

Validation Opinion

VO-4213754



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The Carbon Footprint of Products (CFP) systematic approach, titled as “Sugar Division Methodology for the partial Product Carbon Footprint Calculation of Beet Sugar”, Version 1.0 from 22.10.2025, implemented by

Südzucker Sugar Division
Maximilianstrasse 10
68165 Mannheim

was validated in accordance with DIN EN ISO 14064-3:2020.

We hereby confirm that Südzucker Sugar Division has implemented appropriate procedures to calculate and report the

Partial (cradle-to-gate) **Carbon Footprint of Beet Sugar**

in accordance with DIN EN ISO 14067:2019, in particular Annex C (“The CFP systematic approach”; normative).

Level of assurance: reasonable

Materiality threshold(s): 8% for the total of all reported greenhouse gas emissions

This validation opinion is only valid for the scope of assessment and in combination with the objectives, explanations and criteria for evaluation specified in the following validation report.

This validation opinion refers to the validation of the systematic approach for the calculation and reporting of carbon footprints of products but does not represent the verification of a carbon footprint of a specific product.

TÜV SÜD Industrie Service GmbH
Westendstrasse 199, 80686 Munich, Germany
Validation and Verification Body for Greenhouse Gases, D-VS-14153-01-00
Accredited by DAkkS according to DIN EN ISO 17029:2020 with DIN EN ISO 14065:2022 and DIN EN ISO 14064-3:2020 in accordance with DIN EN ISO 14067:2019

Munich, 31 October 2025

A handwritten signature in blue ink, appearing to read 'H. Kraus', is written over a horizontal line.

Explanations to the validation opinion

Brief description of the validation process

Südzucker Sugar Division as voluntarily ordered an independent (third party) validation of the systematic CFP approach for the calculation and reporting of carbon footprints of beet sugar regarding compliance with the DIN EN ISO 14067:2019-02, in particular Annex C (normative). This validation is based on the intended scope of application, the goals and criteria as agreed upon with the commissioning on 18 July 2025.

The staff appointed by the validation and verification body carried out a system review, an on-site visit and interviews of responsible staff at company's production site in Ochsenfurt, Germany, on 25 July 2025.

The following topics were discussed in detail:

- Methodological approach
- System boundaries, life cycle stages included
- Application to factories in the Südzucker Sugar Division, special features in individual factories
- Planned allocations

Further on-site visits to the other factories involved were not necessary, as many of them have been known for many years from the verification of emission reports for the EU ETS. The details of the respective production processes are very well known.

In particular, the following installations:

- Boiler houses
- Production process from incoming materials to products
- Meters for energy consumption (fuel, electricity, steam)
- Production quantity meters

Following the audit in Ochsenfurt, an interim assessment was carried out, followed by a revision of the method description, including minor adjustments to the calculation model. In connection with this update, a further audit was conducted at the central administrative location in Mannheim on 8 October 2025. The aim of this audit was to assess the feasibility of implementing the calculation model on the basis of concrete data and supporting documents.

Roles and responsibilities

The quantification and reporting of greenhouse gas (GHG) emissions are the sole responsibility of our client. Our role and responsibility as an accredited validation and verification body was to independently verify the adequacy of the GHG emissions reported by our client, as well as the underlying systems and processes for data collection, analysis and control, in accordance with the requirements of DIN EN ISO 14064-3:2020.

Standard for quantification and reporting of the carbon footprints of the products

DIN EN ISO 14067:2019

("Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification"), especially Annex C ("The CFP systematic approach"; normative)

System boundaries

The partial product carbon footprint calculations are calculated on a factory level for the beet sugar factories of the Südzucker Sugar Division:

Factories in Germany:	Südzucker AG:	Ochsenfurt, Offenau, Offstein, Plattling, Rain, Wabern, Zeitz
Factories in France:	Saint Louis Sucre:	Roye, Etrepagny
Factories in Belgium:	Raffinerie Tirlemontoise:	Wanze, Tienen
Factories in Poland:	Südzucker Polska:	Cerekiew, Ropczyce, Strzelin, Swidnica,
Factory in Moldova:	Südzucker Moldova S.A.	Drochia

The calculations have cradle-to-gate system boundaries. This means they include activities from:

- cultivation of sugar beets
- inbound transport of raw materials to the respective sugar factory
- production of beet sugar and its co-products (including energy consumption of non-renewable and renewable fuels or other types of purchased energy, the usage of associated process materials like limestone or basic production chemicals as well as treatment of process waste and wastewater)

Further details on the production process for beet sugar and by-products are contained in Südzucker's methodology description.

Not included in the calculation are GHG emissions coming from the following sources:

- the production of packaging material
- the production of capital goods and infrastructure
- employee commuting and business travel

In addition the following life cycle stages are not included in the calculation:

- Outbound transportation activities
- Use phase of beet sugar
- End-of-Life phase of beet sugar

The declared unit is defined as 1 ton of beet sugar (without packaging).

Emissions per life cycle stage

For the calculation of the partial product carbon footprint of beet sugar the activity data used can be separated into three different life cycle stages:

- cultivation,
- transport and
- processing of beet sugar.

The greenhouse gas emissions from sugar beet cultivation are calculated based on the quantity of sugar beet processed during the fiscal year. Amounts of sugar beets used are taken from CSR related data collection.



Greenhouse gas emissions related to transport activities are based on the average transported distances and used volumes of processed sugar beets as well as associated processing materials within the fiscal year.

For beet sugar processing, site-specific activity data is used for those processes over which the sugar factories have financial control, such as quantities and types of energy consumption and types and quantities of products manufactured.

Table 1 in the methodology description shows a summary of the most relevant primary activity data used in form of inputs and outputs for the three production processes ("Boiler house", "Silosugar production" and "Pulp dryer"). Actual inputs and outputs may vary from factory to factory, for example depending on which fuels are used in a factory to generate electricity and heat.

