's Carbon Saving Graph

Beyond blast furnace slags, which will soon be phased-out as the steel industry decarbonizes, Ecocem has continued to innovate and develop alternative low carbon cement solutions. The company's latest low-carbon cement technology ACT uses widely available clinker substitutes such as limestone filler. There are about 20-25 SCMs that can be used as clinker substitutes and allow the cement industry to decarbonize quickly and at scale.

2/ Detailed measurement of carbon footprint enables informed business decisions

Besides technological innovations related to products themselves, Ecocem is also committed to reducing its overall carbon footprint.

Carbon disclosure through the Carbon Disclosure Project (CDP) helps identifying emissions' sources and develops greater awareness of climate impacts and climate-related risks and opportunities:

- Using blast furnace gas instead of natural gas in the drying process eliminates fossil fuel use and reuses waste products that would otherwise be burnt into the atmosphere. Through this initiative, **Ecocem France has saved 150.6 million kWh of natural gas from being used and 30,758 tons of CO_2 emissions since 2020.**

- In 2021 and 2022, Ecocem decided to switch to a greener fleet to further reduce its internal transport emissions. To this date, **switching to Hydrotreated Vegetable Oil already enabled a saving of 26.4 tons of CO_2.**

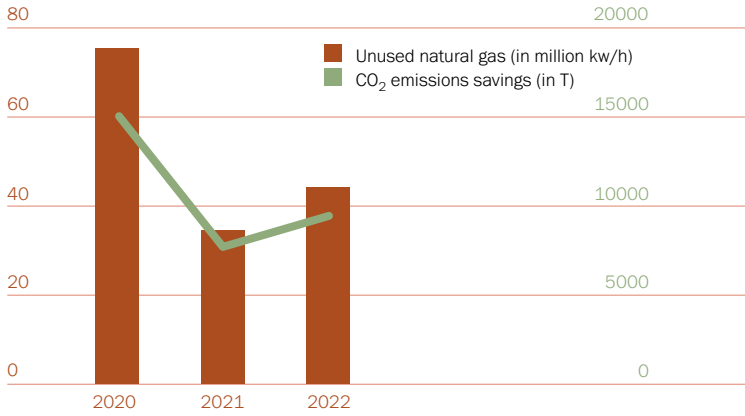


Figure 4. Emissions saving linked to the reuse of blast furnace gas

3/ Developing innovative internal tools facilitates the uptake of lower emissions materials

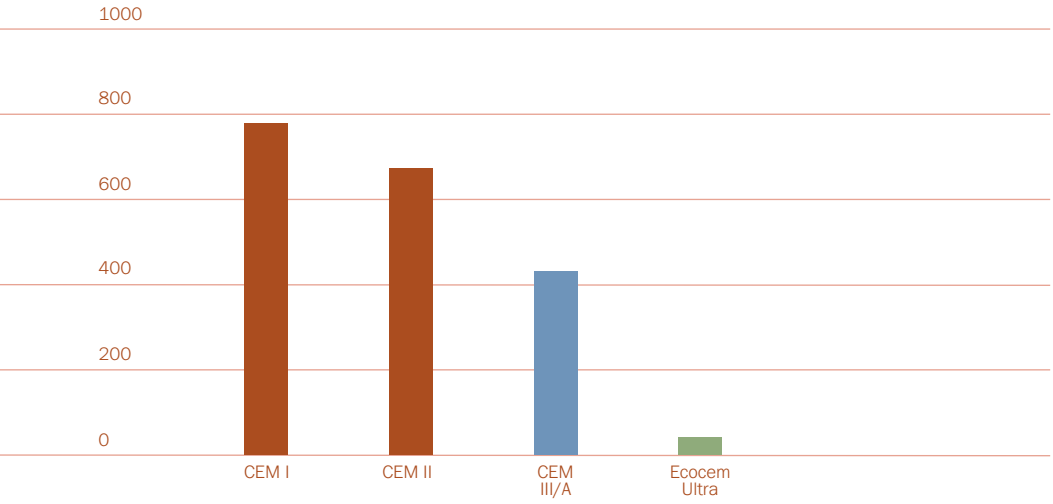


Figure 5. Kilograms of emissions per ton of cement

Ecocem Ultra, a low-carbon cement technology developed in partnership with Vinci, is currently being used in the construction of Paris Olympic Village ahead of next year's Olympic games.

The carbon footprint of Ecocem's Ultra is 78kg CO_{2eq} per ton of cement, around 90% less than traditional cement (Figure 3).

Using Ecocem's Ultra in the Olympic Village construction site **helps save 3382 tons of CO_2 from being released into the atmosphere.**

"Innovation is our lifeblood. Over the last decade we have focused on developing scalable and easily implementable low carbon cement technology solutions that can use a range of locally available raw materials. Our latest innovation ACT, if adopted widely by the cement industry, can deliver substantial reductions in CO_2 emissions by 2030"

— Donal O'Riain,
Founder and CEO,
Ecocem

Demonstrating economic success

Founded in 2000, Ecocem has four manufacturing facilities across Western Europe, selling into several major international markets including France, Ireland, the Netherlands, Belgium, Germany, Scandinavia, the UK, etc. **It produces over two million tons of low carbon cement annually and is responsible for around 10-15% of the cement supply in the markets in which it operates (let alone the low-carbon cement market).**

Ecocem's products can be found in many of Europe's largest and most advanced infrastructure and construction projects, including the Grand Paris Express, Athlete's Village, Paris, and HS2 in the UK. It works closely with many of the world's largest materials and construction companies, including Vinci Construction, Eiffage, Cemex, Holcim, and Heidelberg.

Some of the world's most respected organizations are shareholders of Ecocem and its subsidiaries, induding Saint Gobain Group (world's largest building materials company, market capitalization €28 billion), ArcelorMittal (world's largest steel and mining company, market capitalization €19 billion), and Breakthrough Energy Ventures.

Ecocem is a research led organization and has invested tens of millions of euros in the research and development of low carbon cement technologies. It has nearly 30 researchers directly employed by Ecocem, 16 of which are PhDs, and a wider network of nearly 50, including leading materials scientists working closely together to find solutions to global cement decarbonisation. It works closely with many of the world's leading materials science universities, including Paris-Saclay University, Indian Institute of Technology, Technical University of Munich, University of Toronto, University College London, etc.

Ecocem's revenues have tripled since 2015 and it expected revenues of around €230m in 2023. Ecocem is Europe's independent leader in low carbon cement technology development, sales and growth.

Steel industry decarbonization

Though emissions from the steel sector have already halved since the 1960s, the sector's direct and indirect emissions still represent 5% of CO_2 emissions in Europe and 7% globally. Including upstream Scope 3 emissions (cradle-to-gate carbon footprint), the steel industry represents around 11% of global CO_2 emissions. Therefore, according to the European Commission's Joint Research Centre, the steel industry needs to develop and commercialize new low carbon technologies in the next decade to remain aligned with the European Union's climate objectives.

97% of the European Union's direct emissions from the steel industry come from integrated traditional steelmaking (Blast Furnace - Basic Oxygen Furnace (BF-BOF route)), which, in addition to being emissions intensive, has important environmental impact as it relies on raw materials extraction. For a ton of steel produced through the BF-BOF route, operational emissions amount to 1,987 tons of CO_2 on average. It is therefore essential to find alternatives to the BF-BOF route especially as, according to Sandbag, 74% of blast furnace capacity will have to be renovated this decade.

Two main solutions can be highlighted:

- BF/BOF mills can be replaced by electric arc furnaces (EAFs) which can run on electricty or hydrogen. This can achieve 55% emissions reduction by 2030 especially if EAFs run on fossil-free electricity.
- Recycling streams can be further developed to reduce raw materials extraction and avoid the iron making process. This can result in up to 1,787 tons of CO_2 being saved per ton of recycled steel used as the average carbon footprint of recycled steel is 0.357 tons. In the European Union, the proportion of steel scrap used in crude steel production reached 57.6% in 2021 compared to 69.2% in the US.

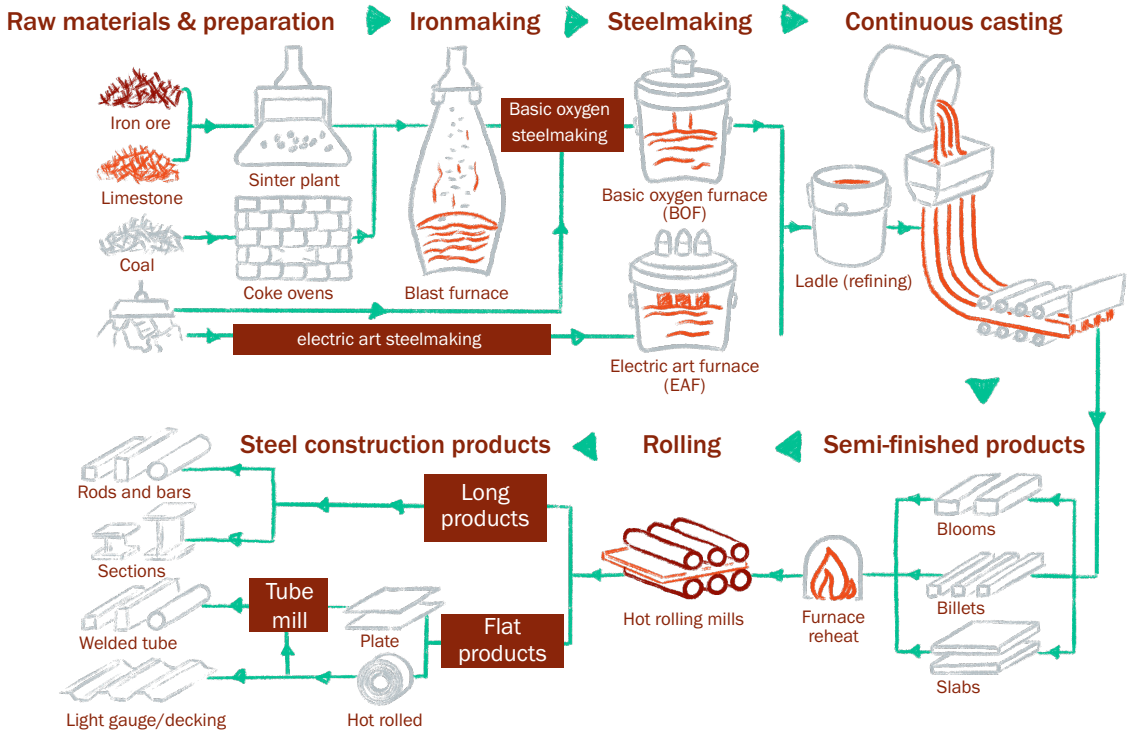
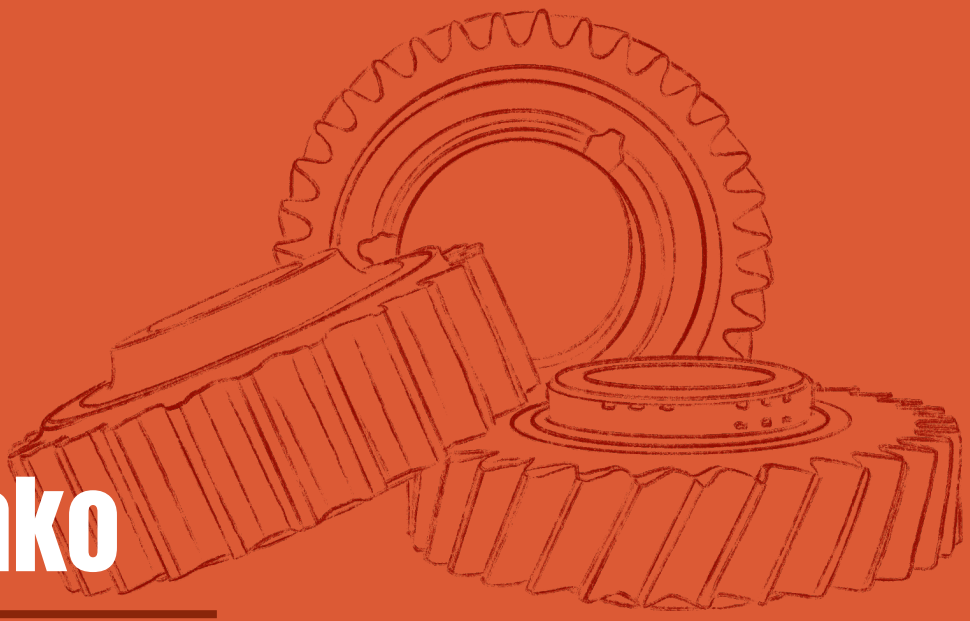


Figure 1. Steel production processes



Ovako

“Our success comes from a need to continually improve because we constantly want to push ourselves to be as environmentally friendly as possible.”

— Vendela Stenius,
Sustainability and Communication Specialist, Ovako

1st
in the world to heat steel prior to rolling with green hydrogen

97%
recycled steel scrap based production

80%
lower CO_2 emissions cradle-to-gate than the industry average

€ Group's revenue in 2019 - €921 million

8 2,900 employees in 2022

The forerunners of **Ovako** were founded around 500 years ago. Since then, Ovako has become the largest recycler of Nordic steel scraps and is engaged in responsible business practices across the entire supply chain. The company is a steel industry leader in minimization of carbon emissions per metric ton of finished steel product, with the entire supply chain taken into account.

Over the years, investments in R&D, innovative thinking and a close collaboration with customers have allowed Ovako to continuously improve with the same objectives: boost productivity, ensure safety, and secure sustainable processes that drive growth.

On average Ovako's steel products today consist **of more than 97% recycled steel.** Ovako has so far reduced its **Scope 1 & Scope 2 carbon emissions by 58% between 2015 and 2022 and its cradle-to-gate emissions by 37% between 2015 and 2020 (Figure 2).**

Cradle-to-gate global emissions for the industry are estimated at 2,600 kilogram (kg) of CO_2 per ton of hot rolled steel, while Ovako achieves a total cradle-to-gate CO_2 footprint of around 430 kg of CO_2 per ton.

80% lower cradle-to-gate carbon footprint than the global average - The recipe to success

Developing a circular business model considerably reduces the climate and environmental impacts.

