GHG inventory according to the GHG Protocol Corporate Standard

For Åkers Sweden AB, reference year 2025.

Ramboll Sweden AB
Org. nummer 556133-0506

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Prepared By	**Harald Olivegren, Katja Tasala Gradin, Ramboll**
Internal reviewer	**Kristian Jelse, Greendesk AB**
Third-party reviewer	**Axel Cullberg, CHM Analytics**

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1. Introduction

In this report, the methods, calculations, and results obtained to determine Åkers Sweden AB's greenhouse gas emissions for the year 2025 are described. The report and underlying calculation are third-party reviewed by an external expert. The results can be used as an input for a sustainability report. In this report, the shorter name "Åkers" refers to Åkers Sweden AB.

Åkers Sweden AB is a subsidiary of Union Electric Steel Corporation, which is a part of Ampco-Pittsburgh Corporation. Subsidiaries manufacture tools for rolling mills in the metal industry, produce granules, and operate as sales and distribution centres (storage at Åkers Sweden AB). Åkers Sweden AB is the biggest subsidiary of Union Electric Steel Corporation and produces cast rolls, sold under the brand name Union Electric Åkers. Manufacturing facilities operate the entire production process from the melting of metals, including scrap, casting of rolls, and finishing with heat treatment and machining. The rolls vary through different alloys and scrap content. In addition, there are different types of heat treatment and machining. The raw materials are primarily cast iron and steel, and the majority of the raw materials are scrap-based.

The calculations and reporting of Åkers Sweden AB's greenhouse gas emissions are done according to the following documents (References):

- Greenhouse Gas (GHG) Protocol Corporate Standard (2004)
- Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011)
- GHG Protocol Scope 2 Guidance (2015)
- Technical Guidance for Calculating Scope 3 Emissions (2013)

The calculations are reported separately in an Excel file, which Åkers Sweden AB can use as a basis for internal climate work, sustainability reporting, and tracking over time. The calculations and the report are also suitable to use as a basis for future annual GHG inventories. This inventory will serve Åkers Sweden AB as input for sustainability reporting and future sustainability certification.

This is the first emissions accounting and reporting that is compliant with the GHG Protocol Corporate Standard and the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard for Åkers Sweden AB. Therefore, the reference year 2025 is set as the base year for Åkers Sweden AB. There is an earlier GHG inventory performed on the holding level, for the reporting year 2024, that included Åkers Sweden AB.

1.1 Recalculation

According to the GHG Protocol Corporate Standard, a recalculation of the base year is required if significant changes in the organisation's structure occur (for example, mergers, acquisitions, and divestitures), substantial changes in calculation methodology (such as change in consolidation method), access to improved activity data or emission factors, and the discovery of substantial or trivial errors that are collectively significant (WRI & WBCSD, 2004). It should be noted that the GHG Protocol standard does not specify any significance threshold, and each organisation must define which threshold necessitates a recalculation of the base year. Ramboll suggests using a significance threshold of 5%, which is also the threshold implemented by the scientific target initiative (SBTi). Changes in facilities that did not exist during the base year, outsourcing or insourcing of activities previously reported under another Scope, and organic growth or decline do not affect the recalculation of the base year.

The guides regarding Corporate Value Chain (Scope 3) (WRI & WBCSD, 2011) set out criteria for determining whether emissions from the base year should be recalculated, such as when adding or changing categories or activities included in the scope 3 inventory. The criteria are summarised in Table 1 below.

Table 1 Compilation of criteria that trigger recalculations of the base year (WRI & WBCSD, 2011)

Criteria for determining whether base year emissions should be recalculated	**The company has previously reported emissions from the activity**	**The company has not previously reported emissions from the activity**
The company has a single base year or GHG target for total scope 1 + 2 + 3 emissions	No recalculation	Recalculate when exceeding the significance threshold
The company has separate base years or GHG targets for individual Scopes (1, 2, or 3) or individual Scope 3 categories	Recalculate if over the significance threshold	Recalculate when exceeding the significance threshold
Criteria for determining whether base year emissions should be recalculated to add or change categories or activities included in the scope 3 inventory	**Add entire categories**	**Add or change activities within categories**
The company has a single base year and GHG target for total scope 3 emissions	Recalculate if going over the significance threshold	Recalculate when exceeding the significance threshold
The company has separate base years and GHG targets for individual scope 3 categories	No recalculation	Recalculate when exceeding the significance threshold

2. Introduction to system boundaries

Organisational boundaries refer to how reporting companies define their entities included in the respective accounting and reporting of greenhouse gases. This is determined by choosing a consolidation method. The chosen consolidation method is operational control. This means that the company reports 100% of the emissions in Scope 1 and 2 from operations where Åkers Sweden AB has 100% operational control.

Setting operational boundaries means classifying emissions from identified activities within the operation and categorising them between Scope 1, 2, and the included Scope 3 categories.

One of the goals of this inventory project is to report GHG emissions from 5 categories in Scope 3 that are identified as significant. The selection of these categories was based on recommendations presented in Appendix D of the GHG Protocol Corporate Standard. Based on the above-mentioned source, the relevance of categories for Åkers Sweden AB's operations and business goals was assessed and described in Chapter 6, Scope 3. The assessment is attached to the report in Appendix I Materiality assessment. The analysis has been done together with Erica Vigholm from Åkers Sweden AB.

2.1 Organisational boundaries

Åkers Sweden AB's main office and production site are operated by Åkers Sweden AB, and both are located in Åkers Styckebruk, Sweden. Åkers Sweden AB's main activity is the manufacturing of rolls, which are tools for rolling mills used in the metal industry. Åkers Sweden AB has two subsidiaries, one real estate company called *Fastighetsbolaget Åkers Styckebruk 3:1 Kommanditbolag*, and an industrial company called *Åkers Specialty Rolls AB*. The real estate company's only operation is to provide premises for Åkers Sweden AB's production, and the GHG emissions associated with this are reported in scope 2, energy consumption. Åkers Specialty Rolls AB is dormant with no operations.

2.2 Operational boundaries

Defining operational boundaries means classifying emissions from identified activities within the operation and dividing them between Scope 1, 2, and the included Scope 3 categories. According to the GHG Protocol Corporate Standard, direct emissions are those from sources controlled or owned by the reporting company based on the chosen control approach. Indirect emissions result from the company's operations, from sources controlled or owned by other companies. The standard categorises Scope 1 as direct emissions, Scope 2 as indirect emissions, and Scope 3 as indirect emissions occurring in the value chain. Scope 3 emissions occur upstream and downstream in the value chain. Additionally, the primary method for Scope 2 reporting is according to the location-based method.

The GHG Corporate Standard requires reporting of Scope 1 and Scope 2, while Scope 3 is optional. However, as a best practice, reporting of significant Scope 3 categories is recommended for companies and could be beneficial for sustainability rating purposes. Benefits also include a better understanding of company hotspots, the ability to use the results to incentivise supply chain actors to provide better data, forming closer relationships with the supply chain, and committing the organisation to improvement to avoid appearing stagnant.

