Comparative Carbon Footprint Study tesa® 4024 Next Generation vs. conventional version

Public Facing Report, 2026-01-31

Content

Executive summary

At tesa, we are committed to sustainability. Our aim is to develop more sustainable adhesive solutions and products that not only minimize our environmental footprint but also help our customers achieve their own sustainability goals.

Following this strategy, we are introducing the next generation of well-known packaging tape tesa® 4024 featuring a biobased acrylic adhesive following the mass balance approach.

This adhesive offers the same proven performance and at the same time significantly reduces the product carbon footprint (PCF).

- Up to 31% reduction of carbon footprint cradle-to-gate including biogenic carbon uptake
- Up to 21% reduction of carbon footprint over the entire lifecycle compared to the previous version
- Up to 87 g CO_2e/m^2 total reduction over the entire life cycle

Since sustainability is closely linked to trust, we have performed a comparative Life Cycle Impact Assessment with external review backing up above statements.

Goal and scope

Goal

The study is intended to substantiate marketing claims related to the product carbon footprint comparison and improvements between the current and the next generation version of tesa® 4024.

The intended environmental marketing claims and comparative statements will be used for commercial or industrial clients (B2B). They are shared with the public through different channels including but not limited to product detail pages on tesa.com, social media posts, and displays for industry trade fairs.

Description of the product and the application

Current tesa® 4024 is a performance grade, filmic packaging tape consisting of a 28µm BOPP backing and an acrylic adhesive coated in a water-based process. It is used for closing light to medium weight secondary corrugated paper board packages.

Intended marketing claims

Compared to the current product version, tesa 4024® NextGen is more sustainable and offers

- Up to 31% reduction of carbon footprint cradle-to-gate including biogenic carbon uptake
- Up to 21% reduction of carbon footprint over the entire lifecycle compared to the previous version
- Up to 87 g $CO2e/m^2$ total reduction over the entire life cycle

Life Cycle Impact Assessment (LCIA)

Methodology and types of impacts

Life Cycle Impact Assessment studies usually cover multiple impact categories. However, we have focused our study solely on the product carbon footprint due to the significance of climate change. The methodology follows ISO 14067 and ISO 14040/44 standards.

Description of the system boundaries

The system boundary is cradle to gate for B2B purposes and cradle to grave for B2C. This assessment includes production of raw and auxiliary materials, transport paid for by tesa, grid power generation and losses, energy usage, and waste management including off-site disposal.

Attributable processes are those involved in producing tesa® 4024 and linked to material or energy flows throughout the product's life cycle. For the product carbon footprints in scope, no materials or energy flows have been excluded.

The use phase is excluded since both product versions are applied in the same way making it irrelevant for both B2B and B2C contexts.