Switching to fossil free electricity and improving energy efficiency further reduce carbon emissions.

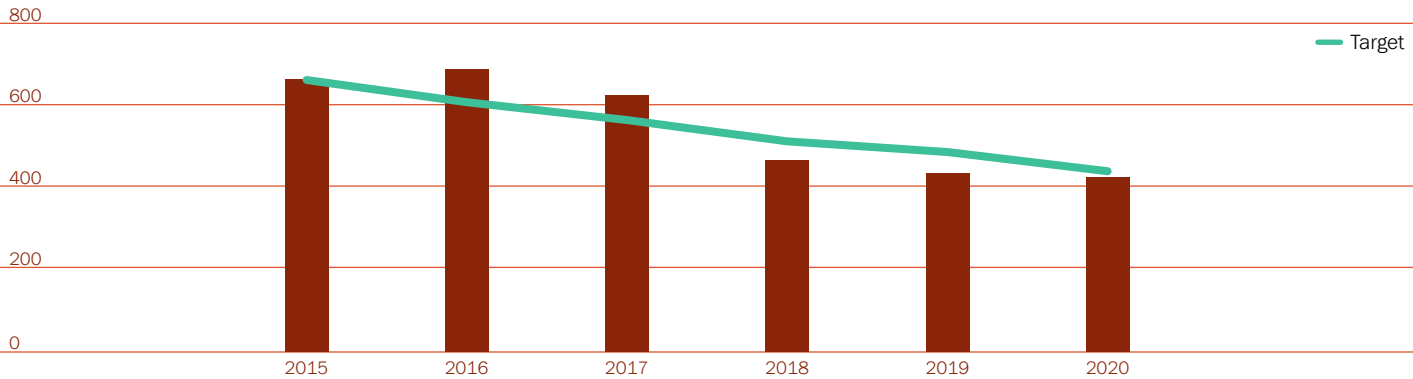


Figure 2. Ovako's cradle-to-gate carbon footprint (in kg) per ton of hot bar steel product.

1/ Developing circularity measures considerably reduces the climate & environmental impacts

Ovako's business model is based on circularity and recycling, remelting scraps to make steel. As steel is totally and infinitely recyclable, scrap-based steel has the same quality as primary steel production.

Ovako products consist of an **average of 97.2% recycled steel scrap, corresponding to over 800,000 tons of scrap per year,** coming from Ovako's own mills, as well as scrap from downstream manufacturing industries and end-of-life products.

For every newly produced ton of steel using recycled materials, **1,100 kg of iron ore and 600 kg of coal can be conserved as well as 74% of energy can be saved,** compared with the BF-BOF route, considerably reducing the climate and environmental impacts.

Ovako works with various partners to constantly find ways for recycling and reuse. The ultimate goal is to explore potential applications for all residuals.

"At Ovako we are fully committed to achieving our ambition of zero emission steel production. But we know that we can't do this alone. Success relies on building strong partnerships throughout our value chain, including suppliers, research institutes and customers. By taking a collaborative approach we can share knowledge, learn from each other -both successes and failures- and broaden our experience."

— Vendela Stenius,
Sustainability & Communication specialist, Ovako

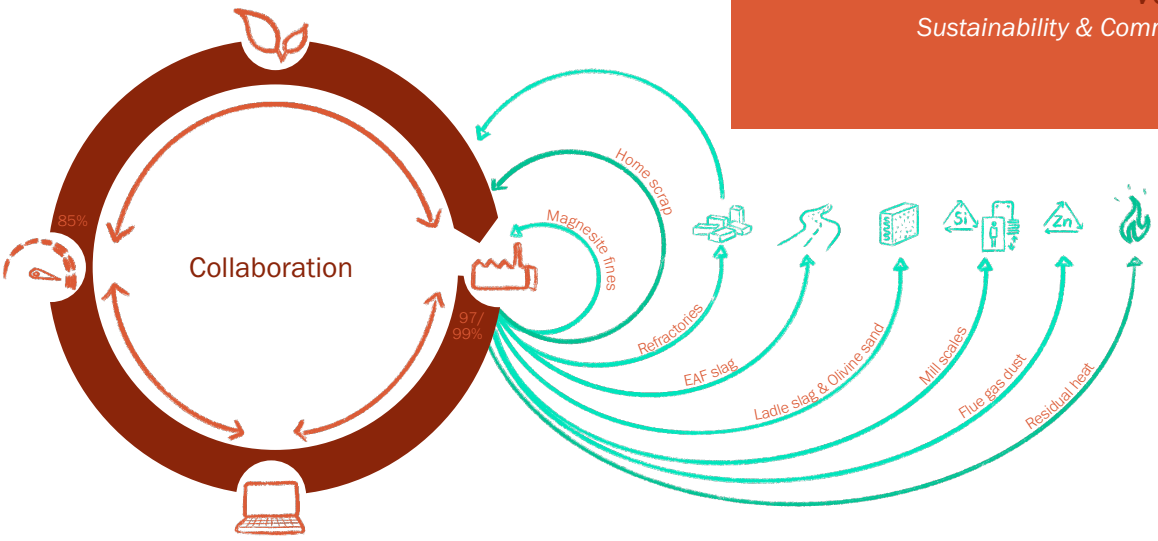
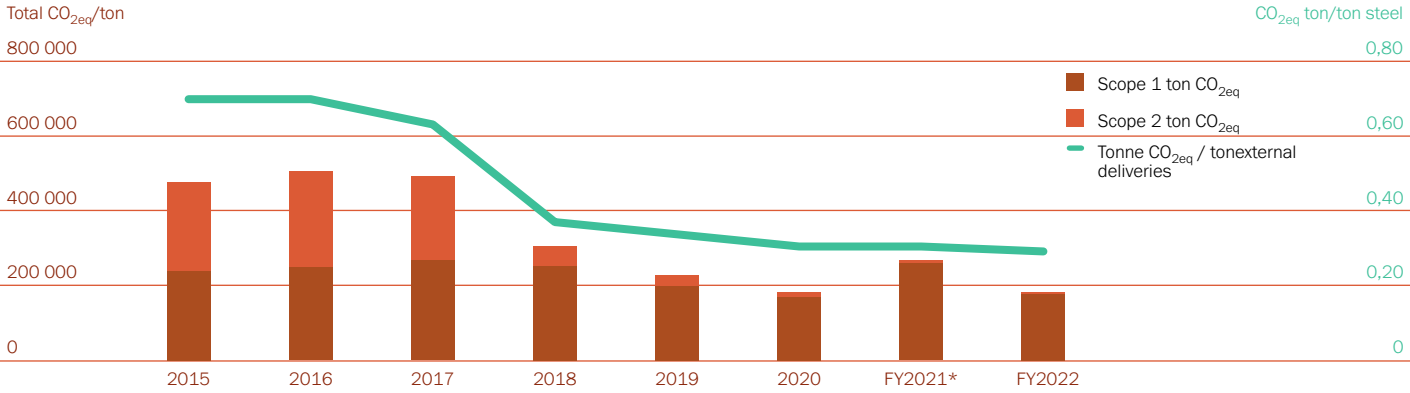


Figure 3. Ovako circularity measures in practice

Residual heat from Ovako's main production sites in Sweden is used in local communities via district heating networks. During the melting process in the steel mills, gases of several hundred degrees are created and cooled before being filtered and released into the atmosphere.
A large portion of the heat previously wasted can be utilized to produce district heating. **The residual heat is enough to cover about 40% of the district heating needs in the whole town of Hofors (around 10,000 inhabitants).**

2/ Switching to fossil free electricity and improving energy efficiency reduce carbon emissions



*Increased emissions due to 15 months in financial year reporting

Figure 4. Ovako's Scope 1 and 2 greenhouse gases emissions between 2015 and 2022

Achievement: Scope 2 emissions brought to almost zero

In the last decade, the company reduced its emissions, with much of its key equipment - from electric arc furnaces that melt the scrap steel to the heat treatment furnaces - now entirely electrified and powered by fossil-free electricity.

These activities saw the company reduce its operational CO_2 emissions from 485,000 to 180,000 tons per year between 2015 and 2022, corresponding to 58% emissions reduction of CO_2 in Scope 1 and 2.

Lessons learned:

- Where metal scraps are available, the recycling route is much more efficient than the traditional BF-BOF route and considerably reduces the environmental impact.
- Value chain partnerships are essential to develop an efficient circular business model.
- Collaborating with key partners can enable strategic investment decisions in breakthrough technologies.
- A clear vision and strategic investments in breakthrough technologies enable profitability and decarbonization.

"Green hydrogen can be used simply and flexibly, with no impact on steel quality, which would mean a very large reduction, around 50%, of Ovako's Scope 1 & 2 carbon footprint."

— Göran Nyström,
Head of Technology and Marketing, EVP

First in the world to heat steel prior rolling with hydrogen

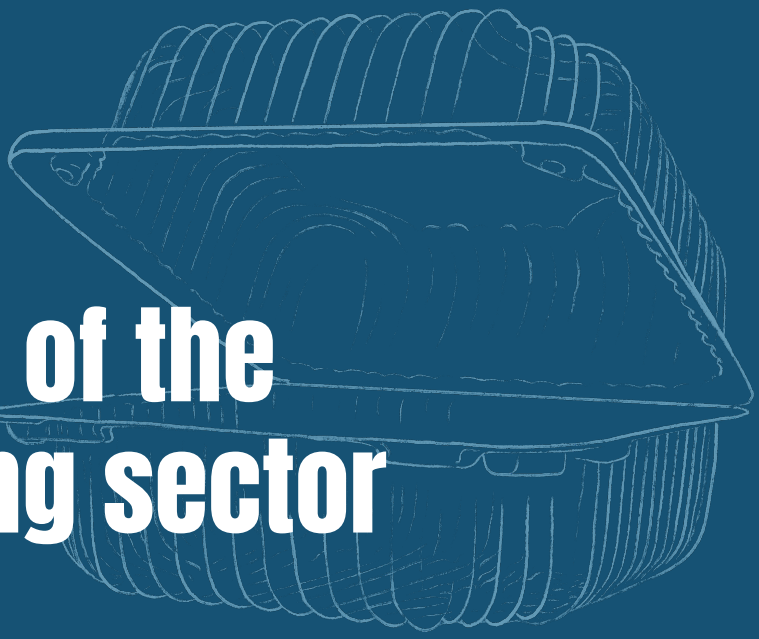
The heating before rolling process cannot be directly electrified because of the heat required (over 1,200 °C).

In order to further reduce greenhouse gas emissions, Ovako collaborated with H2 Green Steel, Volvo Group, Hitachi Energy and Nel Hydrogen to invest in an electrolyzer and related equipment to implement the hydrogen heating method in 2021.

Switching to green hydrogen makes it possible to eliminate over 50% of the CO_2 emissions when fully implemented[1].

This investment was made possible thanks to public funding through the Swedish Energy Agency, partly coming from the European Union. The plant, a world's first, was inaugurated in September 2023.

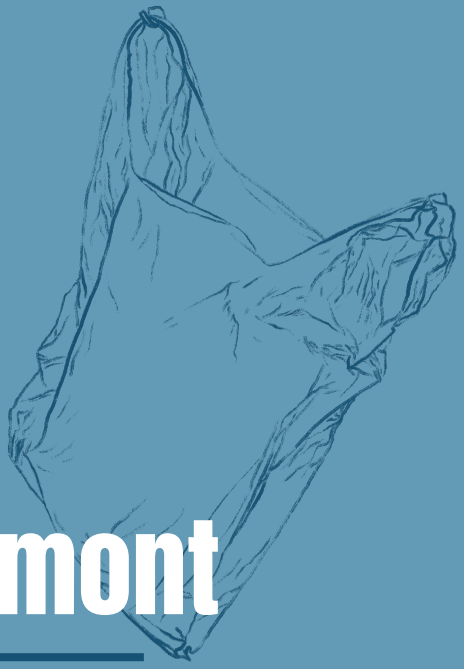
[1] "Environmental Defense Fund is working with industry partners to quantify and understand hydrogen emissions, which indirectly contribute to climate change, with a view to minimizing them in the future thereby maximizing the climate benefits of hydrogen."



Decarbonization of the plastic packaging sector

Since the 1950s, the world has produced over 9 billion tons (bt) of plastics. In 2019, the global production of this material amounted to 460 million tons (mt) which contributed to 3.4% of the world's greenhouse gas emissions. Of these plastics, around 36% are used in packaging. Currently, the majority of plastics used for packaging applications are made from fossil-based raw materials, therefore consuming non-renewable resources and releasing fossil carbon in the atmosphere.

Bio-based compostable and biodegradable plastics can provide an important recycling alternative, in particular for those packaging applications in contact with food. Furthermore, by maximising the recovery of organic matter, compostable packaging increases the development of sustainable systems for the collection and treatment of biowaste. This in turn allows to (i) increase diversion from incineration and landfill of food waste, thus reducing greenhouse gas emissions and (ii) obtain high quality compost, thus reducing the risk of microplastic release in the environment.



Novamont

“For us, being a Benefit Corporation and a B Corp means seeing business as a force for regeneration, rethinking the role of companies in society and looking beyond short-term profit-seeking, being transparent and delivering value to the local community.”

— Catia Bastioli,
Chief Executive Officer,
Novamont

71%

of Novamont’s total revenues (426 million euros) were generated by circular products & activities, in 2022.

284 kt

of CO_{2eq} was the approximate equivalent of the decarbonization potential of the 2022 volumes of bioplastics

25 kt

CO_{2eq} saved between 2009 and 2022 by using Novamont’s Mater-Bi bags in Unicoop Firenze’s stores.

€ Overall turnover in 2022 - €414 million

8 632 employees in 2021

Novamont is an Italian company B Corp certified leader in the production of biodegradable and compostable bioplastics from renewable resources. Its bioplastics optimize the management of organic waste by avoiding microplastics, reducing environmental impacts and increasing the circularity of economic systems. Novamont's bio-based plastics are used in applications designed to be in contact with organic content such as, among others, food packaging.

