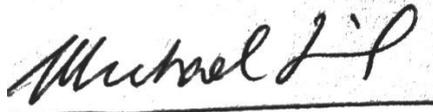


# Life Cycle Assessment of Aer8 Spacer

Update

13<sup>th</sup> March 2026

A handwritten signature in black ink, reading "Michael Friel", is written over a horizontal line.

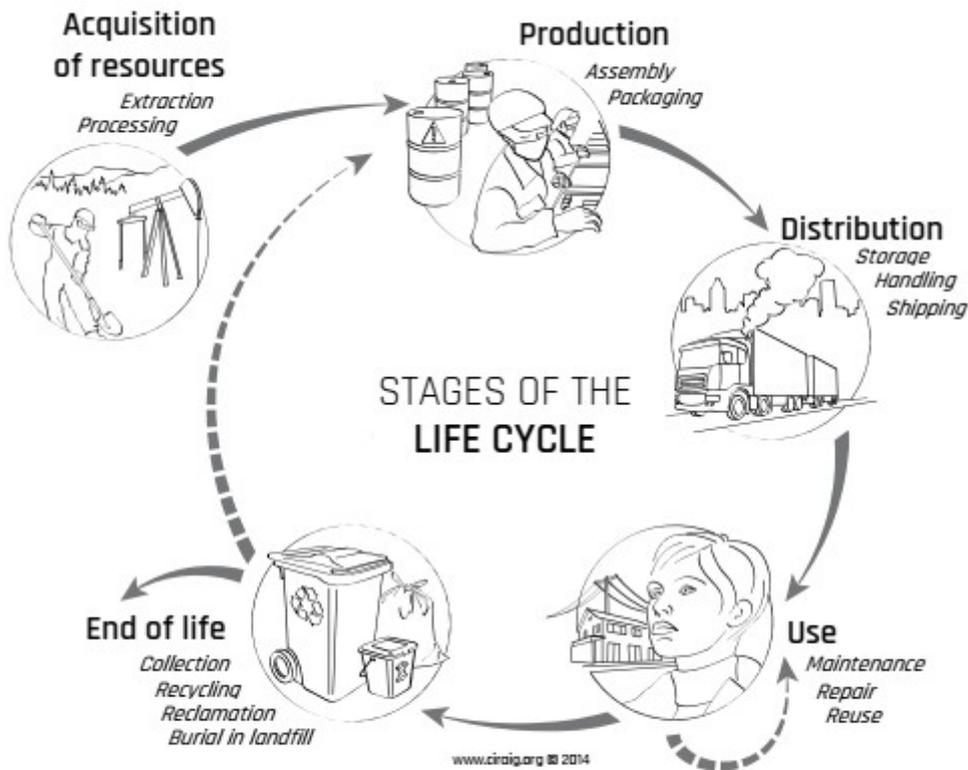
**Michael Friel Mpharm PhD**  
**Technical Director**



# Aer8 spacer life cycle assessment

## Background

Aer8 is made from Swedish wood pulp, contains no plastic parts. It is collapsible, compostable, and large volume portable spacer. It is designed for multiple use and does not have to be cleaned. The spacer is made in two production steps, firstly the production of paperboard and secondly the printing, cutting and assembly. Both facilities follow Good Manufacturing Practice and are regularly audited by the relevant licensing authorities.



**Figure 1:** The stages in the Life Cycle of a product.

The procedures of life cycle assessment (LCA) are part of the ISO 14000 environmental management standards. LCA is a technique to assess environmental impacts associated with all the stages of a product's life from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling.

The accuracy and availability of data does not allow a full analysis here. In this instance, the available data for the base material will be examined, namely Invercote paperboard from Iggesund.