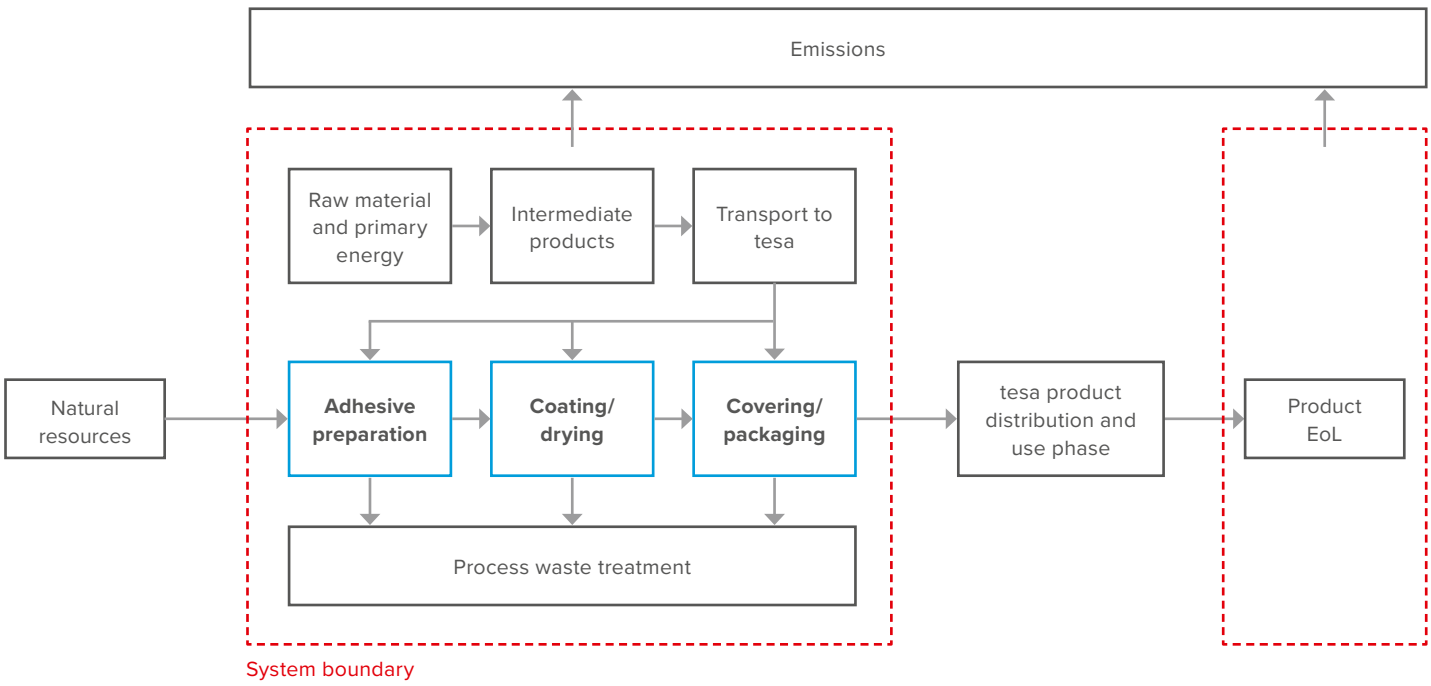


Image 1: Flow chart with LCIA system boundaries

Life cycle inventory and data collection

All relevant life cycle impact data were collected and used for filling in a standardized tool for calculating Product Carbon Footprints of tesa products.

The tool covers energy use, scrap rates, transport, and maps all raw materials to emission factors. The methodology is externally validated and complies with ISO 14044.

Material inputs are sourced from the tesa® 4024 bill of materials, and production data is taken from the work plans. Energy use is based on annual averages from representative machines, and waste rates are estimated at the corporate level. Corporate transport emissions are allocated by product weight.

Additionally, supplier emission factor data quality is assessed using DQR (TfS guidelines) and an additional tesa-specific indicator (DQI) for information maturity.

Life Cycle Impact Assessment calculation results

Results overview

The result tables of the LCIA contain data for the transparent product version which is sold most and is displayed in grams of carbon dioxide equivalent per m^2 of tape.

Below table compares current tesa® 4024 versus tesa® 4024 Next Generation showing the results as used for the intended marketing claims. The table covers both the cradle-to-gate as well as the cradle-to-grave scenario. It differentiates between fossil and biogenic carbon emissions and shows the bio-genic carbon uptake as provided by the biobased acrylic adhesive according to the mass balanced approach.

Comparative Product Carbon Footprint – Overview

Absolute values in [g CO2-eq./m^2]	tesa® 4024	tesa® 4024 Next Gen	Relative reduction	Absolute reduction
Fossil cradle-to-gate emissions	285	235		
Biogenic carbon emissions	1	8		
Biogenic carbon uptake	-7	-51		
Cradle-to-gate emissions including biogenic uptake	279	192	-31%	
Biogenic end-of-life and downstream transport emissions	6	43		
Fossil end-of-life and downstream transport emissions	137	101		
Cradle-to-grave emissions	422	336	-21%	-87

Table 1: Comparative PCF – Overview

Transparency notes: Biogenic carbon uptake means that plants absorb CO_2 during growth and store it temporarily in biomass, which is counted as a negative emission in cradle-to-gate calculations. At the end of the product's life, this stored carbon is released back into the atmosphere and recorded as a positive emission to reflect the full life cycle impact. This approach ensures transparency by recognizing temporary CO_2 sequestration in cradle-to-gate while also accounting for its eventual release at its end-of-life in the cradle-to-grave scenario.

Result details

Below table breaks down the emissions by process and separates fossil and biogenic emissions for each product version.

Comparative Product Carbon Footprint – Details: Cradle-to-grave

	tesa® 4024		tesa® 4024 Next Generation	
Values in [g CO2-eq./m²]	Fossil emissions	Biogentic emissions	Fossil emissions	Biogenic emissions
Material (3.1)	199		155	
Operational waste (3.5)	24	1	17	8
Energy usage (1,2)	33		33	
Solvents incineration (1,2)	0		0	
Transport (3.4)	29		30	
Transport (3.9)	3		3	
End of Life (3.12)	134	6	98	43
Total	422	7	336	51

Table 2: Comparative PCF Details: Cradle-to-grave

Implementation of mass balanced approach

The tesa manufacturing site Comet SpA, Italy has been externally certified under number ISCC-PLUS-Cert-DE100-22206125 and complies with the requirements of the certification system of ISCC PLUS. This covers the mass balance chain of custody as a final product refinement center and converter. This certification confirms the scientific mass balance approach.