With sustainability at its core, Novamont adopts a circular bioeconomy model aiming at reducing waste, increasing the efficient use of resources and helping to conserve the quality of the environment. Its efforts are spent on regenerating local areas and revitalizing industrial sites that are decommissioned, thus creating socially, economically and environmentally positive impacts for its value chain.

By establishing partnerships with stakeholders along the value chain, Novamont fosters innovation and builds markets from scratch, developing materials that are designed to increase the sustainability of end products and ultimate soil and water preservation and regeneration.

Learnings from Novamont's success story:

Implementing a circular bioeconomy model based on efficient use of renewable resources and on territorial regeneration contributes to decarbonizing the economy.

The production of innovative bio-based plastic materials generates significant greenhouse gas and CO_2 emissions savings as compared to fossil-based plastic materials.

Partnerships for sustainable development are essential to speed up the transition towards more sustainable consumption and production patterns.

Integration of circular bioeconomy into concrete policy measures beyond granting subsidies is needed to help innovative technology to grow to scale and address current regulatory bottlenecks.

1/ Implementing a circular bioeconomy model based on efficient use of renewable resources & on territorial regeneration contributes to decarbonizing the economy

Novamont promotes a circular bioeconomy model, which looks at bioeconomy as a factor in territorial regeneration, based on three main pillars:

Regeneration of decommissioned industrial sites

Biorefineries are built in disused or no longer competitive production sites and regenerated through world-first technologies. This enables Novamont to generate positive effects on employment and local economies in exisiting communities, while protecting virgin areas from land take and reducing CO_2 emissions. Reductions come from construction as well as from the increase of energy efficiency of existing plants and use of process by-products.

Sustainable integrated agricultural value chain

Agricultural value chains, integrated in local areas, are based on sustainable practices respecting biodiversity as well as aquatic and terrestrial ecosystems. Novamont purchases raw materials that have lower greenhouse gas emissions throughout their life cycle or that are carbon neutral according to PAS 2060. In 2022, **about 10,957 tons CO_{2eq} from the value chain were offset via voluntary carbon offset credits recognized under the PAS 2060 standard for carbon neutrality.**

Products as solutions

Novamont's products are designed to solve specific problems closely related to water and soil quality. Specifically, products are conceived to close the carbon cycle and ensure that no persistent substances accumulate in compost, treated water, sludge, and soil. Products are also designed to be reused and recycled, therefore prolonging the storage of biogenic carbon.

The circular bioeconomy model of Novamont is fully aligned with the circular economy goals and national bioeconomy strategies aiming at using renewable resources produced in a sustainable way while contributing to the decarbonization of the economy.

Developing a tool to calculate the contribution to circular economy

Novamont developed a metric to measure the company's contribution to the circular bioeconomy: the regenerative turnover. This indicator is calculated by multiplying the actual turnover by the Circular Flow Index (ICF), which is the amount of flows of green material and energy that are generated by renewable sources, recycling, or using regenerative solutions. Incoming circular flows are recycled or renewable raw materials and energy, while waste sent for recycling, recovery or regeneration, recovered end products that are certified compostable and biodegradable in soil are outgoing circular flows. Linear flows are all non-regenerative flows, such as energy from fossil fuels, non-renewable raw materials and waste sent to landfills. The greater the ICF, the better a company's capacity to regenerate revenue from its circular products or activities. In 2022 Novamont's ICF was equal to **0,71** (within a scale that ranges from 0 to 1).

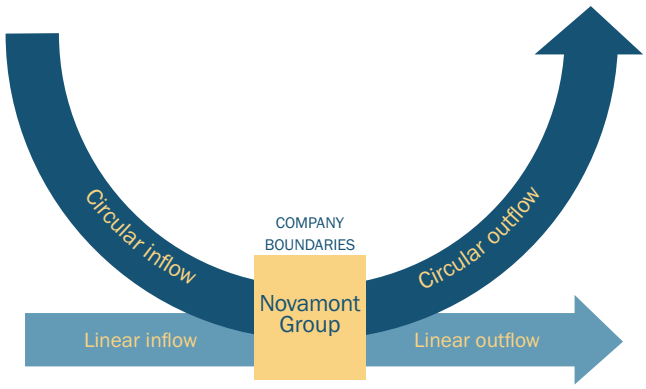


Figure 1. ICF metric measures the share of the circular inflow and outflow compared to the overall inflow and outflow

Demonstrating economic viability

In 2020, Novamont committed to a minimum threshold for revenues generated by circular products and activities ('regenerative revenues') of above 50%.

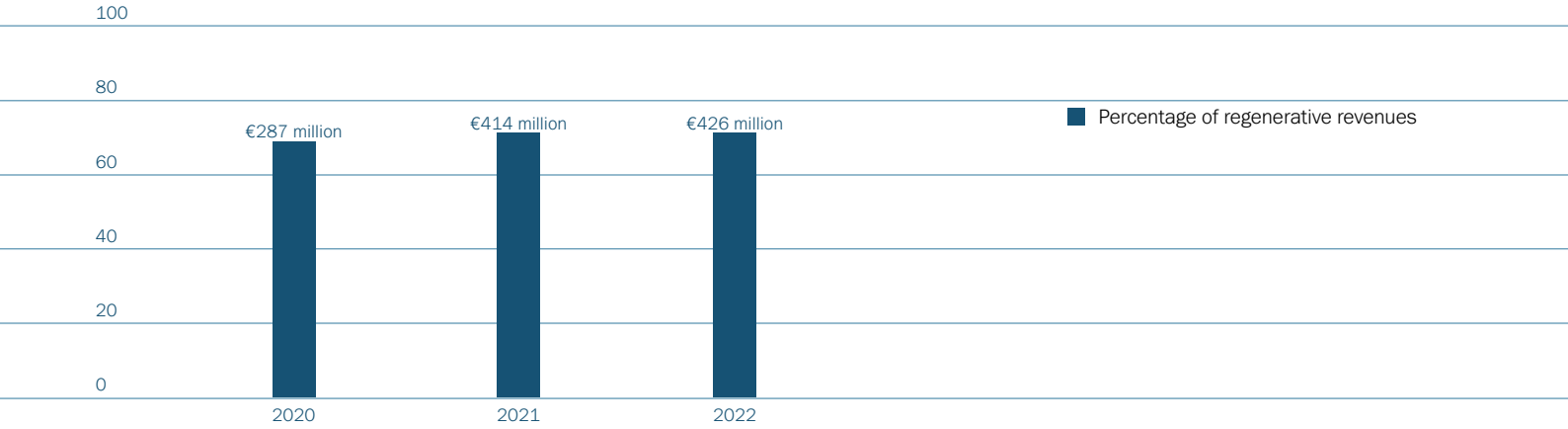


Figure 3. Total revenue of Novamont

2/ The production of innovative bio-based plastic materials generated significant GHG & CO_2 emissions savings as compared to fossil-based plastic materials

Novamont's main product is Mater-Bi, an innovative family of biodegradable and compostable bioplastics made from renewable resources that are used for different applications, among which is packaging. A building block for the production of Novamont's bioplastics is 1.4 bio-butanediol (1,4 bio-BDO), which is produced directly from sugars through fermentation and **has less than half the carbon footprint of conventional BDO produced from fossil fuels.**

Since the beginning of Novamont's operations, five different generations of Mater-Bi have been developed and industrialized. Each Mater-Bi generation has achieved a significant reduction of associated greenhouse gas emissions, thanks to the substitution of fossil-based with bio-based monomers, the increased integration of the supply chain, and the adoption of cogeneration and trigeneration plants, as well as the use of biomethane from exhausted cells, with a view to maximizing energy efficiency.

1st Mater-Bi generation

Complexed starch technology using purchased fossil source polyesters

2nd Mater-Bi generation

Use of self-produced fossil-source Origo-Bi polyesters

3rd Mater-Bi generation

Use of self-produced azelaic acid from a renewable source

4th Mater-Bi generation

Use of self-produced 1,4-BDO from renewable source

5th Mater-Bi generation

Use of self-produced new monomers from renewable sources

With its 4th generation of Mater-Bi, Novamont achieved about a **40% reduction of greenhouse gas emissions** as compared to its 1st generation product. This decarbonization result was obtained thanks to the implementation of Novamont's circular bioeconomy model.

As compared to primary compostable plastic materials but manufactured from fossil resources, the estimation of decarbonization potential associated with the 2022 volumes of Mater-Bi primary bioplastic and Origo-Bi primary biopolymer was equal to approximately **284,000 tons CO_{2eq}**.

The high environmental performance of Novamont's primary bio-based plastic materials is mainly due to highly integrated processes able to recover energy and high value products, powered by energy self-produced by high co-generation plants' efficiency and employing 100% renewable electricity purchased from renewable wind sources. On top of this, the use of renewable monomers characterized by a better performance than fossil-based equivalent significantly contributes to lowering the environmental impact of Novamont bio-based plastics.

3/ Partnerships for sustainable development are essential to speed up the transition towards more sustainable consumption & production patterns

Unicoop Firenze, an Italian consumers' co-operative, was the first large-scale retail operator in Italy to replace traditional plastic takeaway bags with biodegradable and compostable ones in Mater-Bi, as well as the first Italian retailer to have introduced bioplastic bags and gloves for the fruit and vegetable department in its 103 stores. Furthermore, in 2017 Unicoop Firenze confirmed its commitment to environmental sustainability by adopting solutions created with fourth-generation Mater-Bi characterized by an even higher content of renewable raw materials (i.e. >50%) expressed as biogenic carbon/total carbon x 100.

In 13 years, from 2009 to 2022, thanks to the use of takeaway bags and bags for fruit and vegetables made of Mater-Bi instead of traditional plastic bags, Unicoop Firenze was able to avoid the emissions of about **25 kilotons CO_{2eq}**[1].

As a result of this partnership, Unicoop Firenze has been able to leverage an industrial innovation, Novamont's compostable materials, in times that were well ahead other large-scale retail brands. This precious collaboration with Novamont is a real-life example that partnerships for sustainable development have a pivotal role in accelerating the transition towards more sustainable consumption and production patterns.

[1] Estimated greenhouse gas emissions savings were determined as the difference between the emissions of traditional bags, considering the material production and end-of-life phases, and the corresponding emissions of Mater-Bi bags. From 2009 to 2017 traditional bags were made of not compostable fossil plastic, whereas from 2017 to 2022 they were made of compostable bioplastic representative of the Italian market.

A perspective on food waste: the benefits of re-using compostable Mater-Bi bags

Mater-Bi bio-based and compostable plastics are conceived to encourage a proper separate collection of food waste, because they share the same biodegradability of the organic materials they contain. Assuming to increase the separate collection of food waste of just 0.2 kg per bag, the net greenhouse gas saving that would result equals to **350 grams CO_{2eq}**, which is about 30 times higher compared to the greenhouse gas emissions "Cradle to grave" of one fruit and vegetable bag.

The second use of bio-based and compostable bags is a consolidated practice in Italy. Thanks to the integration of new materials, and collection and treatment technologies, Italy is the European country with the most efficient organic fraction management system. On its part, Novamont has promoted many multistakeholder projects aiming at increasing awareness and virtuous behaviors among citizens, municipalities as well as value chain actors about a proper food waste collection and management.

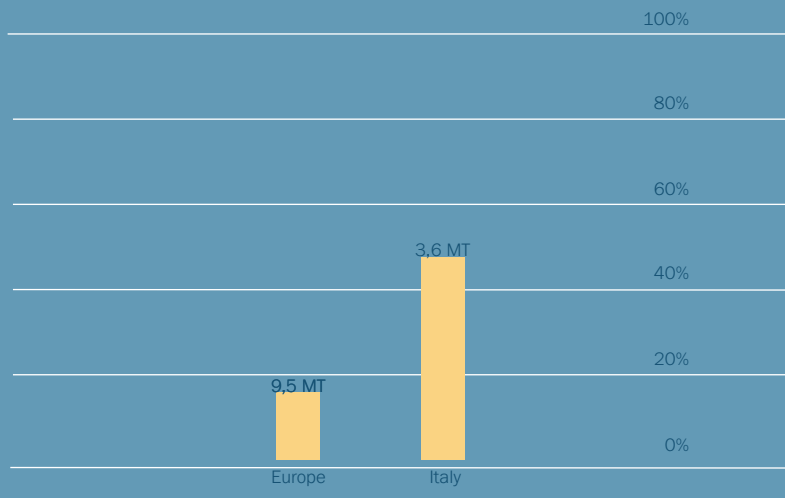


Figure 5. Tons per year of food waste currently collected

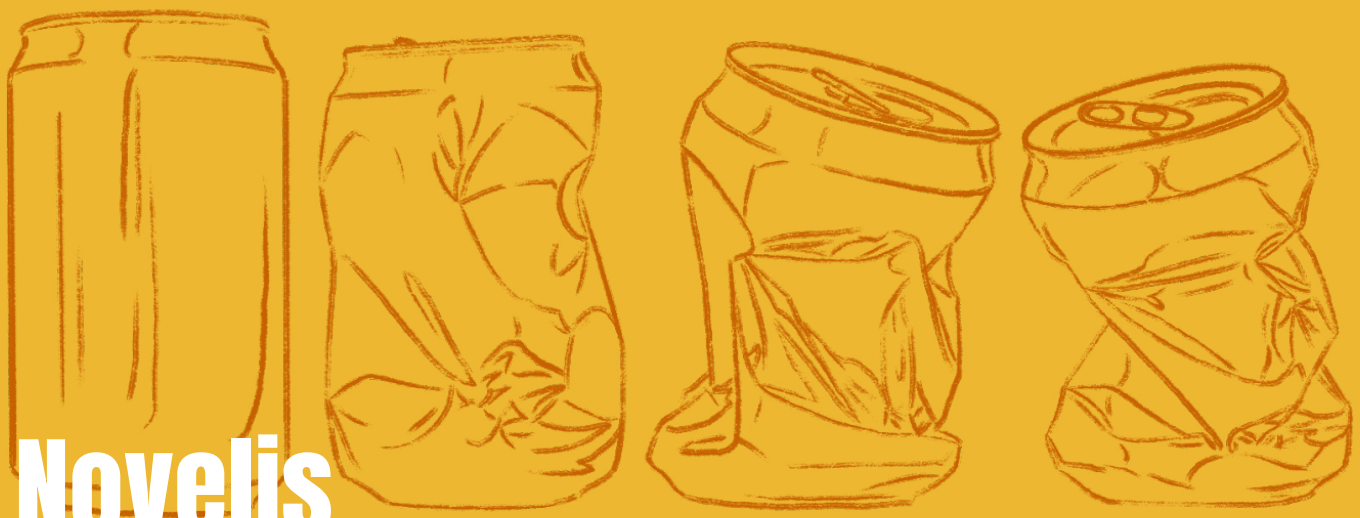
Decarbonization of the aluminum packaging sector

In 2018, the carbon emissions generated by the entire EU packaging sector accounted for 59 million US tons (mt) of CO_2 per year and are expected to rise to 66 mt by 2030. Aluminum represents approximately 2% of all European packaging by weight.