Holmen's Invercote G paperboard making process is subject to environmental management systems, ISO 14001. Paperboard production goes hand in hand with sustainable forest management. For every tree which is harvested and used in the production process, four new ones are planted. The result is a sustainable closed loop cycle that stretches over a century or more. The Holmen Group's

forest management routines are approved in accordance with the Forest Stewardship Council Certification (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) standards as well as certified in accordance with the ISO 14001 standard. The mill holds chain of custody-certifications (CoC) in accordance with FSC and Iggesund Bruk also holds CoC certification with PEFC. This enables certified customers to be part of the chain.

Regulations	Abbreviation/Code	Country
Regulation regarding the product safety of packaging material intended to come into contact with food	EC Regulation 1935/2004	EU
BfR Recommendations XXXVI regarding paper and board for food contact	BfR	Germany
The EU Directive on Packaging and Packaging Waste, requirements on heavy metal content/contamination, see also p. 16	Directive 94/62/EC and subsequent amendments	EU
Regulation 1907/2006 concerning Registration, Evaluation, Authorisation and restriction of Chemicals	REACH	EU
Commision Regulation (EC) No 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food	GMP	EU
Safety of toys	Directive 2009/48/EC	EU
Requirements for the Safety of Toys – Migration of certain elements.	EN 71 Part 3 ISO 8124-3:2010	Worldwide
Legislation from the Coalition of North Eastern Governors regarding the content of mercury lead, cadmium and hexavalent chromium in packaging and packaging components	CONEG	US and Worldwide
Code of Federal Regulations, Food and Drugs Administration (FDA)	FDA regulations	US and Worldwide
EU Timber regulation	EC Regulation 995/2010	EU

**Table 1:** Invercote G manufacturing requirements (Iggesund Technical Manual).

### Carbon footprint Aer8 spacer

In the production of the paperboard, the total emissions of carbon dioxide are 229 kg/tonne board or 0.229 kg/kg board (Holmen Iggesund Invercote carbon footprint 2025).

The Aer8 spacer is manufactured from pure Invercote G 300 gsm. Thus a 19g Aer8 spacer paperboard will have a carbon footprint of 4.35g CO<sub>2</sub>.

### Appendix

1. Invercote Carbon Footprint and Environmental Declaration 2025
2. ISO 14001 Certificate Iggesund Bruk

Appendix 1

# Invercote & Inverform Carbon Footprint & Environmental Declaration 2025

HOLMEN

# Carbon Footprint

Company	Holmen
Site	Iggesunds Bruk
Product	Invercote & Inverform family
Period	2024-01-01 – 2024-12-31

## Carbon Footprint Framework

The Carbon Footprint is calculated according to the guidelines given in the CEPI (Confederation of European Paper Industry) publication "Framework for the development of carbon footprints for paper and board products". The framework is aligned with the GHG Protocol standard and is available at [www.cepi.org](http://www.cepi.org). The carbon footprint is updated annually and based on figures from the previous year.

## Greenhouse Gas Emissions

	CO <sub>2</sub> e (kg/tonne board)	Percentage of total
Greenhouse emission from paperboard manufacturing facilities	48	21%
Greenhouse emission associated with purchased electricity	2	1%
Greenhouse emission from producing the wood fibres	20	9%
Greenhouse emission from producing other raw materials	139	61%
Greenhouse emission associated with transportation	20	8%
<b>Carbon Footprint SUM</b>	<b>229</b>	<b>100%</b>

## Biogenic Carbon uptake and storage

Annual carbon storage in Holmen forest	2,1 million tonnes CO <sub>2</sub>
Carbon stored in paperboard	1494 kg CO <sub>2</sub> /tonne board

## Explanations and comments to Carbon Footprint calculations

**Greenhouse gas emission from paperboard manufacturing facilities** Fossil CO<sub>2</sub>e emissions from combustion of fossil fuels during pulp and paperboard production. From 2025, this figure also includes emissions of Methane and Nitrous Oxide as a result of updated calculation methodology. For Fossil CO<sub>2</sub> emissions only, see Emissions to Air table on page 4.