Scope 1 accounts for direct emissions from stationary combustion (oil ladle burner, winter auxiliary heating), vehicle fuel combustion (from vehicles and machines owned and leased by Åkers Sweden AB), fugitive emissions (refilling of refrigerants), and own waste treatment (landfilling at the plant).

Scope 2 accounts for indirect emissions from the use of purchased energy, in this case, electricity.

Scope 3 reports emissions from the value chain, from sources not controlled by Åkers Sweden AB. There is a total of 15 categories divided between activities occurring upstream and downstream in the value chain. Figure 1 below illustrates the three scopes and categories, as well as the seven greenhouse gases that must be included in the reporting.

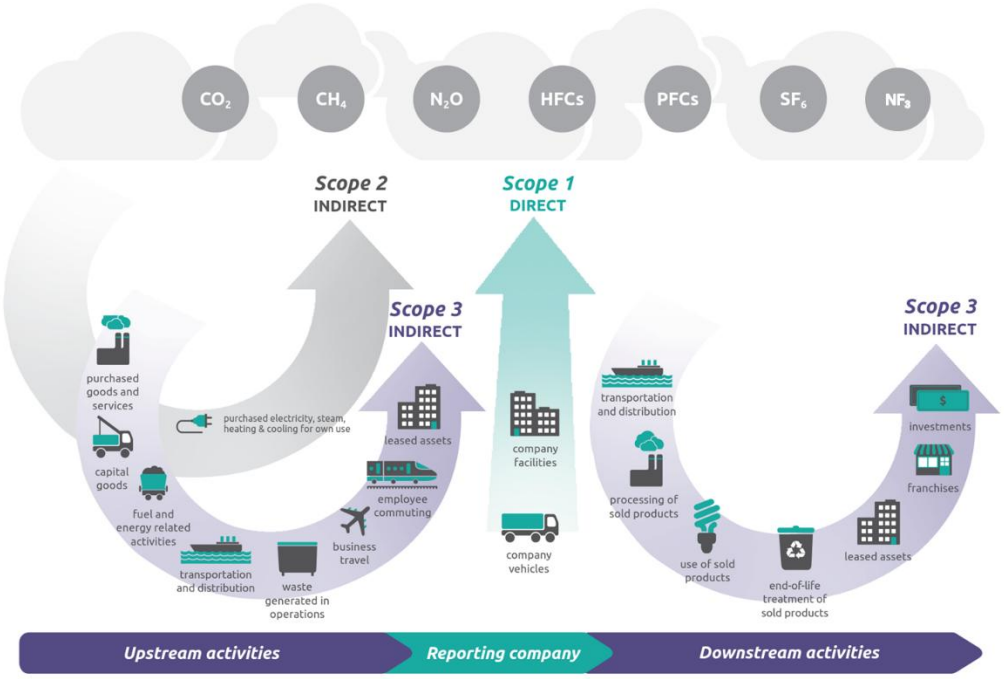

Figure 1 Classification of the company's greenhouse gas emissions into Scope 1-3. (WRI & WBCSD. (2011). NF_3 added).

In accordance with the GHG Protocol Corporate Standard, biogenic carbon dioxide emissions are not included in Scope 1, 2, or 3 but are reported separately, referred to as "out of scope" (see Appendix II). These emissions occur during the combustion of biomass or biofuels.

3. Data and basis of calculation

The collected activity data represents the reference year 2025. The data collection process took place between January and March, 2026. This is Åkers Sweden AB's first reporting in accordance with the GHG protocol, and the reference year 2025 was chosen as the base year. Data has been collected by Åkers Sweden AB. Data was gathered from energy mappings, statistics, suppliers, invoices, and other relevant internal sources within Åkers Sweden AB's organisation and operations.

Emission factors have been selected by Ramboll from public sources. The selected emission factors are in the unit of kilograms of carbon dioxide equivalent (kg CO_2e), which corresponds to the climate impact caused by, amongst others, the following greenhouse gases over a 100-year perspective: CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and NF_3. These seven gases are covered by the Kyoto Protocol and should be reported separately according to the GHG Protocol Corporate Standard. The manly used emission factors (from DESNZ 2025) are based on the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) over a 100-year period so that the Conversion Factors are consistent with current national and international reporting requirements. Other emission factors are, if possible, also based on AR5.

To be able to individually report greenhouse gases, detailed data on emissions of each gas in each activity must be available. Furthermore, specific emission factors for each of the seven greenhouse gases are required. At the moment, public emission factors provide a simplified picture of the climate impact by combining the impact of all greenhouse gases and presenting it in carbon dioxide equivalents (CO2e), making it difficult to disaggregate emissions per greenhouse gas. Consequently, the results are not presented per gas but in an aggregate form of CO_2e, which is a deviation from the GHG Protocol Corporate Standard.

In some cases (EPD for electricity from Vattenfall), GWP (Global Warming Potential) values are also used as the emission factor that has been deemed most representative of the emissions, but which contains more greenhouse gases than those required by the GHG Protocol Corporate Standard, which is also a deviation from the GHG Protocol Corporate Standard. Ramboll has deemed this lack of transparency acceptable, with the assessment that the completeness and accuracy of the inventoried GHG impact increases.

Descriptions of the used activity data, assessment of its quality, assumptions necessary for the calculations, and the methods used are presented in the sections below. A summary of the data quality assessment based on a quality ranking recommended by the GHG Protocol is presented in Appendix III. Discussion on uncertainties, limitations, and future recommendations is provided in Chapter 8.

4. Scope 1

In this Scope, direct emissions from sources that Åkers Sweden AB has operational control over are reported and include vehicle fuel consumption, own waste treatment (landfill), refrigerant leakage, and direct emissions from ladle burners and boilers.

In accordance with the chosen consolidation method, operational control, fuel consumption for both owned and leased vehicles are included in Scope 1. During 2025, on average, the biofuel blend in diesel is 8%, and the biofuel blend in petrol is 8% (Energimyndigheten, 2025). For biofuel in diesel, HVO is assumed, and for petrol, bioethanol is assumed. For heavy tractors and trucks, wheel loaders, loading machines, and light trucks, diesel with FAME blend (7%) is used (Drivkraft Sverige, 2025). Table 2 below shows the emission factors for vehicle fuel considering the reduction obligation. Emission factors are retrieved from the UK Department for Energy Security and Net Zero (DESNZ, 2025). The activity data is primary data and has been provided based on own measurements (diesel stored in tanks for machines), invoices on purchased fuels for cars, and reporting done in line with a Swedish law on energy mapping (EKL) (swe: *lagen om energikartläggning).*

Table 2 Emission factors for direct emissions from vehicle and machine fuels

Activity data	Emission factor (kg CO_2e/l)
Diesel (with 7% FAME)	2.49
Diesel (with 8% HVO)	2.45
Petrol (with 8% bioethanol)	2.15

The next source of GHG emissions accounted for in Scope 1 is connected to ladle burners, kiln dryer heating, and boilers. The activity data is based on Åkers's own measurements (tank volume) collected in Åkers's own statistics on oil and chemicals consumption. Emission factors are retrieved from the DESNZ (2025) and presented in Table 3 below. It has been judged that LPG is the most representative gas for gaseous fuel. Due to the lack of specific emission factors, it was decided to use the same emission factor for two types of gas oil: E10 and E32, which differ in the characteristic of the freezing point. E32 is recommended for cold outside environments where the temperature can fall below -32 degrees Celsius. The emission factor for gas oil corresponds to medium oil used in diesel engines and heating systems (also known as red diesel).