As aluminum is one of the most common materials used for packaging and is a large emitter, it's essential for the aluminum packaging sector to decarbonize, especially for food and beverage.

Specifically for aluminum, the European carbon footprint of primary production processes is 8.6 kilograms (kg) of CO_2 per kg of material produced, mainly due to the energy source (i.e., coal) used to produce the electricity for a required process in the production of primary aluminum. However, if we can promote circularity by bringing beverage packaging back to recyclers like Novelis, we can produce the same quality products more sustainably. Recycling aluminum emits approximately **95% less CO_2** than production of primary aluminum. Thus, there is a direct correlation between increasing recycled content and reducing carbon emissions.

Given the high recycling rate of aluminum packaging both globally (69%) and in Europe (76%), the recycled aluminum sector plays a crucial role when it comes to decarbonization and reducing the overall environmental impact of the packaging industry. By increasing circularity, the sector can also contribute to tackling the issue of packaging waste and reducing the emissions connected to it.



Novelis

"We believe that maximizing circularity is the most effective way to decarbonize, and Novelis is leading the industry on that front by expanding closed-loop recycling partnerships with customers, investing in additional recycling capacity, and creating new alloys and processing methods to increase our use of recycled metal inputs."

— Steve Fisher,
President & CEO,
Novelis

82+ B

cans recycled annually, saving an average of 809,000 US tons CO_{2eq} per year.

2,325 Mt

aluminum recycled in FY23, saving 38.36 mt of CO_2

14%

reduction in absolute CO_2 emissions between 2016 and 2023, accounting for 2.75 mt of CO_{2eq} saved.

€ Net sales in 2023 - €18.5 billion

8 13,170 employees in 2023

As a global leader in aluminum recycling and production of flat-rolled aluminum products, **Novelis** is a large-scale player with real potential to drive the decarbonization of the aluminum industry.

Aiming to become carbon neutral by 2050 or sooner, Novelis focuses its decarbonization strategy on reducing the larger Scope 3 emissions as they account for 87% of its total CO_2 emissions, among which are emissions coming from primary aluminum production processes. This decarbonization of Scope 3 is done by Novelis in four main ways:

- by maximizing closed-loop recycling systems
- by incorporating the highest possible amount of recycled aluminum content into its products
- by increasing recycling capacities and capabilities
- by supporting decarbonization of primary aluminum

These strategies allowed Novelis to achieve **a reduction to 17.27 mt CO_{2eq}** in FY2023 as compared to its FY2016 baseline, which translates to a 14% decrease.

For Novelis' largest value stream of beverage packaging, the company is innovating new high-recycled-content alloys through partnerships with stakeholders across the aluminum value chain. As a result of these efforts, Novelis reached more than 80% average recycled content for its can sheet globally. By 2030, Novelis aims to increase the share of recycled content in its can sheet to 95%, which could reduce the product's carbon footprint by more than 50%.

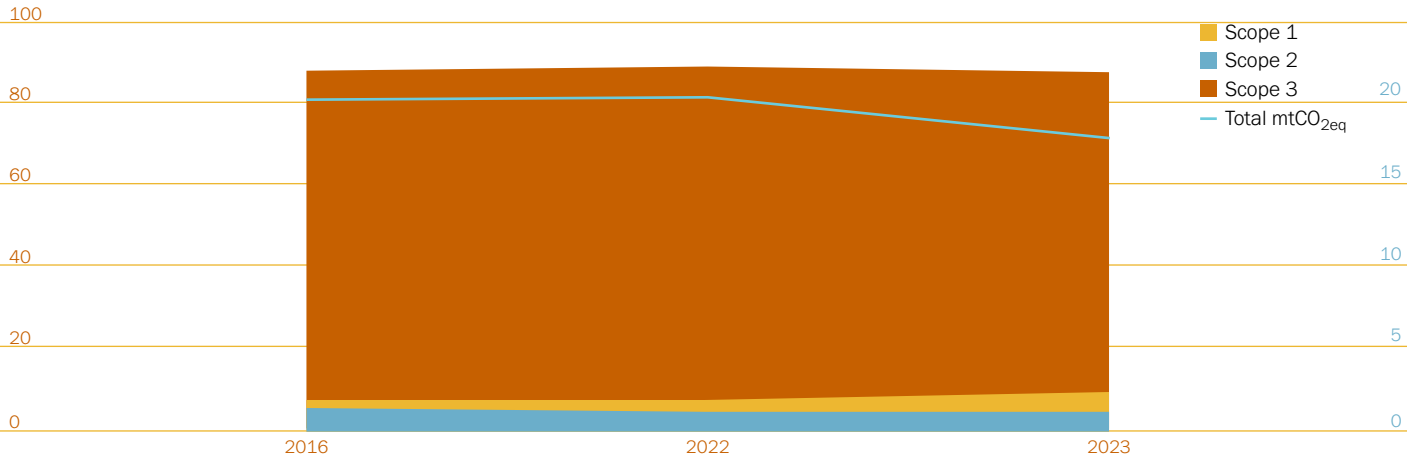


Figure 1. US tons of CO_2 emissions per year and fiscal year 2016 target. Note that macro-level CO_2 emissions have been impacted by factors associated with the Covid-19 pandemic, supply chain disruptions and logistical challenges connected with scrap inputs, as well as Novelis' investments and acquisitions.

Decarbonizing aluminum manufacturing processes – Novelis' key lessons:

Creating a circular aluminum value chain is a critical pathway to decarbonizing the sector.

Increasing the amount of recycled content is the single most impactful way to reduce the carbon footprint of aluminum beverage packaging.

Continuous exploration of innovative technologies and sourcing renewable energy are paramount to further companies' decarbonization ambitions.

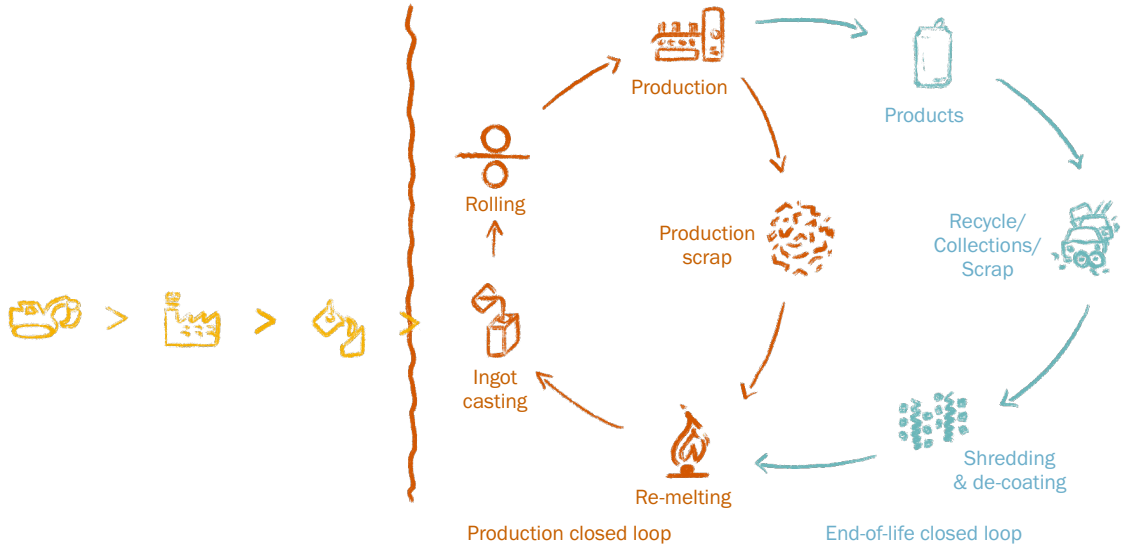
1/ Creating a circular aluminum value chain is a critical pathway to decarbonizing the sector

Novelis closed-loop recycling system for beverage packaging

To help its customers reduce their carbon emissions and waste, and preserve natural resources, Novelis takes back the scrap created during their manufacturing processes and recycles it. All Novelis' beverage packaging customers return their pre-consumer scrap for remelting.

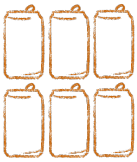
Elsewhere, long-lasting partnerships with scrap recyclers allow the company to source post-consumer scrap from its partners. **Globally, these partnerships result in more than 82 billion used beverage cans recycled by Novelis annually**.

For its beverage can business, Novelis' recycling centers in Europe, the biggest of which is in Nachterstedt, Germany, recycle aluminum and then cast it together with a degree of primary aluminum to make a can body sheet ingot, which is then rolled into can sheet. Every year, the Nachterstedt center casts more than 400,000 mt of aluminum ingots containing both pre- and post-consumer scrap through a technically advanced closed-loop recycling system.



Due to its infinite recyclability, aluminum enables closed-loop systems, without sacrificing quality. By leveraging the properties of this unique material, Novelis provides low-carbon, sustainable solutions that also advance the industry toward the benefits of a circular economy.


Infinitely recyclable


Lightweight, strong & affordable


Exceptional barrier against air, light & moisture


Perfect 360° canvas for product branding


Fast to chill

Focus box - Maximizing circularity by increasing recycling capacities & capabilities

Novelis' joint venture facility in Alunorf, Germany, recently launched a Batch Intelligence System (BIS), an innovative logistics and loading system that increases the scrap input rate and reduces the use of prime aluminum by recording and assessing the available input material.

The new system allows Novelis to significantly reduce its carbon footprint, **saving approximately 500,000 US tons of CO_{2eq} annually**. BIS also protects the health and safety of employees by using an automatic crane that reduces the chances of injuries.

Elsewhere expansion projects are under way that will add up to 1.9 mt new recycling capacity through a total investment of $1.3 billion.

2/ Increasing the amount of recycled content is the single most impactful way to reduce the carbon footprint of aluminum packaging

Novelis is the largest producer of aluminum beverage packaging sheet and the world's largest recycler of used beverage cans. In an ambition to deliver the most sustainable product to the beverage packaging industry, Novelis manufactures aluminum can sheet with an average recycled content of more than 80%, compared to the European average of 54%.

Lowering the amount of prime aluminum used in its can sheet allows Novelis to radically reduce the carbon footprint of its products while also minimizing waste.

Toward a 95% recycled content beverage can

Novelis has a long-standing collaboration with **Ball Corporation**, a supplier of aluminum packaging for the beverage industry that is similarly focused on decarbonizing the aluminum value chain.

They are working together on the development of a single alloy made from high recycled content for both the can body and the can end (currently made from two distinct alloys) to increase the can's total recycled content to >95%.

Such an increase of 20% in the amount of recycled content from the current can design **reduces the carbon footprint by more than 50%.**

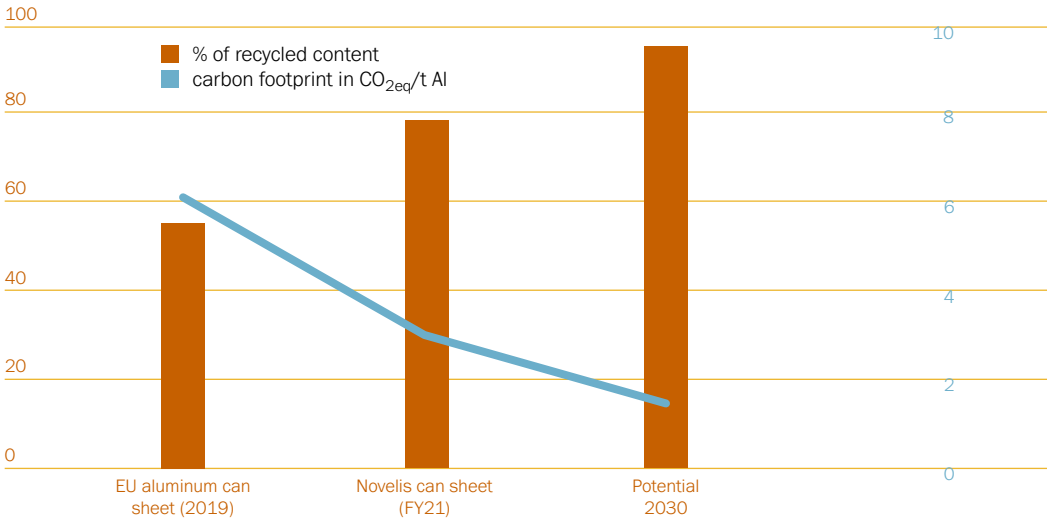


Figure 2. Recycled content in cans and their carbon footprint

Demonstrating economic success

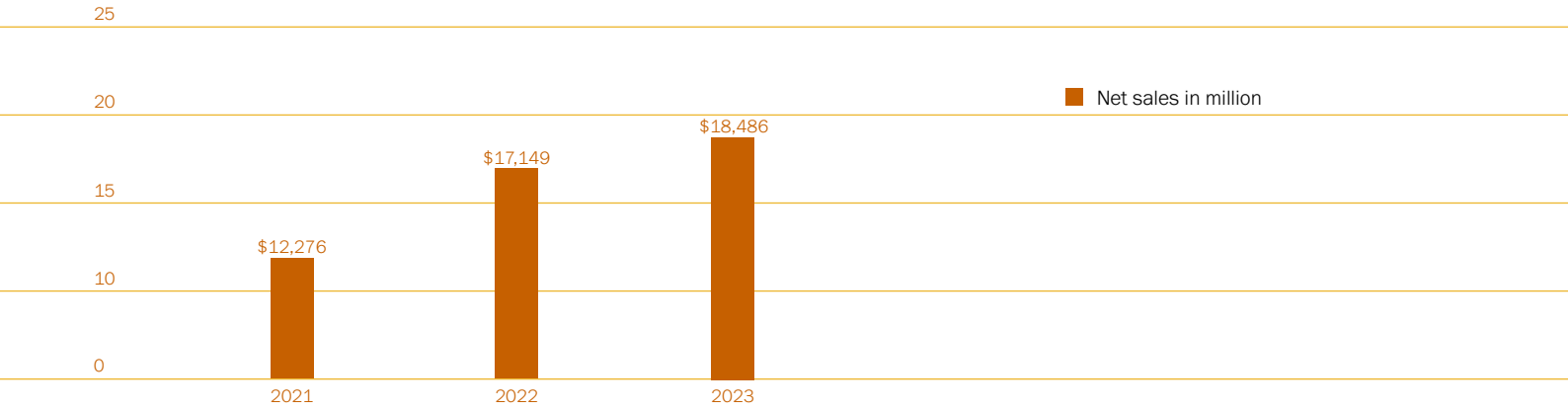


Figure 3. Net sales of Novelis

Figure 3. Net Zero Lab Valais in Sierre, Switzerland

3/ Continuous exploration of innovative technologies & sourcing renewable energy are paramount to further the companies decarbonization ambitions

Novelis' innovative efforts at the Net Zero Lab Valais

The Net Zero Lab Valais in Switzerland is an initiative launched by Novelis in collaboration with research and development partners to advance carbon-neutral solutions for aluminum manufacturing.