**Greenhouse gas emission associated with purchased electricity** Fossil CO<sub>2</sub>e emissions associated with purchased electricity.

**Greenhouse gas emission from producing the wood fibres** Emissions from forest management and harvesting.

**Greenhouse gas emission from producing other raw materials** Fossil CO<sub>2</sub>e emissions from production of non-wood based raw materials and fuels.

### Greenhouse gas emission - general

Emissions outside of own operations consist of a mix of primary data and industry average data and are therefore subject to a degree of uncertainty. We strive to use as much primary data in our calculations as possible and continuously work with our suppliers to secure robust and accurate data. As such, emissions from the value chain will change over time as primary data replaces industry average data.

## Explanations and comments to Biogenic Carbon uptake and storage

### Annual carbon storage in Holmen forest

Growing forests capture carbon. The quoted figure represents the net CO<sub>2</sub> capture in Holmen's own forests past year. For more information see Holmens Sustainability Report.

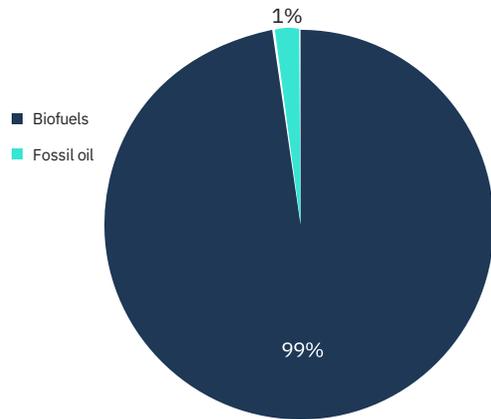
### Carbon stored in paperboard

Biogenic carbon stored in the products.



# Energy

Sources for energy production at Iggesund Mill



# GHG Protocol Reporting

## GHG Protocol reporting – site emissions

	CO <sub>2</sub> e '000 tonne	Percentage of total
Scope 1: Direct GHG emissions	17	21%
Scope 2: Indirect GHG emissions from electricity	1	1%
Scope 3: Other indirect GHG emissions from value chain	64	78%
<b>Greenhouse Gas emissions</b>	<b>82</b>	<b>100%</b>

Sustainability information is reported in accordance with the Global Reporting Directive’s GRI Standards in Holmen’s annual report. Iggesund site emissions are a part of the Holmen sustainability information that is audited by PwC.

Scope 3 emissions consist of a mix of primary data and industry average data and are therefore subject to a greater degree of uncertainty. We strive to use as much primary data in our calculations as possible and continuously work with our suppliers to secure robust and accurate data. As such, Scope 3 emissions will change over time as primary data replaces industry average data.

## Explanations and comments to Energy reporting

The energy produced at the mill is to 99% renewable from biogenic sources. One percent of the internal energy production comes from fossil sources. The additional energy in form of externally purchased electricity is fossil free and comes from renewable sources like hydro power and fossil free sources in form of nuclear energy.

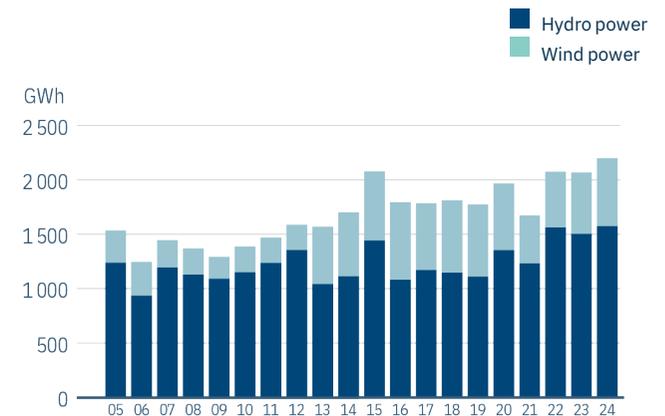
## Explanations and comments to GHG Protocol reporting

Scope 1: Calculated in accordance with the GHG Protocol Corporate Standard and includes the six greenhouse gases covered by the Kyoto Protocol. Our Scope 1 emissions are reported into Swedish authorities.