Åkers Sweden AB uses recovered heat from the foundry for heating purposes. This heating is solely used by Åkers Sweden AB and is not sold further. According to the GHG Protocol Scope 2 Guidance, there is no requirement to include emissions from waste heat. This energy is already captured in emissions from burning fuels for the melting process. This energy consumption is measured and reported in EKL reporting. Energy used for furnace heating is already accounted for in Scope 1; thus, no additional emissions are reported for this energy source.

Table 3 Emission factors for gas oil and propane

Activity data	Emission factor	Unit
Gaseous fuel – LPG (*Gasol P45, gasolflaska*)	2.94	(kg CO_2e/kg)
Gas oil (*eldningsolja E10 and E32*)	2.76	(kg CO_2e/l)
Own heat recovery	0	(kg CO_2e/kWh)

Fugitive emissions are classified as Scope 1 emissions. These emissions arise from leaks in refrigerants within the system, and the quantity filled is used for estimating the emissions. The activity data comes from reports prepared by a third party for Åkers, which are used for governmental reporting. The reports include GWP values based on the Intergovernmental Panel on

Climate Change (IPCC) Fourth Assessment Report from 2007 (AR4); however, it was decided to use newer characterization values supplied by DESNZ (2025), based on the Fifth Assessment Report from 2014 (AR5) (see Table 4). Refrigeration systems used at Åkers sites utilise R407C, R404A, R134A, and R410. In 2025, only R134A was refilled. The refilling was due to leakage.

Table 4 Emission factors for refrigerating medium

Activity data	Emission factor (kg CO_2e/kg)
R134A	1300

Direct emissions of greenhouse gases as a byproduct of the melting process are estimated based on the purchased amount of graphite (for the CO_2 estimate) and literature (for the N_2O estimate). The direct emissions of CO_2 have been estimated based on the purchased amount of graphite and the assumption received from Åkers that 20% of the coal is oxidised during the melting process. The conversion factor for carbon to carbon dioxide (44/12) was used to calculate the contributions of GHG emissions. Regarding N_2O emissions, they have been estimated based on literature values provided by the European Environment Agency (EEA, 2006) and the characterization factor for N_2O provided by the IPCC in the fifth report (AR5). However, there are uncertainties related to these assumptions and estimates. More discussion and motivation on this emission source can be found under Chapter 8 Uncertainties, Limitations, and Recommendations.

Table 5 Factors for direct emissions of CO_2 and N_2O.

Activity data	Factor	Unit
Direct emissions of CO_2 **Conversion factor carbon to carbon dioxide (44/12)**	3.67	kg CO_2e/kg graphite
Direct emissions of N_2O	0.0013	tonne N_2O/produced tonne
Characterisation factor N_2O	265	kg CO_2e/kg N_2O

The last activity connected to Scope 1 emissions is waste treatment conducted by the reporting company. Åkers Sweden AB in Åkers Styckebruk has its own landfill area where the final deposit of slag, lining materials, and disposable materials takes place. As the landfilled materials are inert, no emissions are accounted for in the landfilling process itself. Transportation to the deposit area is already included in fuel consumption reporting, in Scope 1.

5. Scope 2

Scope 2 accounts for indirect GHG emissions originating from the consumption of energy generated outside the organisational boundaries of Åkers Sweden AB, from sources not controlled by Åkers Sweden AB. The upstream GHG emissions of their energy consumption are reported in the scope 3 category 3. In the case of scope 2, it includes electricity consumption by electric cars, offices, and the production site. Åkers Sweden AB does not purchase district heating or cooling.

In accordance with the GHG Protocol Scope 2 Guidance, impacts are reported based on both location-based and market-based methods. In this study, the location-based method is chosen as the main method. Results for both methods can show either a higher or lower impact, depending on the energy source and whether the company has made an active choice, such as opting for fossil-free electricity.

The location-based result represents an average impact from electricity consumption, in this case, represented by the Nordic electricity grid mix, while the market-based result reflects the choice of the electricity contract that Åkers Sweden AB has made — in this case, hydropower supplied by Vattenfall AB is backed up by Guarantees of Origin (GoO). The contractual instruments have been assessed based on the Scope 2 Quality Criteria (WRI, 2015) as the GoO has been disclosed together with the data collection process. According to the GHG Protocol Scope 2 Guidance, it is allowed to account for zero direct emissions per kWh for consumed energy from fossil-free sources.

In the study Nordic grid mix was used to represent the electricity used in the location-based method, and hydro power was used to represent the electricity used in the market-based method. The Nordic electricity mix is used instead of the Swedish electricity grid mix to reflect the complexity of the Swedish electricity market. To representatively include the Nordic electricity mix and to consider both import and export of electricity, the 3-year average Scope 2 emission factor reported in IVL's report (Johansson & Sandgren, 2025) is used. It is in line with the GHG Protocol Standard Scope 2 Guidance to include the impact from import and export.

The activity data comes from internal statistics used for EKL reporting and contains measured amounts of consumed electricity. The amount of consumed electricity also includes electricity used for charging electric vehicles, which are solely charged at the company-owned charging station at the site. The emission factors are presented below Table 6.

Table 6 Energy-related emission factors - Scope 2

Type of energy	Location-based emission factor ($kg\ CO_2e/kWh$)	Marked-based emission factor ($kg\ CO_2e/kWh$)
Electricity consumption	0.046	0

6. Scope 3

In this Scope, other indirect emissions, not controlled by Åkers Sweden AB, resulting from their operations are included. Generally, this includes both upstream and downstream emissions that occur within the value chain. This encompasses all emissions associated with the extraction, production, and transportation of raw materials and used by the organisation to produce the final goods or services. In this GHG inventory, five categories have been selected based on the materiality assessment (see Appendix I Materiality assessment) and in agreement with Åkers Sweden AB. The selection of these categories was based on recommendations presented in Appendix D of the GHG Protocol Corporate Standard regarding the metals sector, even if Åkers Sweden AB´s activities only partly align with the sector. Hence, the expected relevant categories, purchased materials and machinery (categories 1 and 2) and transport (categories 4 and 9), are included in the inventory. The used terms listed below are mainly connected to the expected size of the category GHG emissions compared to other categories. Based on the materiality assessment, it was decided to include categories with the highest and medium relevance to Åkers Sweden AB's operations.