As a result of the Lab's research launched in 2022, Novelis approved an investment for a new electric pusher furnace (used to heat ingots before the rolling process) powered by renewable electricity instead of natural gas. By switching from natural gas to electricity generated from renewable resources, Novelis will **save around 4,500 US tons CO_{2eq} over the furnace's lifetime**. This will allow Novelis to reduce its Scope 1 emissions and reliance on fossil fuels.

The furnace is currently being manufactured, and Novelis expects to install it toward the end of 2025. Over time, the company plans to scale successful Net Zero Lab Valais projects to its other global facilities to reduce Scope 1 and Scope 2 emissions across its operations and advance the achievement of its decarbonization goals.

Novelis' decarbonization goals[1]

- Local pilot: Enabling carbon neutral production at Novelis' Sierre plant by 2030
- Reducing carbon footprint by 30% by 2026, including Scopes 1-3 greenhouse gas emissions
- Achieving carbon neutrality by 2050 or sooner

[1] Currently, Novelis is collaborating with players in the aluminum industry to create methodologies for the establishment of a Science-Based Target initiative (SBTi) sectorial decarbonization pathway for aluminum.

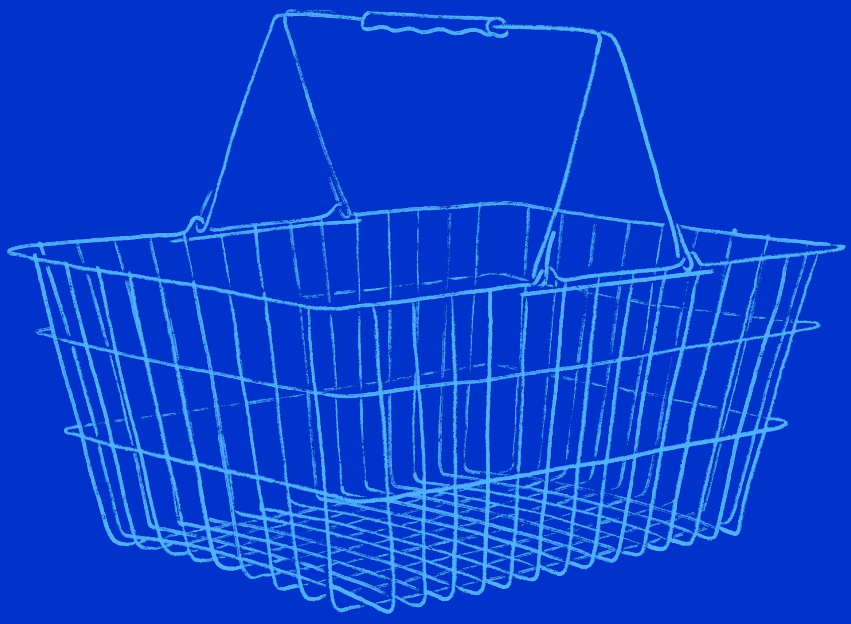
"Electrifying one of our pusher furnaces is a crucial step to decarbonize our Novelis Sierre production. The new electric pusher furnace brings flexibility with regard to renewable energy sources and will initially be fed by hydro power. This is crucial in today's energy management and also contributes to our aim of generating a future-proof energy portfolio for our company."

— Serge Gaudin,
Plant Manager at Novelis Sierre & Director Automotive Operations, Novelis Europe

Retail industry decarbonization

The retail sector currently accounts for approximately 25% of global CO_2 emissions and is expected to grow in the next decades. Reducing the carbon footprint of commercial retailers and their value chains will play a vital role in reaching global climate targets.

90% of total emissions of the sector derive from the value chain. To make impactful reductions, retailers will have to decarbonize their value chains, engaging with commercial partners.



Flying Tiger Copenhagen

47%

emissions reduction in electricity consumption due to increase

from 22% to 80%

in renewable electricity in own operations since 2019.

Since 2019, average CO_2 emissions by kilogram (kg) of product decreased by

13%

from 2.8 kg CO_{2eq} to 2.4 kg CO_{2eq}

€ Group revenue in 2022 - €637 million

8 7,000 employees in 2022

Flying Tiger Copenhagen is a Danish retail company founded in 1995. It operates over nine hundred stores worldwide.

In 2019, following an internal decision to become more sustainable, Flying Tiger Copenhagen partnered with Normative, a carbon accounting engine, to calculate the carbon footprint of its supply chain.

This represented the first step on Flying Tiger Copenhagen's decarbonization pathway, allowing the company to identify Greenhouse gas emission hotspots and subsequently target them with its decarbonization strategy. Among others, the company discovered that textiles were an emissions hotspot while representing only a small percentage of product materials, enabling Flying Tiger Copenhagen to tailor its emissions reduction plan accordingly.

Having a clear overview of emissions led to the development of Flying Tiger Copenhagen's emissions reduction targets, **approved by the Science Based Targets Initiative (SBTi) in 2021.**

Flying Tiger Copenhagen's decarbonization story

Detailed measurement and understanding of carbon footprint is necessary before setting target(s).

Switching to renewable electricity helps drive down emissions from own operations.

Developing innovative internal tools facilitates the uptake of lower emissions materials.

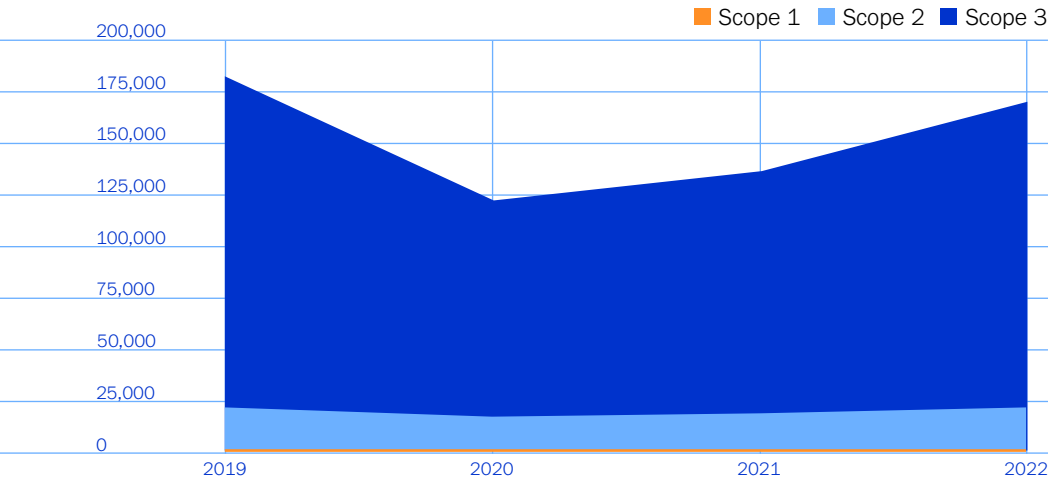


Figure 1. Reduction in CO_2 emissions since the development of Flying Tiger Copenhagen's sustainability strategy (2019)

Figure 1 illustrates Flying Tiger Copenhagen's emissions by scope, indicating a reduction of 7,1 million kilograms CO_2 between 2019 and 2022. Note that absolute numbers depend on the company's total activity, which decreased in 2020 and 2021 due to the Covid-19 pandemic. The accounting methodology has since been updated, integrating more data points as of 2022 compared to previous years.

1/ Detailed measurement and understanding of carbon footprint is necessary before setting target(s)

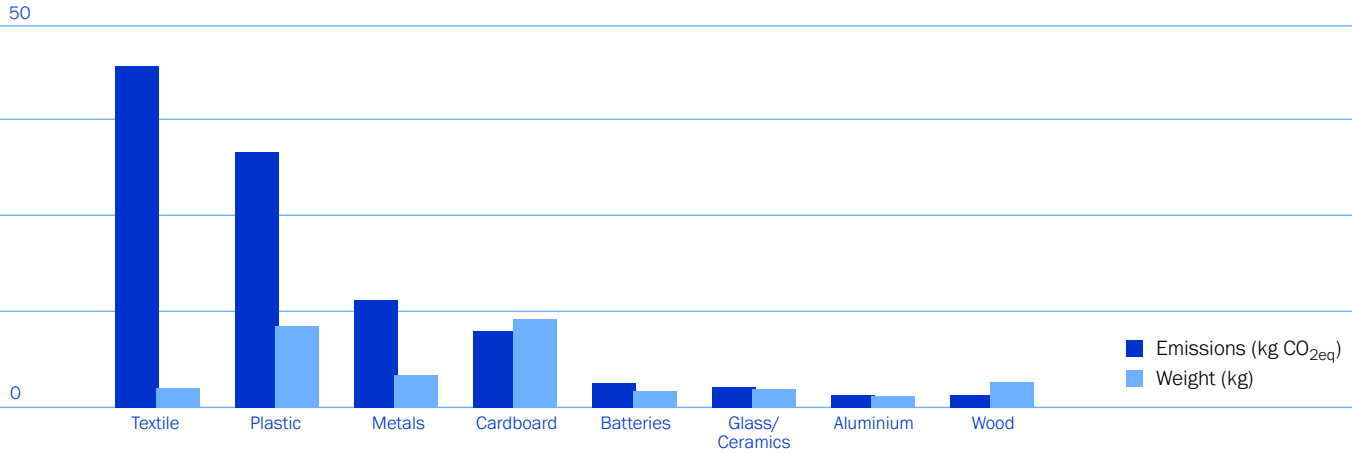


Figure 2. Weight and emissions by material

Key lessons:

- **Understanding carbon footprint is an essential first step** in decarbonizing a company's activities: without this exercise, Flying Tiger Copenhagen would not know clearly where to prioritize with reduction targets.
- **SBTi certification increases trust and respect for the company in addition to creating pride among employees.**
- **Measuring carbon footprint and setting credible emissions reduction targets helps the management to take more informed business decisions.**

> **"Flying Tiger Copenhagen doesn't just want to have pretty numbers - we want to do what's right. Precisely calculating emissions to set credible carbon reduction targets was an essential starting point"**
>
> *— Trine Pondal,*
> *Director of Sustainability & Social Responsibility, Flying Tiger Copenhagen*

2/ Switching to renewable electricity helps drive down emissions from own operations

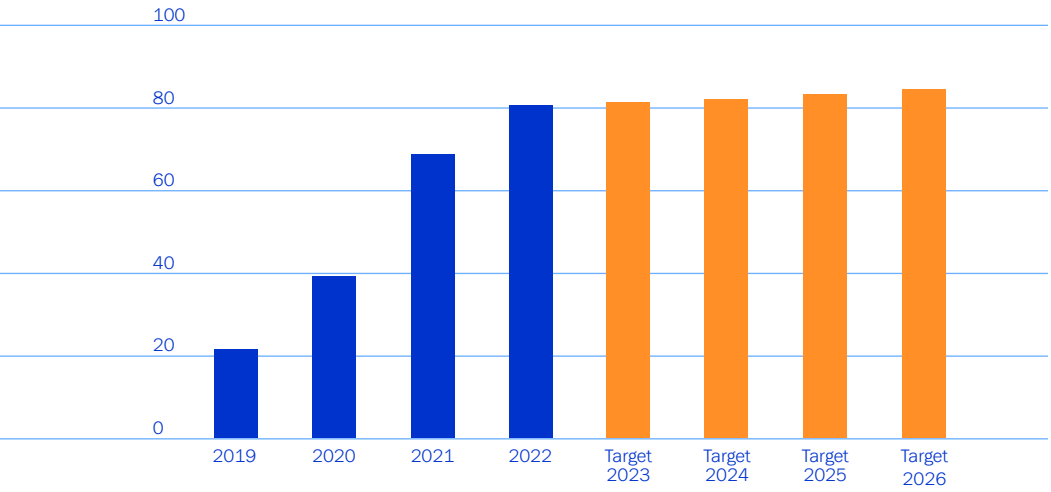


Figure 3. Renewable electricity in own operations, %

Since 2019, Flying Tiger Copenhagen has increased the share of renewable electricity in own operations **from 22% to 80%** (Figure 3), well ahead of its initial SBTi target of 84% by 2026.