Scope 2: Calculated in line with market-based methodology, with EPDs (Environmental Product Declaration) from Electricity supplier, Vattenfall, Sweden.

Scope 3: Calculated using primary data when available and industry averages when needed from data bases like Sphera/GaBi and EcoInvent.

## Holmen Group deliveries of hydro and wind power, GWh



Holmens deliveries of energy from own hydro power and wind power contributes to a great extent with renewable electricity to the Swedish Grid.

# Environmental Declaration

Product	Invercote and Inverform, 180-770 gm <sup>2</sup>
Site and company	Iggesunds Bruk, Holmen
Paper type	Invercote and Inverform
Period	2024-01-01 – 2024-12-31

## Product composition

Wood fibre pulp	75%-100% of which 100% produced at site
Coating	0%-25%

## Environmental management

Certified environmental management system	SS-EN ISO 14001 SP-2778 M since 2001 COC for FSC and PEFC since 2007
Certified energy management system	SS 62 77 50 since 2005 and upgraded to ISO 50001 in 2011
Food Safety System Certification	FSSC 22000 since 2021

## Handling after use of the product and its packaging

All our products are intrinsically recyclable and biodegradable. Products can be recoverable as a material or energy resource. For quantification regarding composting tests, should be made on the final packaging after the converting process (EN 13432:2000).

## Environmental load

Production site process waste water discharges, atmospheric emissions and solid waste per tonne board (total environmental load of the production of board produced at the Site divided by the total production of board).

### Emissions to water

COD	11 kg/t
AOX	0,08 kg/t
Nitrogen	0,19 kg/t
Phosphorus	0,03 kg/t
Water use	60 m <sup>3</sup> /t

### Emissions to air

S (total)	0,08 kg/t
NO <sub>x</sub>	1,44 kg/t
CO <sub>2</sub> e (from fossil sources)	17,4 kg/t

### Waste to landfill

0,12 kg/t
-----------

**Emissions to water** Iggesund Mill is situated on the shores of the Baltic Sea, which is classified as a highly sensitive marine ecosystem. The mill complies with emissions levels set by the Swedish environmental authorities and continually measures discharged water at several test points. Iggesund regularly monitors the conditions of the marine ecosystems around the mill to ensure that their balance is not disturbed.

**Process water discharge** The Iggesund Mill is geographically located in an area of abundant water supply and there is no shortage of availability. Process water is re-circulated and re-used within the production process a number of times before final discharge to the receiving water. Process water is treated in three steps which includes mechanical, biological and chemical treatment, a combination of treatment technologies considered as Best Available Technology.

**COD** Chemical oxygen demand is a measurement of the amount of oxygen consumed in the decomposition of organic compounds. The presence of organic by-products such as bark and wood chips gives rise to a COD value. The Swedish environmental authorities set emission levels based on COD deemed acceptable to the local conditions and the marine environment adjacent to the mill.

**AOX** Adsorbable organic halogen is formed in the pulp making process. High levels of AOX negatively affect marine organisms. Here, too, limits are set to be acceptable to local conditions and the marine environment adjacent to the mill.

**Nitrogen and phosphorus** Nitrogen and phosphorus are elements that when present in large amounts contribute to the overfertilisation (eutrophication) of marine environments.

**Emissions to air – S and NO<sub>x</sub>** These normally arise from combustion processes used in the production of energy. They contribute to eutrophication, acidification and the creation of ground-level ozone. All emissions are regulated and monitored by the Swedish licensing authorities.

**CO<sub>2</sub>e (from fossil sources)** Carbon dioxide is an invisible gas that occurs naturally but its increased emissions from fossil fuel use are contributing to global climate change. This figure indicates the emission of fossil CO<sub>2</sub> from the production of Invercote. The figure should not be confused with the far broader concept of carbon footprint, which encompasses much of the product's lifecycle.