The decision to include the category was based on four levels of relevance:

- Not relevant – The category has no relevance for Åkers Sweden AB due to no occurring activities within the category.
- Low – Activities within the category are deemed to have a low contribution to emissions in Scope 3
- Medium – Activities within the category are deemed to have a medium significant contribution to emissions in Scope 3
- High – Activities within the category are deemed to have a highly significant contribution to emissions in Scope 3

Based on the materiality assessment and in consultation with Åkers Sweden AB regarding the choice of the most relevant categories within Scope 3, it was decided to include the following categories in this study:

- *Category 1: Purchased goods and services – high relevance*
- *Category 2: Capital goods – medium relevance*
- *Category 3: Emissions related to energy – medium relevance*
- *Category 4: Upstream transportation and distribution – high relevance*
- *Category 9: Downstream transportation and distribution – medium relevance*

Categories which have been excluded are:

- *Category 5: Wastes generated in operations - low relevance*
- *Category 6: Business trips - low relevance*
- *Category 7: Employee commuting - low relevance*
- *Category 12: End-of-life treatment of sold products – low relevance*

The remaining categories have been judged to be not relevant for Åkers Sweden AB:

- *Category 8: Upstream leased assets*
- *Category 10: Processing of sold products*
- *Category 11: Use of sold products*
- *Category 13: Downstream leased assets*
- *Category 14: Franchises*
- *Category 15: Investments*

Description of the materiality assessment process and what has been considered as underlying supportive information to assess the relevance of each category is provided in the section Appendix I Materiality assessment. All relevant categories have been included in the Scope 3 assessment, which meets the minimum boundaries of the Scope 3 standard. Any activities within included categories that have been excluded are disclosed and justified under sections 6.1-6.5.
Categories that are not relevant to Åkers Sweden AB, the last list above, in the materiality assessment, are reported as zero in the results. However, both not-relevant and excluded categories should be reviewed in subsequent reporting to assess if they continue to lack relevance.

6.1 Scope 3 category 1. Purchased goods and services

This category includes the purchase of supplies and services related to both production and office-based work. Emissions in this category are calculated using two methods: average-product and spend-based. Åkers Sweden AB collected data on the weight of raw materials used in roll production. The emission factors are presented below in Table 7. It should be noted that the majority of the raw materials used for roll production are scrap metals. This means that the chosen emission factor significantly influences the emissions of the purchased roll raw materials.

Due to the lack of available public emission factors, approximations and estimations based on expert knowledge have been used to match the material with an adequately representative emission factor. The emission factors are sourced from the German Environmental Agency (pig iron, NiMg, FeW, FeTi, Flux, Mischmetal), Saevarsdottir et al. (2021) paper on the footprints of silicon and aluminium production (FeSiTi and Al), the International Molybdenum Association (IMOA) (FeMo), Nickel Institute (Ni), and DESNZ (2025) (remaining materials). For NiMg, the approximation is based on the shares of Ni and Mg from Åkers Sweden AB's LCA study and emission factors for the respective metals. FeSiMg emissions are estimated with the shares of FeSi and Mg from Åkers Sweden AB's LCA study, and the proxy emission factor for FeSi together with the emission factor for Mg. This means that in this study, the emissions are connected to the alloy materials but do not include the fusing process. According to Raabe (2023), most of the emissions from alloy production come from primary extraction and refining; therefore, the lack of an emission factor for the fusing process step is expected to have minimal impact on the results. For FeW, the emission factor for magnesium is used as a proxy, and for FeTi, the emission factor for titanium is used as a proxy. FeSiTi is estimated with the emission factor for silicon MG.

Emission factors from DESNZ (2025) are all proxies and are based on the metal category for cans, either aluminium, steel, or mixed. It has been assessed that the chosen emission factors are acceptable approximations of the matched materials. However, for the respective metals, this could mean both under- and overestimations of emissions.

As defined in the Scope 3 standard, emissions associated with recycling and energy recovery are attributed to the reporting organisation that uses the recycled material or waste to generate energy. The emissions attributed to the company that generates the waste cover only the collection of waste from their site and deposit at the first point of processing. In this case, any scrap and secondary materials bought by Åkers are unprocessed, i.e., unmelted. The emissions associated with the melting are reported in Åkers Sweden AB's scope 1 and 2.

To calculate GHG emissions from the purchased aluminium, a proxy emission factor for primary aluminium used for cans and foil is used (DESNZ, 2025).

Table 7 Emission factors for category 1 - raw materials

Activity data	Emission factor (kg CO_2e/kg)
Pig iron	1.76
Scrap, rails, ingots	0.02
Graphite	0.027
Inolate 10	9.12
FeSi, FeSi 0,1-2 mm, FeSi 1-3 mm	9.12
SiC	9.12
Inolate 40	9.12
Inobar	9.12
SiCaMn	9.12
FeMn	2.86
FeS	9.12
FeCr, FeCr Affine	5.11
Ni	13.0
FeNi Fines	9.12
NiMg	15.69
FeSiMg	10.06
FeMo	7.41
FeV 80 %	9.12
FeNb	9.12
FeW	28.81
FeTi	50.86
FeSiTi	11.3
Al	14.30
Flux	0.21
Mischmetal	28.81
Lunkertherm	2.86

Parts of the impact in category 1 are calculated using a spend-based method because the available activity data is the sum of paid invoices (SEK, Swedish krona) per account. The accounts have been categorised by Åkers based on the main suppliers. For the 2025 inventory, a more specific categorisation has been applied to the highest 60% of spend. Emission factors are presented in the Table 8 (USD) and Table 9 (SEK) below.

The last two categories, *Miscellaneous services* and *Miscellaneous supplies*, have been estimated based on the remaining 40% uncategorised spend. The total uncategorised spend amount has been assessed and set to be 59% services and 41% supplies; this share is based on internal information at Åkers and on the nature of suppliers in this amount. The above spend-inventory cover 95.9% of Åkers Sweden AB's spend for 2025; the missing 4.1% is added to the uncategorised spend with the same share of services and supplies.

Inflation reduces the monetary value of money: the same amount of currency buys fewer goods and services over time. That erodes purchasing power; hence, the spend-based emissions factor should be updated accordingly. The USD-based emission factors are from a source published in 2020. The value of one USD, between 2020 and 2025, is reduced by about 21%, meaning that the emissions factors per one USD are reduced by the same amount. This is done in the GHG calculations.

The Swedish spend-based emissions factors are published in 2024, and these are not compensated for inflation since the difference is minimal between 2024 and 2025, compared to the uncertainty of spend-based GHG calculations.