Interpretations and conclusions

The main factor influencing the product's carbon footprint is the raw material used, making up nearly half of the total impact. Within this, adhesive production is especially important, contributing up to 30% of the footprint. The new generation adhesive has much lower emissions because it uses more renewable resources and is produced more efficiently. This reduces fossil emissions both during production and at the product's end-of-life.

The PCF comparison of conventional tesa® 4024 with tesa® 4024 Next Generation is valid, as both options serve the same purpose and have identical functions and performance. The comparative evaluation allows for the intended marketing claims to be tailored to the intended audience.

Limitations

The study's results are based on data from different sources and supplier self-declarations, so figures may change as data improves. Using bio-based materials lowers fossil emissions but increases bio-genic emissions at end-of-life. The results focus only on climate change and do not cover other environmental effects.

It is recommended to regularly update PCF data and improve data quality over time. For further information see the comments of the critical review statement.

Critical review

To ensure that all relevant methods, data, and calculations conform with the ISO 14067 standards and that the intended goals of the study can be achieved, a critical review of the technical Life Cycle Impact Assessment was conducted by an independent external expert.

The critical review report is annexed to this report and was performed by Ramboll Deutschland GmbH, Germany. The critical review statement refers only to the technical report, whereas the critical reviewer has not reviewed this public facing report.

Overall, it can be concluded that despite limitations in the data quality and consistency the calculations are suitable for comparing the different product variants in the intended way.

Appendix 1: ISCC PLUS Certificate

SGS

ISCC PLUS Certificate

Certificate Number: ISCC-PLUS-Cert-DE100-22206125

SGS Germany GmbH
Europa Allee 12, D-49685 Emstek
certifies that

Comet SpA

Via L.Cadorna 27
22043 Solbiate con Cagno (CO)
ITALY

complies with the requirements of the certification system

ISCC PLUS

(International Sustainability and Carbon Certification)

Place of the audit:
see above

This certificate is valid from 03/02/2025 to 02/02/2026

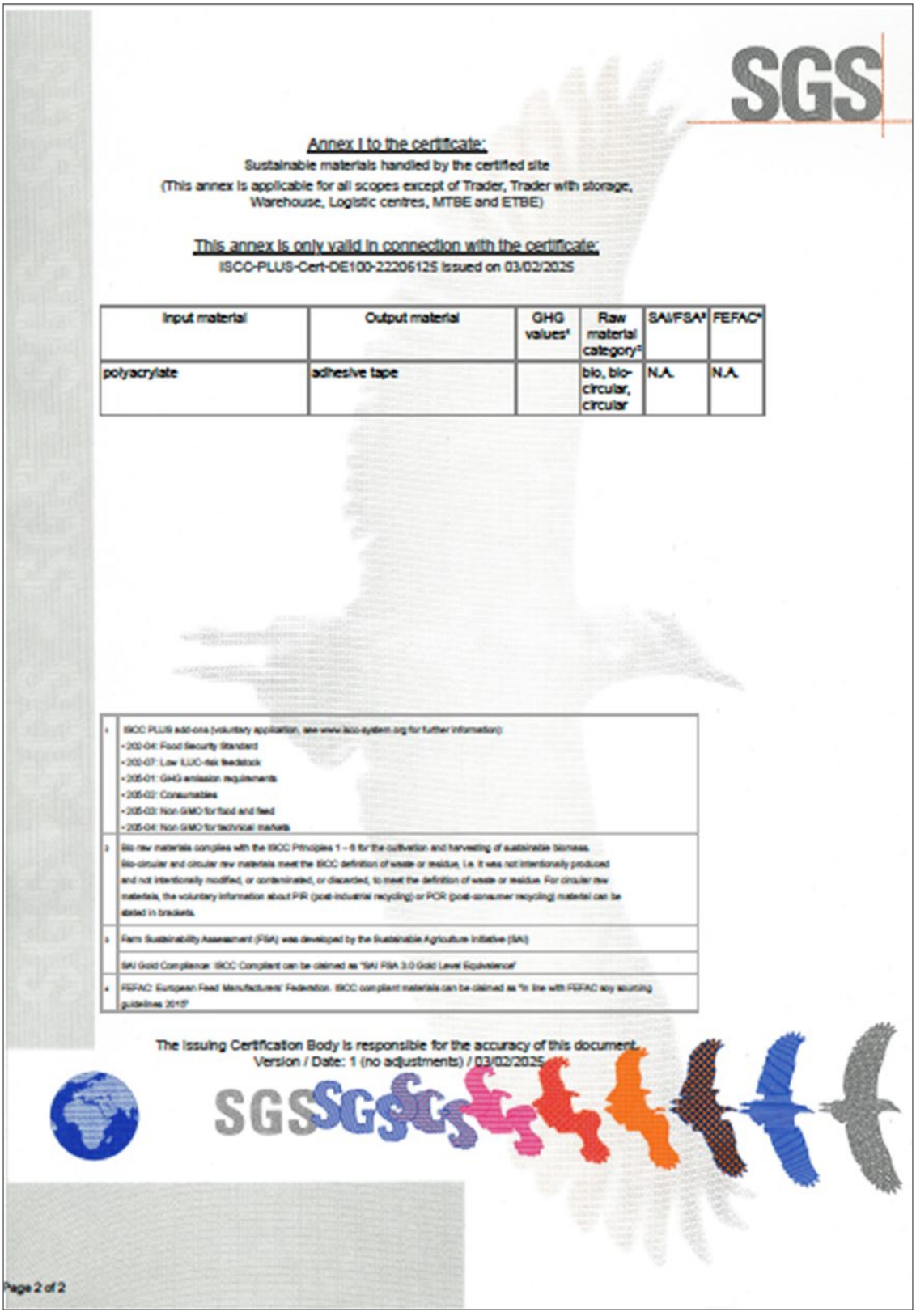
The site of the system user is certified as:
converter, final product refinement