In doing so, Flying Tiger Copenhagen **reduced emissions from electricity consumption at their sites by 47% between 2019 and 2022.**

3/ Developing innovative internal tools facilitates the uptake of lower emissions materials

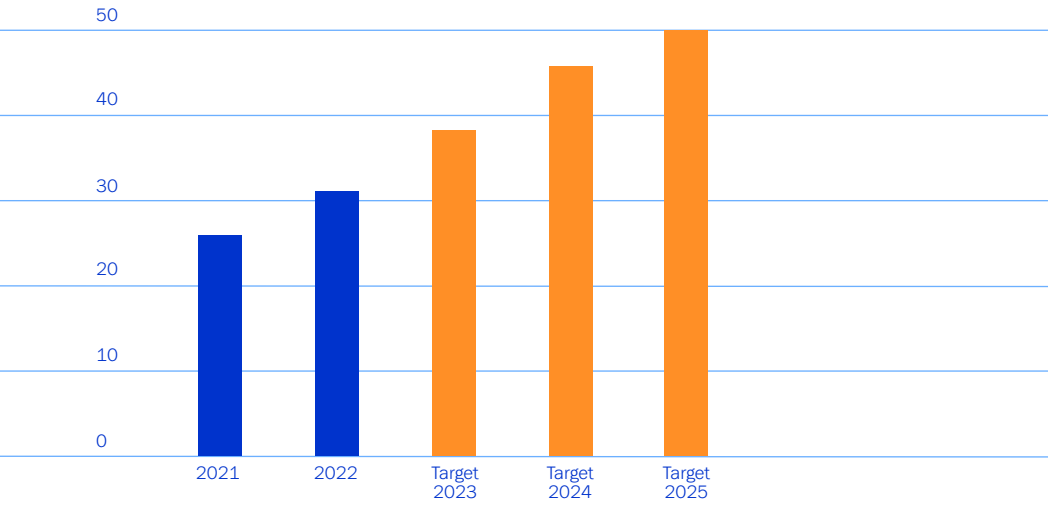


Figure 4. Share of eco-conscious products, %

Products represent **56% of Flying Tiget Copenhagen's carbon footprint,** approximately **101 million kilograms of CO_2 equivalent.**

Reducing products' carbon footprint is essential to decarbonize. Flying Tiger Copenhagen's own eco-conscious product definition served as an internal tool to support buying teams when choosing product materials, helping them select more circular and often lower emissions materials.

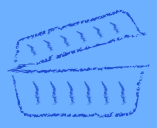
With this internal definition, Flying Tiger Copenhagen created a set of guidelines to prioritize the use of certain materials based on circularity, CO_2 footprint and deforestation criteria.

An eco-conscious product is made from:

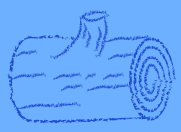
95% FSC-certified materials

and/or

80% recycled material



and/or



95% renewable material

and/or

easily recyclable materials (glass, aluminum, steel, or iron products) with content ≥ **95%**

or

a mix of the above (individually assessed by the sustainbility department)

Flying Tiger Copenhagen's internal tool to make their products more sustainable contributed to a **16% overall reduction in product plastic use between 2019 and 2022,** from 28% in 2019 to 22% in 2022 (Figure 5).

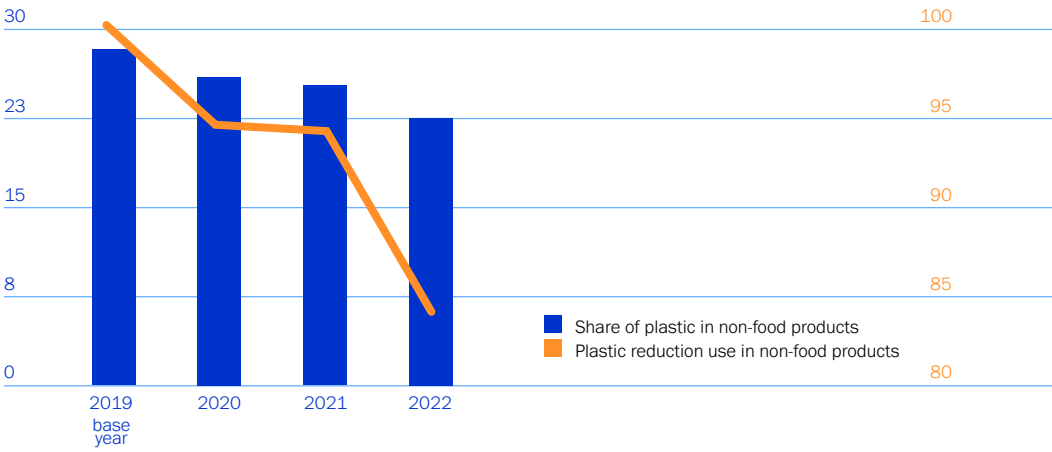


Figure 5. Plastic reduction in non-food products

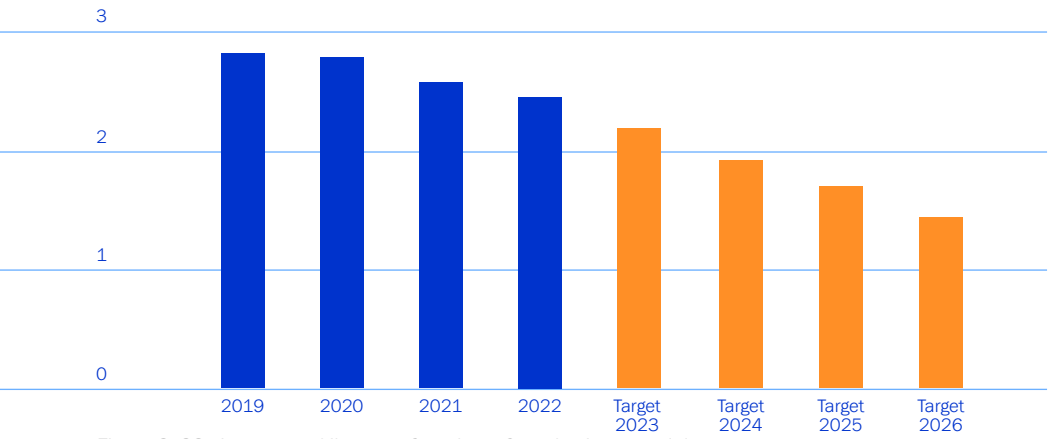


Figure 6. CO_2 impact per kilogram of products & packaging materials

The internal tool further contributed to reducing the climate impact per kg of product materials. **Between 2019 and 2022, average CO_2 emissions per kg of product and packaging material decreased by 13%, from 2.8kg CO_{2eq} to 2.4kg CO_{2eq}** (Figure 6).

Demonstrating economic success

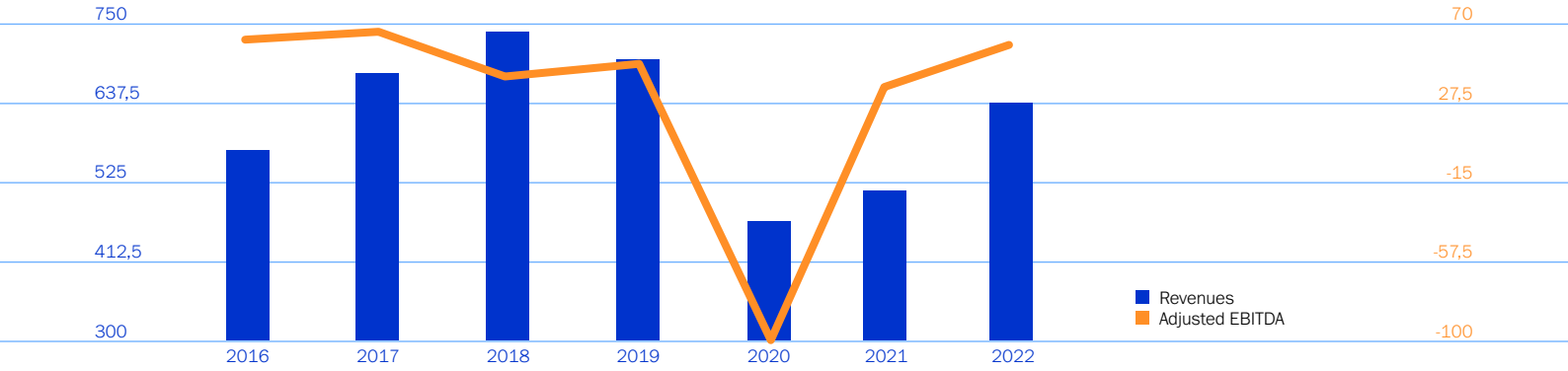
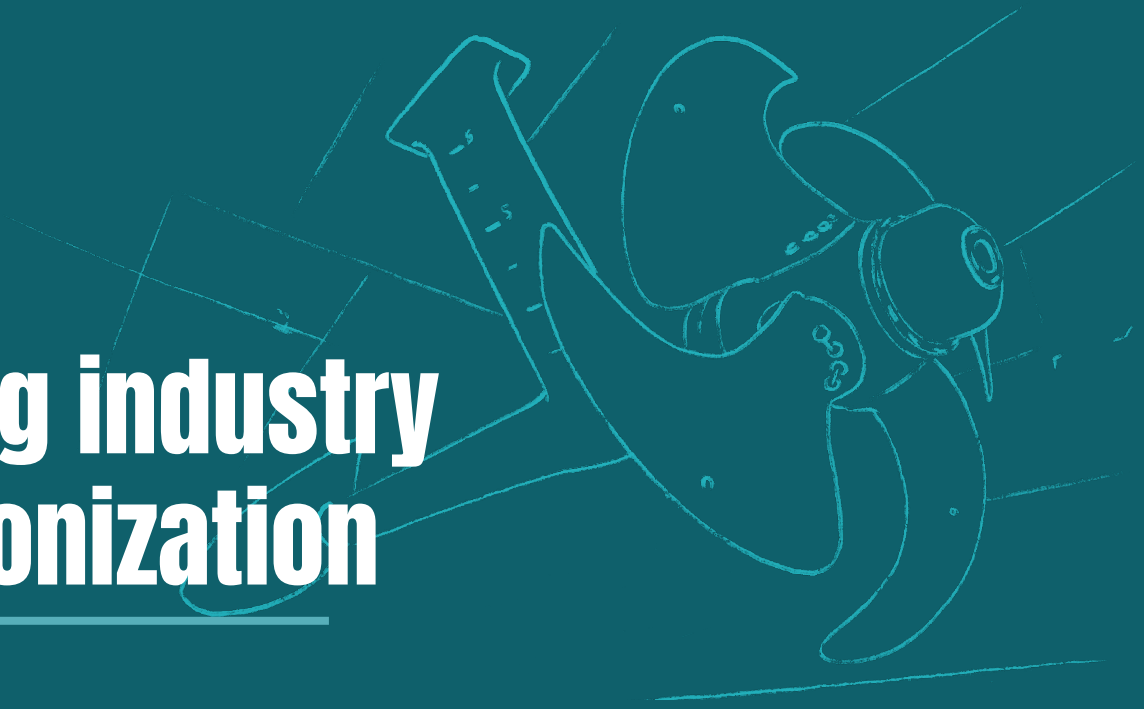


Figure 7. Revenues and adjusted Earnings Before Interest Taxes Depreciation and Amortization (EBITDA) (€ million)

Despite the financial impact of the Covid-19 pandemic, Flying Tiger Copenhagen's 2021 recovery, confirmed in 2022, demonstrates that decoupling financial growth from CO_2 emissions is possible in the retail sector. In 2022, Flying Tiger Copenhagen exceeded its 2016 revenues, before its decarbonization strategy was defined.

"At Flying Tiger Copenhagen, our decarbonisation strategy is much more focused on actual reductions than innovation. We don't believe we can only innovate our way out of this crisis, we know we must make difficult choices"

— Amy Frances Wright,
Sustainability Specialist,
Flying Tiger Copenhagen

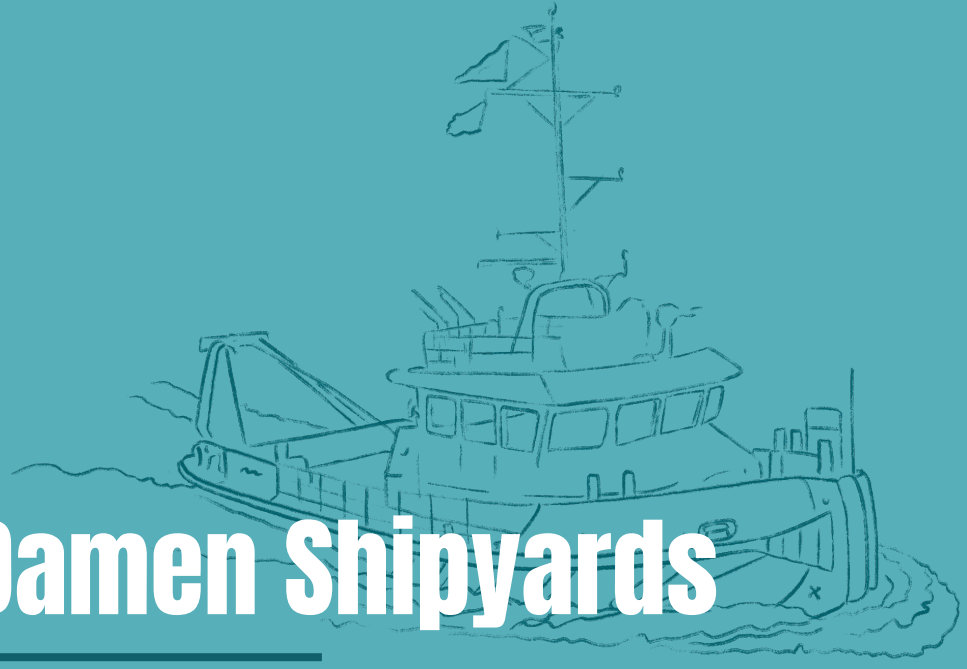


Shipping industry decarbonization

The European Union maritime industry represents 3% to 4% of EU's total CO_2 emissions (2021). Globally, the shipping industry accounted for 2.89% of greenhouse gas emissions in 2018. Emissions from the industry are expected to rise in the coming decades, possibly reaching 150% of 2008 emissions by 2050.

The shipping industry has traditionally relied heavily on oil-based fuels. According to the International Energy Agency, over 99% of total energy demand for international shipping has been historically met with oil-based fuels. Replacing these with low-emission fuels and developing suitable technologies for energy efficient vessels are essential measures to decarbonize.