# Wood supply and certifications

## Certifications

Mill's environmental certificates:	FSC® TUEV-COC-000232 (Logo license: FSC-C110018) PEFC <sup>a</sup> TUEV-PEFC-COC-117551 (Logo license: PEFC/05-33-105)
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## Methods

Certification scheme	Method
FSC® Volume credit system	All FSC® certified deliveries contain 100 % certified fibre
PEFC <sup>a</sup> Volume credit method	All PEFC <sup>a</sup> certified deliveries contain 100 % certified fibre

## Wood supply

All wood used at Iggesund Mill is either certified in accordance with FSC or PEFC or meets FSC requirements for controlled wood. Invercote and Inverform can be supplied certified in accordance with FSC or PEFC. All wood raw material used in the production of Invercote and Inverform is sourced from forests that are replanted with new trees after harvest ensuring that the land remains forested. The production of Invercote and Inverform is to no extent contributing to deforestation.

## Wood sourcing compliance

All fibre sourcing, including Due Diligence requirements, complies with the current EU Timber Regulation (Regulation EU No 995 /2010 ). The EUTR is replaced by EU Deforestation regulation (Regulation EU No 2023/1115) entered into force on June 29 2023 and will enter into application on December 30 2025.

## Wood sourcing information, Iggesunds bruk 2024

Country of origin	%	Procurement region	Species	Forest owners	Certificates
Sweden	88.3	Region Mitt	Pinus Sylvestris Pinus contorta, Picea abies Betula spp, Populus tremula	Forest companies and private owners	DNV-COC-000004 DNV-FM/COC-000043 2003-SKM-PEFC-006 2015-SKM-PEFC-062
Estonia	5.8	Western Estonia	Pinus Sylvestris Picea abies Betula spp, Populus tremula	State forests and private owners	DNV-CW-000004 SA-COC-007273 DNVSE-PEFC-COC-006
Latvia	4.7	Western Latvia	Pinus Sylvestris, Picea abies Betula spp, Populus tremula	State forests and private owners	DNV-CW-000004 SA-COC-007273 DNVSE-PEFC-COC-006
Finland	0,8	Finland	Pinus Sylvestris, Picea abies	Forest companies and private owners	DNV-COC-000004 DNVSE-PEFC-COC-006
Norway	0,4	Region West	Pinus Sylvestris, Picea abies	Forest companies and private owners	DNV-COC-000004 DNVSE-PEFC-COC-006

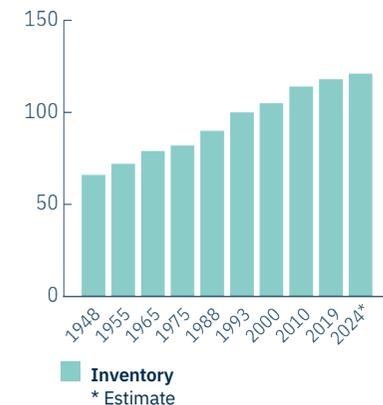
## Sustainable forestry

Holmen's forest management practices must be run with the aim of achieving high-volume and sustainable production of forest raw material. The forests must be managed responsibly in a way that ensures the long-term survival of native plants and animals in the forest landscape and the protection of biodiversity. All wood must be traceable back to its origin.

## Holmen's forests 2024

Total land acreage	13 030 km <sup>2</sup>
Total forest land acreage	11 600 km <sup>2</sup>
of which nature conservation areas	2 110 km <sup>2</sup>
Productive forest land	10 450 km <sup>2</sup>

## Volume of standing timber, m<sup>3</sup> growing stock, solid over bark per hectare of productive forest land



## Contact information:

Jonas Bergström, Sustainability Manager, Sweden.  
jonas.bergstrom@holmen.com

# Certificates and



**THE GLOBAL GOALS**  
For Sustainable Development



## CDP

Holmen has reported to the CDP Climate Program since 2007 and to the CDP Forest Program since 2013.