Table 8 Emission factors for category 1 – spend-based supplies and services, USD 2020 value

Activity data	Emission factor (kg CO_2e/USD)	Description
Refractories	0.40	Clay Building Material and Refractories Manufacturing
Coating, Flux, Fused Silica	0.72	All Other Miscellaneous Non-metallic Mineral Product Manufacturing
Grinding, Inserts	0.18	Cutting Tool and Machine Tool Accessory Manufacturing
Machining	0.18	Rolling Mill and Other Metalworking Machinery Manufacturing
Neck rings, other accessories	0.23	All Other Miscellaneous General Purpose Machinery Manufacturing
Pallet's chassis	0.14	Wood Container and Pallet Manufacturing
Electrical material	0.22	Electrical Contractors and Other Wiring Installation Contractors
Mechanical, Pneumatic, Tools, Fasteners	0.23	All Other Miscellaneous General Purpose Machinery Manufacturing
Oil & Grease	0.36	Petroleum Lubricating Oil and Grease Manufacturing
Mechanical services; Heating engineering maintenance; Wheel loader from contracted manuf. Service; Cranes maintenance; Hydraulic maintenance; industrial cleaning	0.14	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
Miscellaneous services	0.14	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
Miscellaneous supplies	0.18	Cutting Tool and Machine Tool Accessory Manufacturing

Table 9 Emission factors for category 1 – spend-based supplies and services, SEK 2024 value

Activity data	Emission factor (kg CO2e/SEK)	Description
Audit & Consulting	0.0006[a]	Legal, organisational, economic, management, services, and consultants - default value
Hard- & Software*	0.006	IT software
Bank	0.0002	Banking and financial services and costs – default value

* Only software included in category 1. Hardware reported in category 2.

Majority of the emission factors have been retrieved from the U.S. Environmental Protection Agency database (Ingwersen, 2020). The emission factors used are those marked as supply chain emission factors without margin, which represent cradle-to-gate. Since the emission factors are provided in USD (U.S. dollars) and spend per account in SEK, the spend has been adjusted with the exchange rate from USD to SEK for 2025 (after the adjustment of inflation). The exchange rate is an annual average exchange rate for 2025 retrieved from Sweden's central bank (Sveriges Riksbank, 2025). It was decided to use the exchange rate from 2025 to match the reference year of the activity data.

Spend-based emission factors for audit & consulting, software, and financial services are sourced from the Swedish national agency for public procurement's method for environmental spend analysis (Upphandlingsmyndigheten, 2019). Most emission factors are so-called default values, which consist of a specific emission factor per either specific material or service that represents the entire purchase category in the Swedish national agency for public procurement's calculation file (Johansson, 2024). Emission factors are aggregated and converted into monetary-based values based on data from sustainability reports (Upphandlingsmyndigheten, 2019). The spend-based calculation method has limitations, which are further described in Chapter 8.

The purchase of waste handling services is included in this category since category 5: Wastes generated in operations is not included in this inventory.

There is an ongoing process to establish semi-finished roll processing in the US. During 2025, 1590.5 tonnes of semi-finished rolls were sent to Indiana, US, for processing by a company within Union Electric, but not an Åkers Sweden AB subsidiary. The roll process is a purchased service, and, therefore, the emissions are reported in category 1. After the process, the rolls are sold by Åkers Sweden AB to an end client.

By using Åkers Sweden AB's energy consumption for the same processing, an average electricity consumption of 262 kWh/ton melt output is obtained. This average is used to calculate the GHG emissions of the US processing. The electricity emission factor for the eGRID RFCW, covering Indiana, the Total Output Emission Factors (including only CO_2, CH_4, and N_2O) is used to calculate the process GHG emissions (EPA, 2025), emission factor presented in Table 10. For the 2025 GHG inventory, the emissions from this processing are reported in category 1, as it is a purchased service. Transport of rolls is reported in category 4.

Table 10 Emission factor, US roll processing

Activity data	Emission Factor (kg CO2e/kWh)
Roll processing, Indiana electricity mix	0.415

6.2 Scope 3 category 2. Capital goods

According to the standard, capital goods include items with a longer lifespan, meaning those purchased less frequently than annually, which can affect the ability to analyse and track emissions in category 1. Åkers Sweden AB interprets capital goods as machinery, other equipment such as computers, desks, and similar IT hardware. Emissions were calculated based on invoices from the purchasing department using spend analysis, in the same way as for purchased goods.

In Table 11 the purchased items are presented along with the chosen emission factors based on the Swedish Agency for Public Procurement's method for environmental spend analysis (Johansson, 2024).

Table 11 Emission factors for category 2 – capital goods

Activity data	Emission factor (kg CO_2e/SEK)	Description
Overhead crane	0.29	Machines and apparatus for lifting or other handling, loading, unloading, or transport
All new purchased equipment: oven for heat treatment, tools, moulding station, spectrometer, extinguishing system, and scale for trucks	0.31	Pumps, machines, fans – default value
Installation of Overhead crane	0.0046	Electrician services – default value
Charge buckets	0.032	Metal container manufacturing

6.3 Scope 3 category 3. Fuel- and energy-related activities

In this category, the upstream impact from the purchased energy and consumed fuel is reported. The impact is calculated based on the same quantities of energy as reported in Scope 2 and fuels in Scope 1. Emission factors used to calculate the upstream impact of the fuels are presented in Table 12 below.

Table 12 Emission factors for category 3 - fuels

Type of energy	Emission factor	Unit
Diesel (with 7% FAME)	0.62	kg CO2e/l
Diesel (with 6% HVO)	0.62	kg CO2e/l
Petrol (with 6% bioethanol)	0.61	kg CO2e/l
Gaseous fuel – propane (*Gasol P45, gasolflaska*)	0.35	kg CO2e/kg
Gas oil (*eldningsolja E10 and E32*)	0.74	kg CO2e/l

For market-based upstream impacts of purchased electricity, Vattenfall's EPD for hydropower (Vattenfall AB, 2026) is used, and it is supplier-specific data. The GWP-total value for Total-generated is used here. This means that both upstream and core impacts are considered, including the production of oils and fuels for maintenance and inspection trips, the construction and decommissioning of facilities, including foundations, machinery, dams, and waterways. This likely led to overestimated emissions as it includes more than upstream processes, and the GWP-total value includes more gases than those required by the GHG protocol. The choice of this emission factor should be considered a conservative choice. The emission factor for electricity for the location-based method comes from the IVL's report (Johansson & Sandgren, 2025).

Scope 3.3, grid losses are also included, calculated as 3.68% of the upstream electricity emissions accounted for by both location-based and market-based methods. The percentage distribution is derived from an article by Sveriges Riksbank on the Swedish electricity market (Holmberg & Tangerås, 2023). A compilation of emission factors for the upstream impact on electricity is presented in Table 13 below.