The International Maritime Organization (IMO) has understood the need to take urgent action and targets in its recently revised greenhouse gas strategy net zero emissions around 2050, and a -20% reduction by 2030 aligned with the Paris agreement. To decarbonize the sector, the European Union extended its Emission Trading System to international shipping that will put a price on the industry's carbon emissions for the first time. The European Union also introduced the FuelEU Maritime regulation that will boost demand for renewable and low-carbon fuels and reduce the greenhouse gas intensity of marine fuels, setting an 80% greenhouse gas emissions intensity reduction target by 2050.



Damen Shipyards

Lessons learned:

- Innovation and new vessel development can help the whole maritime industry cut emissions at scale.
- Repair and conversion projects are important in both improving the longevity and decreasing the lifetime carbon intensity of the vessels.
- Besides measures to decarbonize, measures to reduce waste and use of water and to improve wastewater treatment are essential.

512 t

of CO_2 saved per vessel in diesel emissions annually

In 2022, at Group level Scope 1 emissions were reduced by

1750 t

Between 2021 and 2022, wastes were reduced from 82,600 tons to

74,000 t

€ Group's revenue in 2022 - €2.5 billion

8 12,000 employees in 2023

Damen Shipyards Group offers maritime solutions such as ship building and ship repair worldwide, operating a total of 35 shipyards in 13 countries. **In 2022, the Group employed a total of over 12,000 people and reached a production value of 2.5 billion euros.**

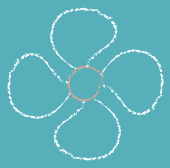
Damen aims to be the most sustainable maritime service provider and shipbuilder in the world. The company strives to help its customers operate with net zero carbon emissions and places a lot of importance on the decarbonization of its value chain. It wants to achieve this by integrating sustainability comprehensively in its daily work and both enhancing the sustainability of production and offering more sustainable solutions. More specifically, they achieve this by offering a comprehensive portfolio of adaptable and sustainable green solutions powered by zero-emission technologies.

Damen improved its environmental reporting system to commit to Science-Based Target initiative (SBTi) in the near future. **In 2022, despite increasing the number of its reporting entities from 37 to 42, Damen managed to decrease its Scope 1 emissions from around 49,049 tons to 46,457 tons, mainly due to efforts taken at Damen Shipyards Galati.**

Damen is continuously innovating. It has introduced new types of vessels, such as the first hydrogen powered inland shipping vessel in the Netherlands as well as increasing the longevity of vessels by integrating more sustainable technologies and propulsion mechanisms.

Decarbonization of shipping industry - Key Lessons

Cutting Scope 1 & 2 emissions relies on building ships in a more sustainable way.



Focus on the operational phase of the ship is important to decrease its lifecycle carbon intensity.

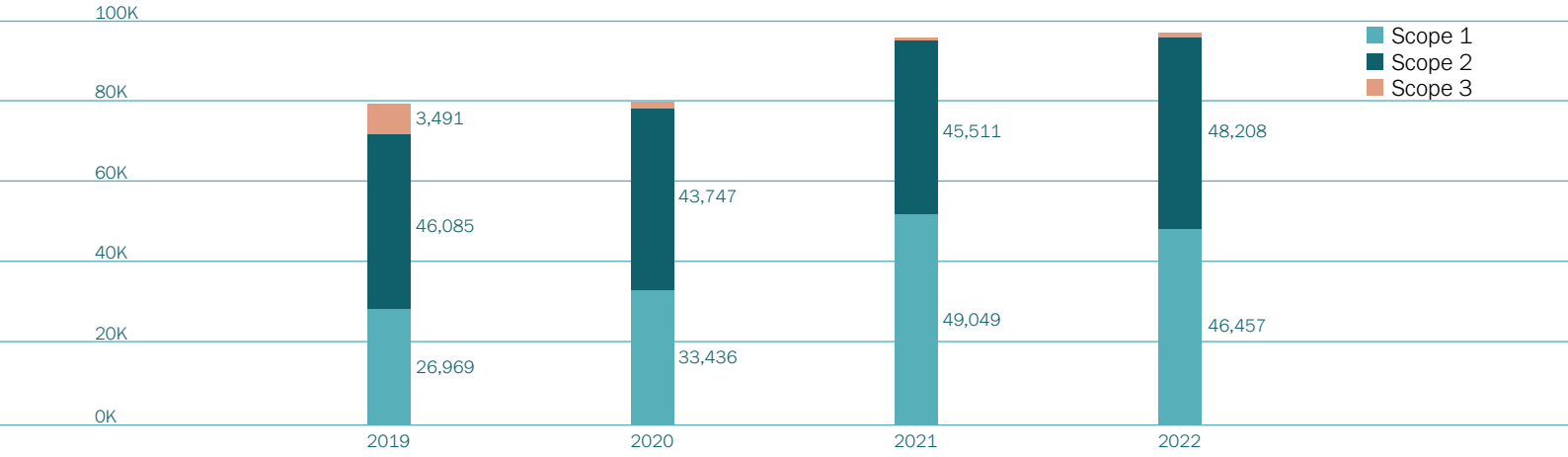


Figure 1. CO_2 per year, in absolute values. Damen Shipyards Group's emissions by scope. The number of reporting entities included has grown from 18 to 42, explaining the increase in reported emissions.

1/ Cutting Scope 1 & 2 emissions relies on building ships in a more sustainable way

Damen is committed to reducing the carbon intensity of its operations. In 2022, most yards reduced their Scope 1 emissions, especially the emissions from natural gas and mobile combustion of commissioned vehicles.

Damen is also committed to reducing its waste and water consumption. **In 2022, Damen reduced its waste from 82,600 tons to 74,000 tons, reaching its 10% reduction target in waste produced by production hours with an average number of 4.2 kilograms (kg)/per Full Time Equivalent (FTE) compared to 4.7 kg/per FTE in 2021.**

In addition, Damen is both reducing its use of water and improving the treatment of wastewater. **The company managed to reduce its water consumption from 6,83 million (M) m^3 to 5,36M m^3 between 2021 and 2022.**
To reduce its carbon intensity, the Damen Shiprepair & Conversion (DSC) is working on repair projects and ship upgrades, especially integrating more sustainable technologies and propulsion mechanisms to existing vessels. It notably replaces the vehicles by fully electric models at the point of retirement.

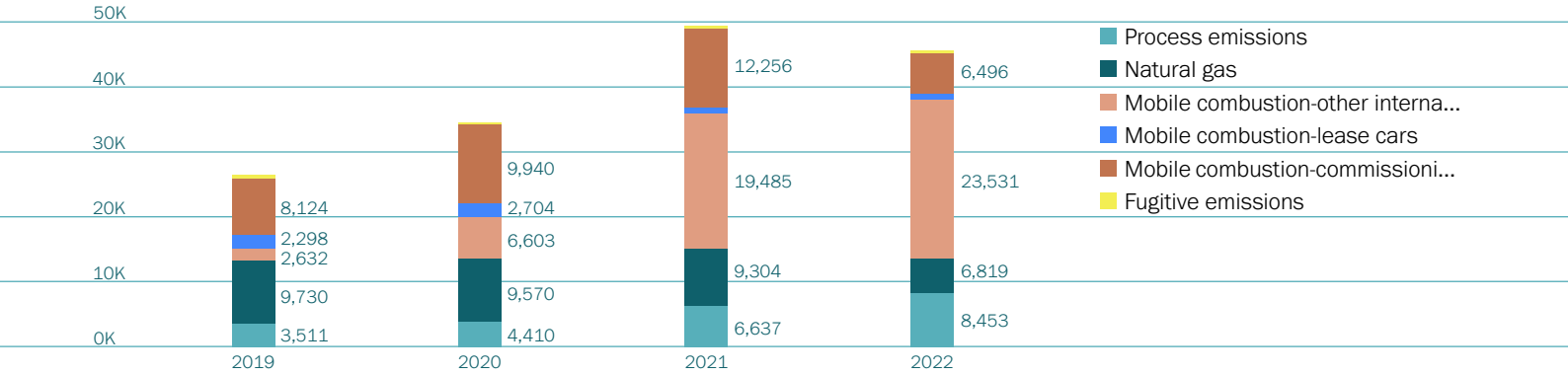


Figure 2. Scope 1 emissions breakdown

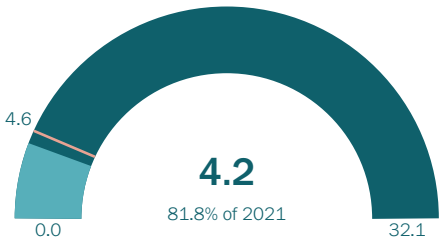


Figure 3. KPI on waste reduction (10% of previous year)

2/ Focus on the operational phase of the ship's life is important to decrease its lifecycle carbon intensity

Understanding the importance of a value chain approach, Damen is committed to including the full Scope 3 emissions in its reporting and helping its downstream customers reduce their emissions. The reported Scope 3 emissions represented 83.5% of Damen's total 481,000 tons CO_{2eq} emissions in 2022. Innovative cradle-to-cradle ship design and ships operating in an emission-free way are key in Damen's vision. **Damen's Workboats division produced and delivered its first full electric tug, Sparky, which will save approximately 465 tons of CO_2 in diesel emissions annually per tug.** In addition, the operating cost of an electric tug is less than a third of the cost of a diesel equivalent. Damen is planning to electrify other vessels and develop hybrid vessels for the offshore wind market.

Besides the electrification of ships, Damen is working on the introduction of methanol and hydrogen powered vessels. Damen signed with Caterpillar, the US engineering equipment manufacturer, to jointly develop methanol-powered vessels, with the first one anticipated to be ready in 2025/2026. In addition to designing and producing these ships, **Damen is also actively helping its customers in the acquisition of these innovative, costly ships by leasing them to the customers instead of selling them.**

CSOV 8720 to support windfarm installation

The Damen Commissioning Service Operations Vessel (CSOV) 8720 is designed to support wind farm installation in northwest European waters.

The vessel features an efficient propulsion system that never uses more power than necessary. With its hybrid-electric system, the vessel has no need for a backup diesel generator. Another feature is the advanced switching in the electric distribution system which can rapidly detect faults and take corrective actions. **Taken together, these characteristiccs contribute to a reduction in fuel consumption - and therefore emissions - around 5% to 10%.**

Lessons learned:

- Innovation and new vessel development can help the whole maritime industry cut emissions at scale.
- Repair and conversion projects are important in both improving the longevity and decreasing the lifetime carbon intensity of the vessels.
- Besides measures to decarbonize, measures to reduce waste and use of water and to improve wastewater treatment are essential.

Transport-logistics decarbonization

According to the European Environment Agency (EEA), while the transport sector currently accounts for a quarter of the European Union's total greenhouse gas emissions, road transport represents 77% of all emissions from the sector. Unlike other areas, overall emissions from the European Union's transport sector increased by more than 33% between 1990 and 2019, with road transport emissions increasing by 27.8%.

According to the EEA, the climate impacts of a passenger-kilometer travelled by car are substantially higher than those of buses, trains and active travel modes, such as walking or cycling. Similarly, the climate impacts of a tonne-kilometer transported by trucks currently exceed those of rail and inland waterway transport. In contrast to the latter modes of transport, the modal share of Heavy-Duty Vehicles (HDVs) in inland freight transportation has grown, thus increasing the environmental impact of the sector.

Despite the vehicle and operational efficiency gains that have been achieved in the last three decades, as the EEA notes, these advancements have been outpaced by the continuously growing demand for freight transport. This is the reason why total emissions from HDVs have been increasing.

Since the demand for freight transport is projected to continue to grow, transport operators must take definitive steps, employing the latest innovations to considerably reduce emissions and, ultimately, decarbonize the transport sector.

Girteka Europe West

“Our gains, in terms of emissions savings and revenue, demonstrate that economic and environmental sustainabililty objectives are not mutually exclusive terms. On the contrary, in today’s market, sustainable solutions can contribute significantly to the sustained and continuous growth of a road freight transportation business.”

— Viktorija Terekė,
Head of Sustainability,
Girteka Europe West

43.39 m.kg

of CO_2 saved between 2017 and 2022 using intermodal rail transport

Between 2016 and 2017, average CO_2 emissions by kilometer reduced by

24.5%

€ Consolidated revenue in 2023 - €1.93 billion

8 18,000 employees in 2020

Girteka Group, the largest asset-based transport company in Europe, started its history in 1996 with a single truck. 27 years later, Girteka now stands as one of the leaders in the decarbonization of Europe's road freight transport, driving sustainability initiatives forward.

To calculate its carbon footprint, the Group uses the **Global Logistics Emissions Council (GLEC) framework**, a tool in line with the Greenhouse Gas Protocol and the Science Based Target initiative (SBTi). This enabled the company to better understand its environmental impact and invest accordingly. Striving to move towards greener transportation while maintaining sustainable growth, one of the Group's companies, Girteka Europe West, outlines 7 focus areas for reducing emissions both in transportation and supporting activities. **Between 2016 and 2022, Girteka Europe West reduced CO_2 emissions per km driven by 24,5% going from 1,197grams CO_{2eq}/km to 903 grams CO_{2eq}/km.**

Girteka does not only seek to reduce its own carbon footprint. It is also one of the **founding members of the European Clean Trucking Alliance (ECTA)**, an association supported by the International Council on Clean Transportation (ICCT), advocating for more ambitious policies at the European Union level to accelerate the decarbonization of the road freight sector.

Girteka Europe West's Decarbonization Story - Key Lessons

Gathering & analyzing data enables the company to attain a lower carbon footprint and make more informed, data-based investment decisions.

Continuously renewing the fleet and advancing intermodal transport capabilities are effective strategies for reducing emissions in transportation services.

Developing innovative solutions to enhance operational efficiency helps decrease the carbon footprint.