CDP ratings demonstrate that Holmen's forest management practices provide a good strategy for mitigating negative impacts of climate change.

## EcoVadis

All Holmen's paperboard and paper mills have once more been awarded a Platinum rating by the international analysis company EcoVadis. EcoVadis assesses participating companies' performance with respect to the environment, sustainable purchasing, ethics, workers' rights and human rights. The Platinum rating confirms that Holmen is among the top 1% of companies examined.

## MSCI

ESG Ratings from MSCI ESG Research are designed to measure a company's resilience to financially material environmental, societal and governance (ESG) risks. MSCI's ESG Ratings provide a window into one facet of risk to financial performance. Holmen is ranked as a leader in the paper and forest products industry.

## SBTi

In 2021, Holmen's Group management set the target of reducing greenhouse gas emissions. Figures are compared with 2019 levels and the emissions targets are in line with the UN's climate goals under the Paris Agreement, as confirmed by the UN-backed organisation the Science Based Targets initiative (SBTi).

## The UN's Sustainable Development Goals

We have been building our experience for 400 years and we constantly work to find long-term solutions to current challenges. Thanks to the sustainable use of our forests' ecosystems, today we are able to operate a circular, renewable and bio-based business that benefits our customers, shareholders, employees and local communities. Our production, business and organisation contribute to the UN's Sustainable Development Goals and thus also to the 2030 Agenda.

## UN Global Compact

As members in UN Global Compact, Holmen annually reports on a "Communication on Progress" (COP) that describes how the work with Global Compact's principles for responsible business practice is progressing.

## GRI - Global Reporting Initiative

Holmen has opted to base its sustainability reporting on the reporting option Core in the guidelines for sustainability reporting issued by the Global Reporting Initiative (GRI). Holmen has appointed PwC to conduct a general review of the content in the Group's GRI reporting. The sustainability report is presented in Holmen's Annual report. A complete GRI register and auditors' report can be found on Holmen.com.

## Nasdaq ESG Transparency Partner

The certification is used by Nasdaq to signal engagement in market transparency and in raising environmental standards. The Nasdaq ESG Matrix includes data points from Environmental, Social, Corporate Governance as well as Future Sustainability Goals all of which Holmen considers in its operation.



**HOLMEN**

[holmen.com/boardandpaper](https://holmen.com/boardandpaper)

  
**RI.  
SE**  
**CERTIFIKAT****ISO 14001**

Härmed intygas att/This is to certify that

**Holmen Board and Paper AB  
Iggesunds Bruk**

Ringvägen 35, 825 32 IGGESUND, SWEDEN

har ett miljöledningssystem som uppfyller kraven enligt SS-EN ISO 14001:2015 vad gäller  
has an environmental management system that fulfils the requirements of SS-EN ISO 14001:2015 with respect to

Tillverkning av cellulosa och kartong samt plastbeläggning och laminering  
av kartong till grafisk industri och förpackningsindustri

Manufacture of chemical pulp and paperboard as well as plastic coating and lamination  
of paperboard to graphical and packaging industry

Ursprungligen utfärdat/Originally issued	2001-05-07
Giltigt till och med/Expiry date	2027-09-06
Beslutsdatum/Decision date	2025-01-16



Jonas Madsen

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## I certifikatet ingående verksamheter och orter/Scope and geographical locations

**Holmen Board and Paper AB, 556088-5294**

Ringvägen 35, 852 32 IGGESUND	Huvudkontor. Kartongbruk
Påbodavägen 10, 825 95 STRÖMSBRUK	Plastbeläggning och laminering av kartong
Skärnäsvägen, Skärnäs Hamnkontor, 825 32 IGGESUND	Hamn, stuveri, terminal