The scope of the certificate includes the following chain of custody options:
mass balance

Emstek, 03/02/2025
Place and date of issue

SGS Germany GmbH
Stamp, signature

The issuing Certification Body is responsible for the accuracy of this document.
Version / Date: 1 (no adjustments) / 03/02/2025



SGS

Annex I to the certificate:

Sustainable materials handled by the certified site

(This annex is applicable for all scopes except of Trader, Trader with storage, Warehouse, Logistic centres, MTBE and ETBE)

This annex is only valid in connection with the certificate:

ISCC-PLUS-Cert-DE100-22206125 issued on 03/02/2025

Input material	Output material	GHG values[1]	Raw material category[2]	SAI/FSA[3]	FEFAC[4]
polyacrylate	adhesive tape		bio, bio-circular, circular	N.A.	N.A.

1	ISCC PLUS add-ons (voluntary application, see www.isccsystem.org for further information): • 203-04: Food Security Standard • 203-07: Low ILUC-risk feedstock • 205-01: GHG emission requirements • 205-02: Consumables • 205-03: Non-GMO for food and feed • 205-04: Non-GMO for technical markets
2	Bio raw materials complies with the ISCC Principles 1 – 6 for the cultivation and harvesting of sustainable biomass. Bio-circular and circular raw materials meet the ISCC definition of waste or residue, i.e. it was not intentionally produced and not intentionally modified, or contaminated, or discarded, to meet the definition of waste or residue. For circular raw materials, the voluntary information about PIR (post-industrial recycling) or PCR (post-consumer recycling) material can be stated in brackets.
3	Farm Sustainability Assessment (FSA) was developed by the Sustainable Agriculture Initiative (SAI) SAI Gold Compliance: ISCC Compliant can be claimed as "SAI FSA 3.0 Gold Level Equivalence"
4	FEFAC: European Feed Manufacturers' Federation. ISCC compliant materials can be claimed as "in line with FEFAC soy sourcing guidelines 2015"

The issuing Certification Body is responsible for the accuracy of this document.
Version / Date: 1 (no adjustments) / 03/02/2025