Table 13 Emission factor for category 3 - electricity

Type of energy	Location-based emission factor (kg CO_2e/kWh)	Marked-based emission factor (kg CO_2e/kWh)
Electricity	0.013	0.0052

6.4 Scope 3 category 4. Upstream transportation and distribution

In category 4, transport and distribution of products purchased by Åkers Sweden AB are reported, specifically transport that occurs between Åkers and Tier 1 suppliers. In accordance with the Scope 3 standard (WRI & WBCSD, 2011), outbound logistics are also included, i.e., transport of sold products to Åkers' customers if Åkers Sweden AB pays for the shipping.

This category was calculated using two methods: distance-based and spend-based. The spend-based method is used to calculate the transport of purchased goods to Åkers. Activity data are the same as in category 1 and correspond to gate-to-shelf in accordance with US EPA emission factors. The remaining transport was calculated using the distance-based method with the emission factor from DESNZ (2025), based on HGV and articulated trucks. The transport of metals was calculated based on an estimation of the average distance from specific suppliers. The weights are taken from category 1. Most suppliers are in Sweden, with average distances between 60 and 500 km. Suppliers from the Netherlands and Norway are accounted for with respective distances of 1360 km and 700 km.

Specific data are available from Scan Global Logistics and Bertling, where emissions for all product deliveries to customers from Åkers Sweden AB are reported. Ramboll conducted a plausibility check on supplier data and deemed it reliable. The suppliers claim to use the GLEC framework, which follows ISO 14083 regarding transporters and logistics providers on how to report emissions from logistics activities, developed to align with the GHG Protocol's Corporate Standard. However, there are some uncertainties regarding the choice of emission factors that could not be verified, and this is commented on in the Chapter 8 Uncertainties, Limitations, and Recommendations.

The GHG emissions due to smaller purchased transport services from a number of service suppliers are reported based on spend-based data.

Table 14 Emission factors for category 4 - transport and distribution

Activity data	Emission factor	Unit
Refractories	0.05	kg CO2e/USD
Coating, Flux, Fused Silica	0.07	kg CO2e/USD
Grinding, Inserts	0.02	kg CO2e/USD
Machining	0.02	kg CO2e/USD
Neck rings, other accessories	0.02	kg CO2e/USD
Pallet’s chassis	0.03	kg CO2e/USD
Electrical mtrl	0.02	kg CO2e/USD
Mechanical, Pneumatic, Tools, Fasteners	0.02	kg CO2e/USD
Oil & Grease	0.03	kg CO2e/USD
Supplies	0.02	kg CO2e/USD
Transport of metals to Åkers	0.20	kg CO2e/tkm
Transport of rolls to customers (>33t)	0.06	kg CO2e/tkm
Transport of rolls to customers (>3,5-33t)	0.08	kg CO2e/tkm

6.5 Scope 3 category 9. Downstream transportation and distribution

Category 9 reports the transport and distribution of products sold by Åkers Sweden AB, which they do not pay for. This means that it includes transport occurring between Åkers Sweden AB and its customers. In detail, payment for the transport is divided between the customer and Åkers in such a way that Åkers pays for and is responsible for transport to the Gothenburg port (which is included in category 4), while the customer pays for and organises transport from the terminal to its site, including the container ship.

Specific supplier emission data are available from Scan Global Logistics (SGL), where emissions for all product deliveries from Åkers Sweden AB to customers are reported. Ramboll conducted a plausibility check on supplier data and deemed it reliable. The suppliers claim to use the GLEC framework, which follows ISO 14083 regarding transporters and logistics providers on how to report emissions from logistics activities, developed to align with the GHG Protocol's Corporate Standard. However, there are some uncertainties regarding the choice of emission factors that could not be verified, and this is commented on in Chapter 8 Uncertainties, Limitations, and Recommendations. SGL reported transport emissions for well-to-wheel, i.e., including both upstream and combustion GHG emissions.

7. Climate impact Åkers Sweden AB 2025

Climate impact results are presented per scope and categories for Åkers Sweden AB in Table 15. The results cover activities during 2025 and are presented in the unit metric tonnes of CO_2 equivalents (tonne CO_2e). The results indicate that the largest share of Åkers Sweden AB's impact lies within Scope 3. Categories 8, 10, 11, 13, 14, and 15 are assessed as not relevant for Åkers Sweden AB's operations and are reported with zero emissions (no activities).

Table 15 Compilation of Åkers Sweden AB's GHG emissions during 2025, location-based method

Category	Description	tonne CO_2e	%	Description
Scope 1	*Vehicle and machines fuels*	115	0.60%	
Scope 1	*Ladle burner and boiler*	231	1.2%	
Scope 1	*Refrigerant refilling*	8	0.04%	
Scope 1	*Direct emissions from the melting process*	323	1.7%	
Scope 1	*Own waste treatment (landfill)*	0	0	
	Total Scope 1	**675**	**3.5%**	
Scope 2	*Purchased electricity*	2 020	10.6%	
	Total Scope 2	**2 020**	**10.6%**	
	Scope 1 + 2	**2 696**	**14.1%**	
3.1	3.1 Purchased products	11 472	60.2%	
3.2	3.2 Capital goods	2 127	11.2%	
3.3	3.3 Energy-related emissions	757	4.0%	
3.4	3.4 Upstream transportation	1 489	7.8%	
3.5	3.5 Waste management	Excluded		
3.6	3.6 Business travel	Excluded		
3.7	3.7 Employee commuting	Excluded		
3.8	3.8 Upstream leased assets	0**	0%	
3.9	3.9 Downstream transportation	520	2.7%	
3.10	3.10 Processing of products	0**	0%	
3.11	3.11 Use of products	0**	0%	
3.12	3.12 End-of-life treatment of sold products	Excluded		
3.13	3.13 Downstream leased assets	0**	0%	
3.14	3.14 Franchises	0**	0%	
3.15	3.15 Investments	0**	0%	
	Total selected categories within Scope 3	**16 365**	**85.9%**	
	Total*	**19 061**	**100%**	

*Includes scope 1, 2, and selected categories in scope 3

** The category is reported as zero since Åkers Sweden AB does not have activities in the category

The largest portion of the total climate impact lies in Scope 3, with just under 86% of total emissions. In relation to the total GHG emissions, Scope 1 and 2 contribute over 14%. Emission categories within Scope 1 are also presented in Figure 2.