There are no direct capture and storage of greenhouse gases in sugar factories.

Other special features of the quantification method used

There are no product category rules available for this use case.

In the past, beet sugar was mainly produced using fossil fuels such as hard coal, heavy fuel oil, lignite or natural gas to generate the necessary energy. In order to advance the transformation to a climate-friendly circular economy, Südzucker AG is continuously putting effort in increasing its usage of renewable energy.

In order to be able to offer customers climate-reduced products, Südzucker Sugar Division uses a mass balance approach for factories which use renewable fuels. This mass balance approach is based on the requirements of ISO 22095 regarding mass balancing and works similar like the one for purchasing green electricity from the electricity grid. Since energy from different sources (renewable and non-renewable) is mixed in the boiler house, this mass balancing allows to claim a certain share of renewable energy based on accounting rather than physical flow. At the same time, it ensures that the total amount of renewable energy claimed does not exceed the amount actually consumed.

Relevant GHG emissions in the inventory

- | | |
|--|---|
| ☒ Carbon dioxide (CO ₂), | ☐ Perfluorocarbons, |
| ☒ Methane (CH ₄), | ☐ Sulphur hexafluoride (SF ₆), |
| ☒ Nitrous oxide (N ₂ O), | ☐ Nitrogen trifluoride (NF ₃) |
| ☐ Hydrofluorocarbons, | ☐ other |

The greenhouse gas inventory was calculated as CO₂ equivalents.

For all secondary data based emission factors the following two recognized LCA databases (accessed through the LCA software SimaPro) are used:

- Agri-footprint (Blonk et al, 2019)
- ecoinvent (Wernet et al, 2021)



Intended user of the carbon footprints and this validation opinion

- internal Stakeholders:
Use as a methodological guidance for determining partial PCF
- external Stakeholders:
Use in communication with customers who purchase beet sugar to provide insights and a deeper understanding of the methodological principles upon request

Standard for the validation

DIN EN ISO 14064-3:2020
 ("Specification with guidance for verification and validation of GHG statements")

Objectives of the validation

The assessment was performed with due regard to our impartiality in a risk-based approach. Rational procedures were applied to reach reliable and reproducible conclusions. Within the scope of our audit, a sufficient amount of suitable evidence needed to be collected and explained in the audit by representatives of Südzucker AG. This enabled sufficient traceability of the information presented to the systematic approach for calculating and reporting the carbon footprints of products of the sugar factories.

Criteria

The data review was conducted according to the following criteria:
 Relevance, completeness, accuracy, transparency of information and consistency.
 The assessment of alternatives according to the quantification model used was carried out according to the principle of conservatism.

Agreed level of assurance: reasonable

Note:

With a reasonable - but not absolute - level of assurance, we verify that the greenhouse gas statement is substantially correct. This includes reviewing the processes, data and evidence for their correctness and accuracy with an appropriately adequate sample size.

Materiality threshold(s): 8 %
 for the total of the reported greenhouse gas emissions
 according to the established reporting boundaries
 for one ton of beet sugar

Note:

*The materiality threshold is a benchmark for our assessment of data gaps, errors and non-conformities remaining at the end of our review.
 Gaps, omissions, inaccuracies identified during the review that result in quantities greater than the established thresholds constitute a "material deviation", i.e. non-conformities, that must be addressed before a validation opinion can be issued.*

Methods of validation

- Strategic analysis and risk assessment based on the submitted tools and documents for the calculation and reporting of carbon footprints of products
- Detailed audit planning and scheduling
- Review of data and information systems and methodologies for collection, aggregation, analysis and verification of information used to determine GHG emissions
- Interviews of personnel of Südzucker AG within the scope of audits
- Sampling of data and evidence for consumption of fuels, electricity, materials
- Sampling of data for beet sugar and byproducts
- Random sample checks of supporting evidence and database values
- Tracking the allocations included in the calculation approach
- Plausibility check by recalculating significant values of the life cycle impact assessment
- Internal, independent review by an auditor not involved in the validation process (four eyes principle)

Particularities / Limitations

In order to be able to offer customers product quantities with specific information, Südzucker's sugar division uses a mass balance approach for factories that use renewable fuels. This mass balance approach is based on the requirements of ISO 22095 and works in a similar way to the approach used for purchasing green electricity from the grid. Since energy from different sources (renewable and non-renewable) is mixed in the boiler house, this mass balance allows a certain proportion of beet sugar to be claimed using renewable energy on the basis of accounting rather than physical flow.

This validation is limited to the review and assessment of the calculation method specified for this purpose. The resulting application for the marketing of beet sugar was not part of our audit activities.

Conclusions

With our review of the systematic approach for the calculation and reporting of the Carbon Footprints of beet sugar of Südzucker Sugar Division, we conclude that, in all material respects, the greenhouse gas emissions are calculated and presented fairly and factually in accordance with the specifications of the DIN EN ISO 14067:2019-02.

Based on the results of our validation process, we confirm that the organization responsible has developed appropriate procedures to calculate and report the carbon footprint (cradle to exit-gate /partial) of one ton of beet sugar in accordance with the DIN EN ISO 14067:2019-02, including the achievement of the agreed level of assurance and compliance with materiality thresholds.

Our validation opinion solely refers to mentioned tools and documents for the calculation and reporting of carbon footprints of the products of Südzucker Sugar Division but does not represent the verification of a carbon footprint of a specific product from a specific factory or a specific fiscal year.

This opinion is issued in accordance with the agreement reached with the client and within the framework of our validation and verification program. The results documented here are based on our internal documentation dated 23 October 2025, for this validation with project no. 4213754.