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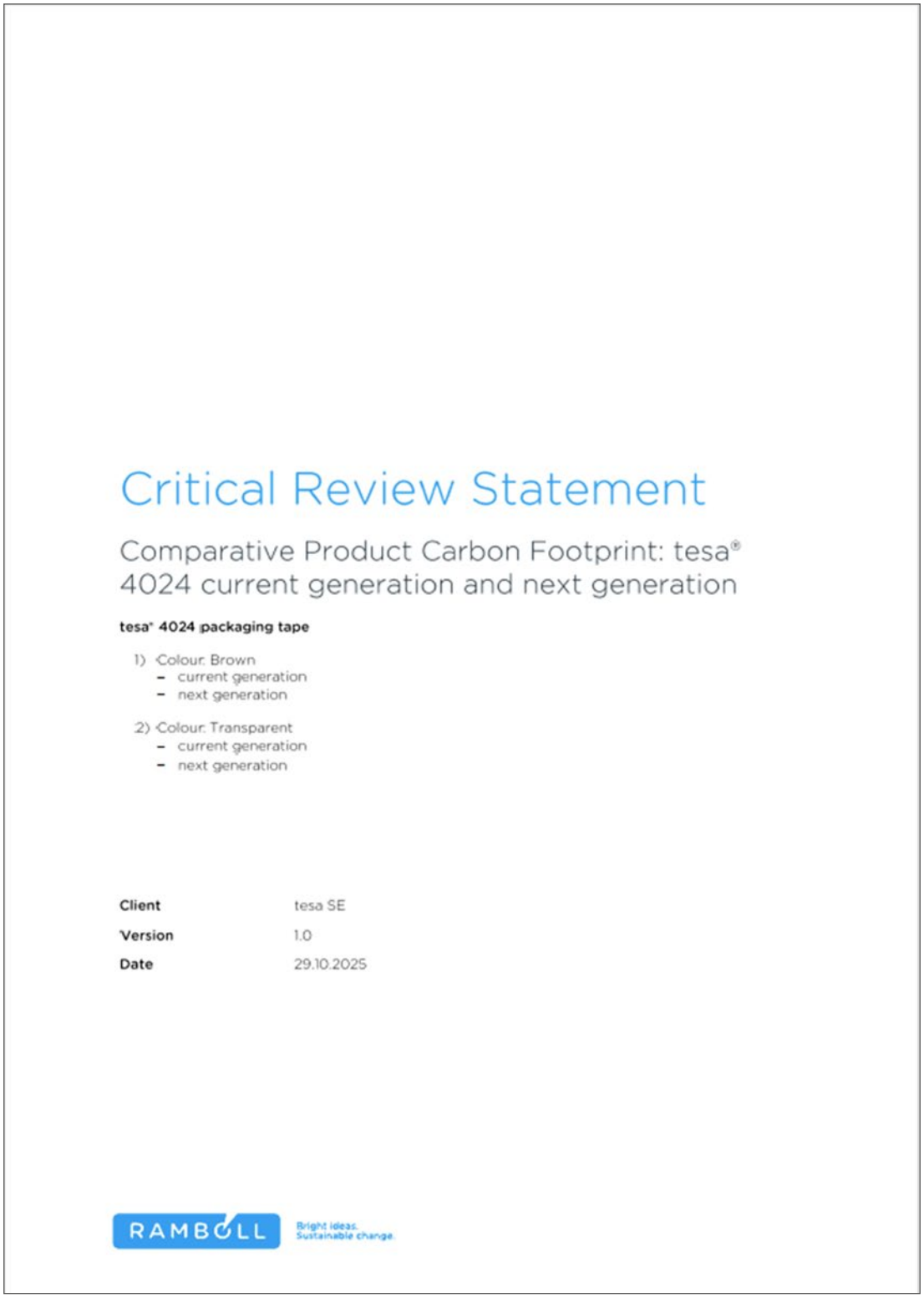
Appendix 2: Critical Review Report



Critical Review Statement

Comparative Product Carbon Footprint: tesa® 4024 current generation and next generation

tesa® 4024 packaging tape

1) Colour: Brown
   - current generation
   - next generation

2) Colour: Transparent
   - current generation
   - next generation

Client	tesa SE
Version	1.0
Date	29.10.2025

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1. General Information

Title of the Study	Comparative Product Carbon Footprint: tesa® 4024 current generation and next generation
Reference to standards	– ISO 14067 (2014): Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification incl. Annex C the CFP systematic approach – ISO 14040 (2006): Environmental Management - Life Cycle Assessment - Principles and Framework – ISO 14044 (2006): Environmental Management - Life Cycle Assessment - Requirements and Guidelines – ISO/TS 14071 (2014): Environmental management — Life cycle assessment — Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006
Commissioner of the LCA Study	tesa SE Hugo-Kirchberg-Straße 1 22848 Norderstedt Germany
Practitioner of the LCA Study	Martin Ibing
Supporting documentation	Version 4, dated 23.07.2025
Organisation carrying out the study	Ramboll Deutschland GmbH Jürgen-Töpfer-Straße 48 22763 Hamburg Germany
Type of review	☒ Critical review by external expert ☐ Critical review by panel of interested parties
Reviewers	Alexander Boeth, Eva Knüpffer