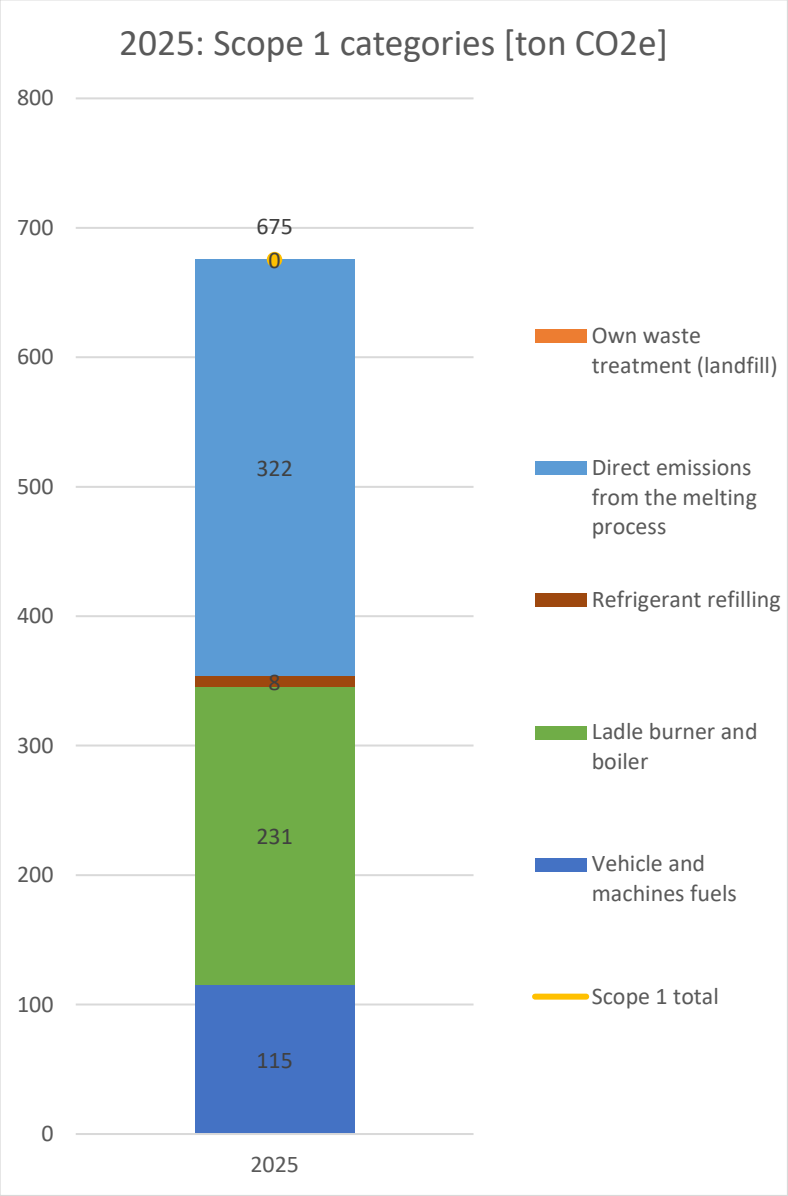

Figure 2 GHG Emissions - Scope 1 with categories, 2025.

Within Scope 1 emissions, those associated with gas oil and propane incineration in the ladle burner and boiler, as well as direct emissions from the melting process, contribute the most to direct Scope 1 emissions.

The result is presented in Figure 3 to visualise the size of the climate impact within the three scopes.

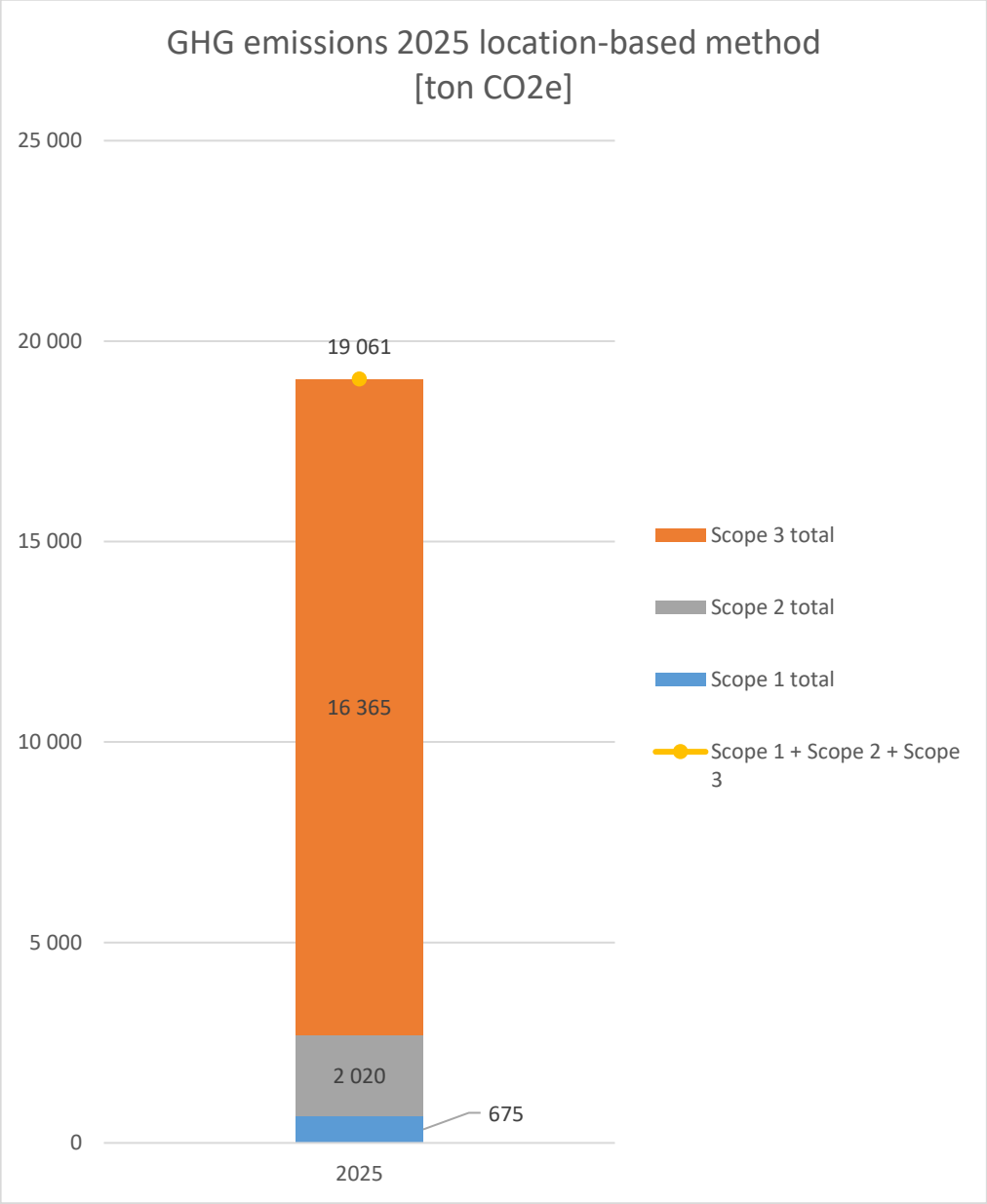

Figure 3 GHG emissions 2025, location-based method. Scope 1, 2, and 3.