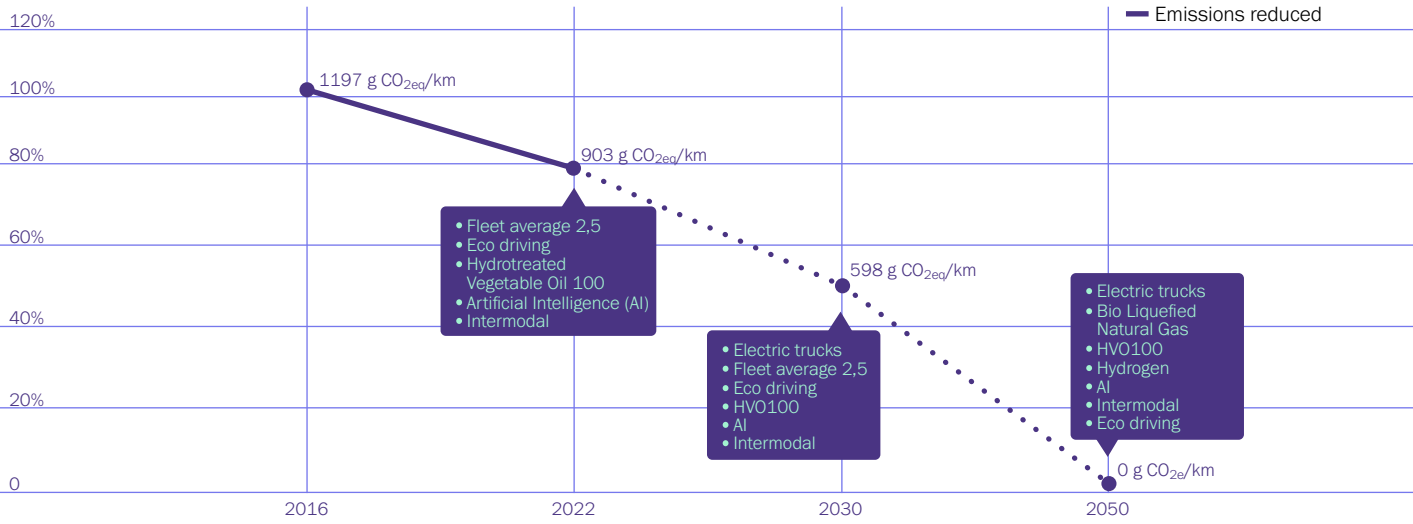
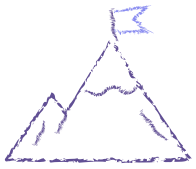


Figure 1. Cargo transportation Emissions

1/ Gathering & analyzing data results in a lower carbon footprint and better investment decisions

CO_2 emissions are directly related to fuel consumption. Therefore, the reduction of both values is useful for both business and society. Girteka realized this some time ago and initiated internal combustion engine (ICE) optimization projects in cooperation with truck manufacturers (OEMs).

During these projects, a significant amount of Girteka's vast truck fleet was monitored by OEMs. Telematics were used to gather data and perform relevant analysis. At the same time, most of Girteka's driven routes were tested in OEMs' simulation environment to understand how far the trucks in operation were from the efficiency threshold. Later, this information was used for further discussions between Girteka's and OEMs' expert teams to map out the next steps, necessary to make the company's vehicles more efficient and less polluting. These discussions resulted in changes to the hardware or specifications of Girteka's vehicles, as well as to the software and drivers' training programs. In some cases, all the aforementioned measures were implemented to achieve better vehicle usage efficiency.



Main achievements

Limitation of driving speed (82 km/h on autopilot, 79 km/h by driver);

Engine idle shutoff (after a certain time, the engine turns off automatically, if the vehicle is standing idly);

Locking the truck's driving programs that are not suitable for Girteka (Girteka's drivers can only drive in Eco mode).

Savings

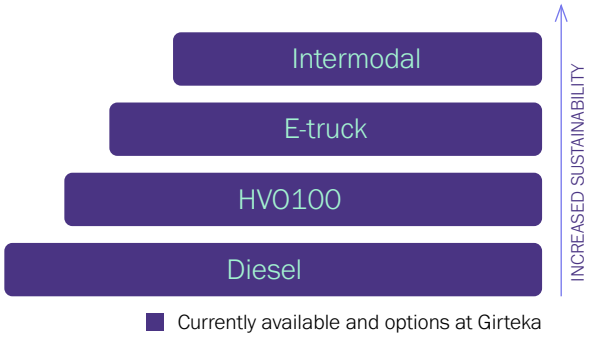
During the project, it is possible to save up to 7.5% in terms of both fuel consumption and CO_2 emissions.

Additional benefit

The implemented measures have contributed to improving road safety (for the driver and other traffic participants, as well as the vehicle and the cargo being carried). In fact, road safety is a very important issue for Girteka – the company promotes road safety through various educational initiatives for the general public each year.

2/ Diversification & development of multimodal transport modes are efficient ways to decarbonize transportation services

Girteka is currently testing electric trucks provided by Europe's main manufacturers (OEMs) for short-haul operations.
"There is definitely less vibration, and the acceleration is much faster, which is something very new to me when driving a truck. It is a good feeling knowing that you are operating a vehicle that is far less polluting. On the road, it seems like everybody takes a second look because people are just not used to a truck being so quiet." Arvydas Jonaitis, Girteka driver, speaking on his experience of test-driving an electric truck.



Carrying goods by intermodal rail systems with electric propulsion can save as much as 90% of CO_2 emissions compared to road transport.

Since the beginning of their intermodal transport activities in 2017, Girteka Europe West saved 43,39 million kg of CO_2 from being emitted compared to a business-as-usual scenario (Figure 2):

This resulted in:
- 900 tires saved
- 61 road accidents avoided

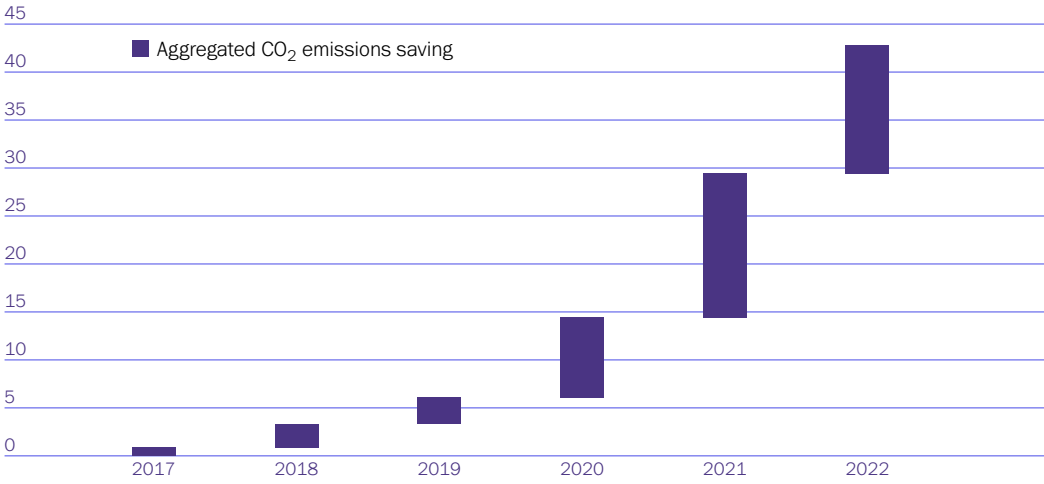


Figure 2. CO_2 emissions savings arising from the switch to intermodal transport (in million kg)

Before the widespread deployment of electrified heavy-duty transport is made possible, biofuels, such as **Hydrotreated Vegetable Oil (HVO),** offer transitional alternatives to decarbonizing diesel trucks.

If the purest form of the fuel is used, namely, the HVO100, *"greenhouse gas emissions can be reduced by up to 90% over the fuel's life cycle compared to fossil diesel"*, according to Neste.

HVO fuel also reduces local emissions, with up to 33% lower levels of fine particulates, 30% fewer hydrocarbons (HC), 24% lower carbon monoxide (CO) emissions, and 9% less nitrogen oxide (NOx) emissions compared to regular diesel.

Since Girteka Europe West began using HVO fuel in 2021, throughout 2021 and 2022, the company saved a total of **516,259 kg CO_{2eq}.**

"Expanding our intermodal rail services is one of the main steps we have taken to reduce our greenhouse gas emissions. Moving loads in an environmentally friendly way is equally important for us, our clients, and the community. We are aware that we are raising the bar for the whole transport industry, and we do not intend to stop."

— Viktorija Terekė,
Head of Sustainability,
Girteka Europe West

3/ Developing innovative solutions to increase efficiency in operations reduces the carbon footprint

Girteka's in-house Drivers' Academy provides a compulsory course on **eco-driving**, focused on developing the company's drivers' skills in a more environmentally friendly way of driving. The skills gained in this course are incentivized through an initiative known as the Eco League.

The Eco League is an example, whereupon the goal to be more sustainable is done via encouraging the company's professional drivers to drive more ecologically by gamifying the process. Drivers are rewarded for their effort with a prize in two seasons per year.

The Eco League, which applies to Girteka's entire state-of-the-art fleet of 9,200 trucks, has resulted in a 2% reduction in emissions on an average journey. While that is not a huge number, as eco-driving is a "soft" measure, it does add up in the grand scheme of things.

The results are immediate – they come into effect as soon as a driver completes the eco-driving training and is deployed on a route, and the Eco League initiative is easily replicable. Operational changes can also make a difference. With the company beginning its digital journey, one of the main goals was to move its transport management processes to SAP's dedicated Transport Management solution, streamlining Girteka Europe West's operations.

With the help of the **AI Planner**, Girteka Europe West has continued to reduce the number of empty kilometers driven. This has allowed the road freight transport provider to emit 15% fewer CO_2 emissions per km compared to the industry average.

- Following the initial launch of the AI Planner in 2021, the tool was applied to the planning of up to 65% of all cargoes.
- Having fully implemented the AI Planner in 2022, a steady 80-86% rate was reached.

Throughout 2023, due to falling demand across the road freight market, the AI Planner has been utilized for the planning of up to 75% of all cargo deliveries.

The emissions savings results showcase that even if, currently, there is no possibility to operate zero-emission trucks, there are other innovations that can be utilized to reduce a road freight transportation company's environmental impact.

> **"As a result of taking part in the Eco League, I have learned to drive better. Now I know what the best routes are. Most of the time, I can drive without a navigator. I also think that eco-driving is wise. In general, a lot depends on the driver himself. The faster you drive, the more dangerous it can be. However, when you drive economically, you drive calmly,carefully, and safely."**
>
> *— Pavlo Diachuk,*
> *Driver and winner of the Eco League Season 8 (2022), Girteka*

Drivers are judged according to a set of parameters:

Empty run %
POINTS (max 100)

Brake presses (times/100 km)
POINTS (max 100)

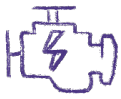
Sharp braking (times/100 km)
POINTS (max 100)

Stops (times/100 km)
POINTS (max 100)

Rolling %
POINTS (max 100)

Autopilot %
POINTS (max 100)

Autopilot efficiency %
POINTS (max 100)



Engine load %
POINTS (max 100)

Demonstrating economic success: Girteka Europe West

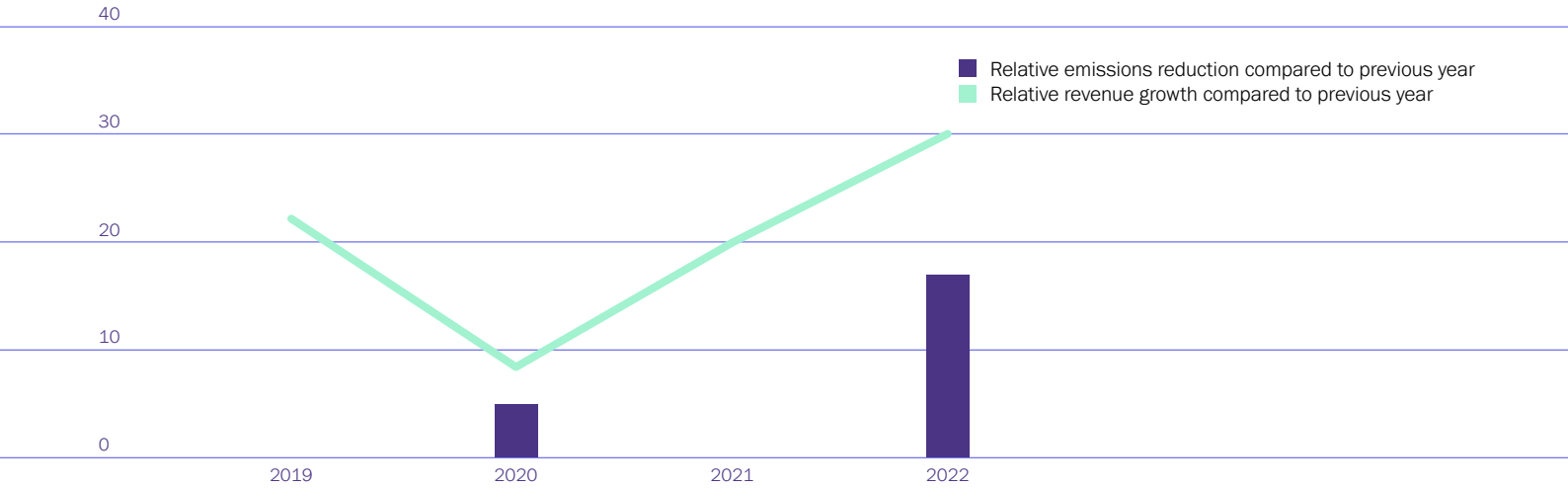


Figure 4. Correlation between relative revenue growth and relative emissions reduction compared to year N-1

As can be seen from the data above, reduction in emissions correlates with the company's revenue growth. The only exception to this trend is the period of the COVID-19 pandemic (2020), which had a significant negative impact on the whole transportation industry in terms of decreased activity.

Lessons learned from the road transport sector:

- The development of an innovative culture and mindset within a company drives ambition upwards and delivers great results.
- The sum of smaller, easily replicable innovations (optimization projects, ECO League, empty miles reduction) highlights a pro-active approach and shows great emissions reduction potential.
- Strategic investments and choices benefit the company's growth while reducing the carbon footprint.

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Author

Thorfinn Stainforth, Senior Policy Manager at Environmental Defense Fund

In partnership with

Francesca Riccardi & Antoine Grall, Sustainability Advocates at #SustainablePublicAffairs

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