2. Description of the Review Process

Scope of the Review	– Accordance of the PCF methodology with ISO 14067 – Scientific and technical validity – Appropriateness and relevance of data – Achievability of the intended objective despite identified limitations
Supporting documents	Tesa provided a report ("LCA Report tesa 4024") for the review, as well as calculation tables as an annex to ensure the traceability of the results: – 24-09-09_tesa_Review_Statement_Signed.pdf – Supplier information for adhesives – Inventory.xlsx – LCA Report tesa 4024_V4 – PCF_framework_final - Copy.pdf – PCF_Standard_vs_Next Gen 24.02.2025.xlsx – tesa 4024 Mapping.xlsx
Process	The review was conducted in accordance with ISO 14067:2014 and ISO/TS 14071:2014. Between April and August 2025, the process comprised three comment rounds followed by corresponding updates to the documentation. The review was carried out at the end of the study, not concurrently.
Comments and Implementation	Comments and observations made during the review process were documented, discussed in detail with the study practitioner, and subsequently implemented where applicable.

3. Remarks

During the review, items were identified that could affect the accuracy and validity of the results.:

Evaluation Method	The method used for the evaluation was constrained to IPCC AR6 (excluding biogenic emissions). Biogenic GHG removals and emissions were determined on the basis of the biogenic carbon content of the biogenic components. Therefore, parts of the biogenic GWP are included, yet the assessment of biogenic emissions is incomplete.
Material and Waste Emissions	Emissions calculations for materials involved have been performed using "LCA for Experts" software and are stored in an Excel database for further emissions calculations. The study under review uses these stored values. The same applies to the treatment of production waste (incineration) from these materials. This systematic approach, "CFP Framework and data governance (Version 1.0)", was critically reviewed in 2024. A detailed examination of the individual datasets and emission factors used in the calculations was beyond the scope of this review.
Transportation Emissions	Transportation emissions data were derived from the Corporate Carbon Footprint and allocated to 1 m² of products under consideration. The exact calculation method and emission factors used for transportation are not documented, leading to potential inconsistencies compared to other LCA approaches.
Energy Emissions	Similar to transportation, energy emissions were calculated with emission factors from various data sources. They are not fully consistent with data from LCA for Experts. Furthermore, verification of activity data is beyond the scope of this review.
Product Carbon Footprints (PCFs) of Adhesives	The current supplier of the 100% fossil based adhesive did not consider biogenic emissions. The supplier of the new generation bio attributed adhesive determined biogenic removals and emissions based on the carbon content of the material. Other biogenic emissions in the upstream processes are not considered relevant and have been neglected.

4. Conclusion and Recommendations

While the study largely adheres to ISO 14040 and ISO 14044 requirements, methodological and data-related uncertainties were identified that impact the reliability of the LCA results for the products under investigation.

However, it is important to note that these uncertainties affect both the current and next generation of the adhesive tapes equally. The most significant difference between the two assessments is the adhesive material sourced from different suppliers. The manufacturing process of the tape itself as well as the material composition remain essentially the same across both variants.

Ultimately, the comparison result heavily depends on the emission factors of the adhesive provided by the respective suppliers, with the emission factor for the adhesive in the current variant being particularly opaque regarding LCA methodology and evaluation. However, the use of these emission factors is supported by the fact that their temporal, geographical and technological representativeness can be considered (very) high.

Overall, it can be concluded that, despite the limitations with regard to data quality and consistency, the calculations are suitable for comparing the different product variants. However, the absolute results should be used with caution due to the inconsistencies mentioned above.

Based on the identified issues, the following recommendations are made to improve future LCA studies:

- Employ evaluation methods that include all emissions required by ISO 14067, e.g. biogenic GHG emissions
- Ensure a transparent and verifiable data flow for all primary data, including data collection and all performed calculations
- Document the calculation foundations for transportation and energy emissions to ensure methodological consistency.
- Obtain detailed methodological information for PCFs from suppliers, including clear separation of fossil and biogenic components.

The review was based solely on the information and documentation provided by the commissioner and study author.
The reviewer is not responsible for the accuracy or completeness of the underlying data or for subsequent use of the reviewed report by third parties.

This statement reflects the professional judgment of the undersigned reviewer at the time of review and does not constitute a legal certification or guarantee.

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