The result in Scope 3 indicates that category 3.1, Purchase of goods and services, contributes the most to the total potential impact (see Figure 4) contributing to 60% of Åkers Sweden AB's total inventoried and reported GHG emissions during 2025. The emissions are linked to the production of raw materials and the purchase of supplies and services. It is the raw material supply that contributes the most to this category. The second largest category is category 3.2 Capital goods. This category contributes just over 11% of the total GHG emissions.

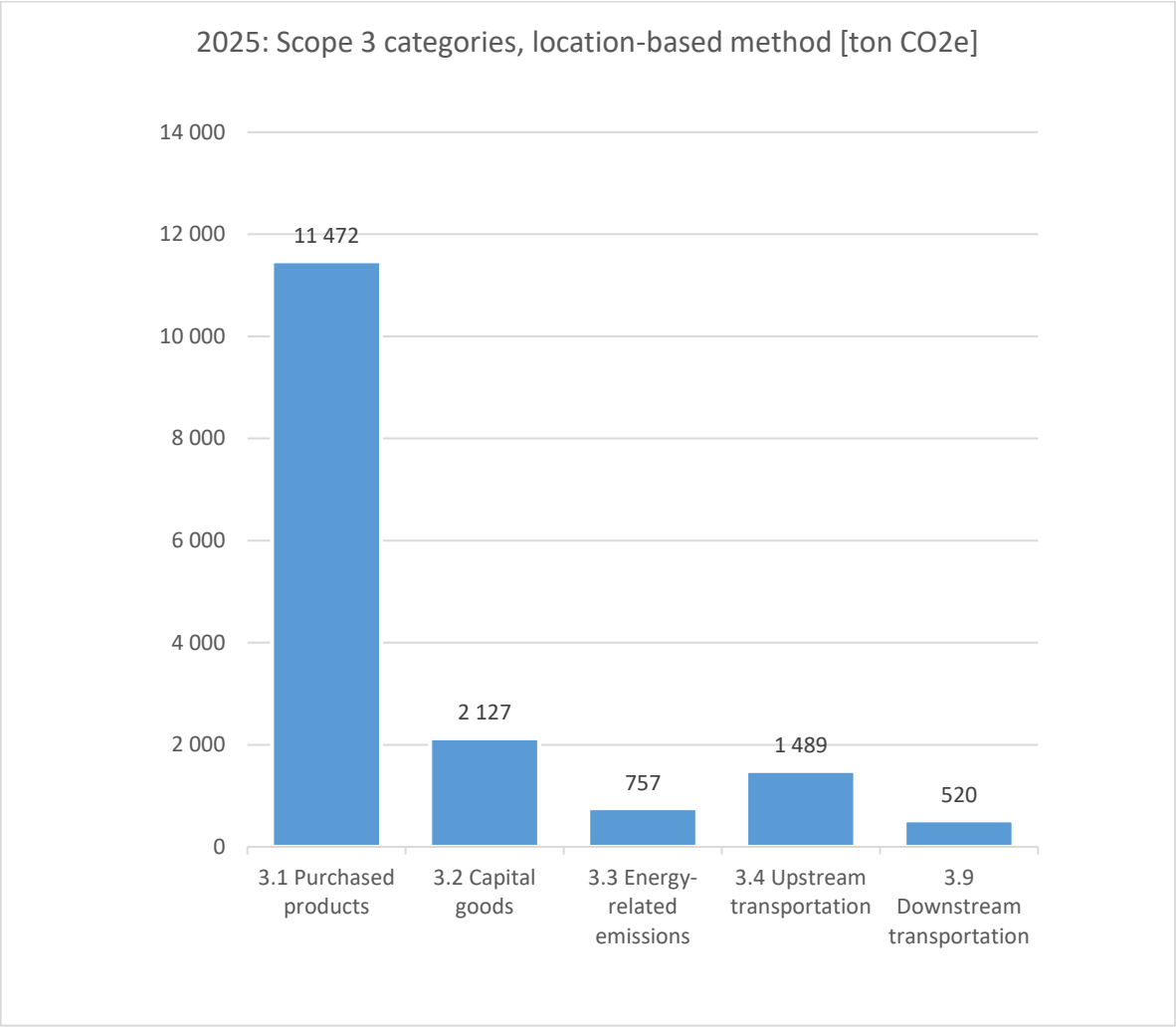

Figure 4 Emissions within Scope 3 categories, 2025

Below, in Table 16 Åkers Sweden AB's GHG emissions, calculated with market-based emission factors, are presented. Note that only the scope 2 and scope 3 category 3 are affected by the change to the market-based method.

Table 16 Compilation of Åkers Sweden AB's GHG emissions during 2025, market-based method

Category	Description	tonne CO_2e	%	Description
Scope 1	*Vehicle and machines fuels*	115	0.69%	
Scope 1	*Ladle burner and boiler*	231	1.4%	
Scope 1	*Refrigerant refilling*	8	0.05%	
Scope 1	*Direct emissions from the melting process*	322	1.9%	
Scope 1	*Own waste treatment (landfill)*	0	0%	
	Total Scope 1	**675**	**4.1%**	
Scope 2	*Purchased electricity*	0	0%	Market-based result
	Total Scope 2	**0**	**0%**	
	Scope 1 + 2	**675**	**4.1%**	
3.1	3.1 Purchased products	11 472	69.1%	
3.2	3.2 Capital goods	2 127	12.8%	
3.3	3.3 Energy-related emissions	325	2.0%	Market-based result
3.4	3.4 Upstream transportation	1 489	9.0%	
3.5	3.5 Waste management	Excluded		
3.6	3.6 Business travel	Excluded		
3.7	3.7 Employee commuting	Excluded		
3.8	3.8 Upstream leased assets	0**	0%	
3.9	3.9 Downstream transportation	520	3.1%	
3.10	3.10 Processing of products	0**	0%	
3.11	3.11 Use of products	0**	0%	
3.12	3.12 End-of-life treatment of sold products	Excluded		
3.13	3.13 Downstream leased assets	0**	0%	
3.14	3.14 Franchises	0**	0%	
3.15	3.15 Investments	0**	0%	
	Total selected categories within Scope 3	**15 933**	**95.9%**	
	Total*	**16 608**	**100%**	

*Includes scope 1, 2, and selected categories in scope 3

** The category is reported as zero since Åkers Sweden AB does not have activities in the category

Compared to the location-based method, there is a significant difference in the result for Scope 2 and a difference for the Scope 3 category 3 (see Figure 5). Results for other Scope 3 categories and Scope 1 remain the same. These differences in Scope 2 and Scope 3.3 are due to the market-based method that takes into account the active choice of energy contracts for the purchased energy; this impacts the GHG calculation for the Scope 2 and Scope 3.3 Upstream energy-related emissions.

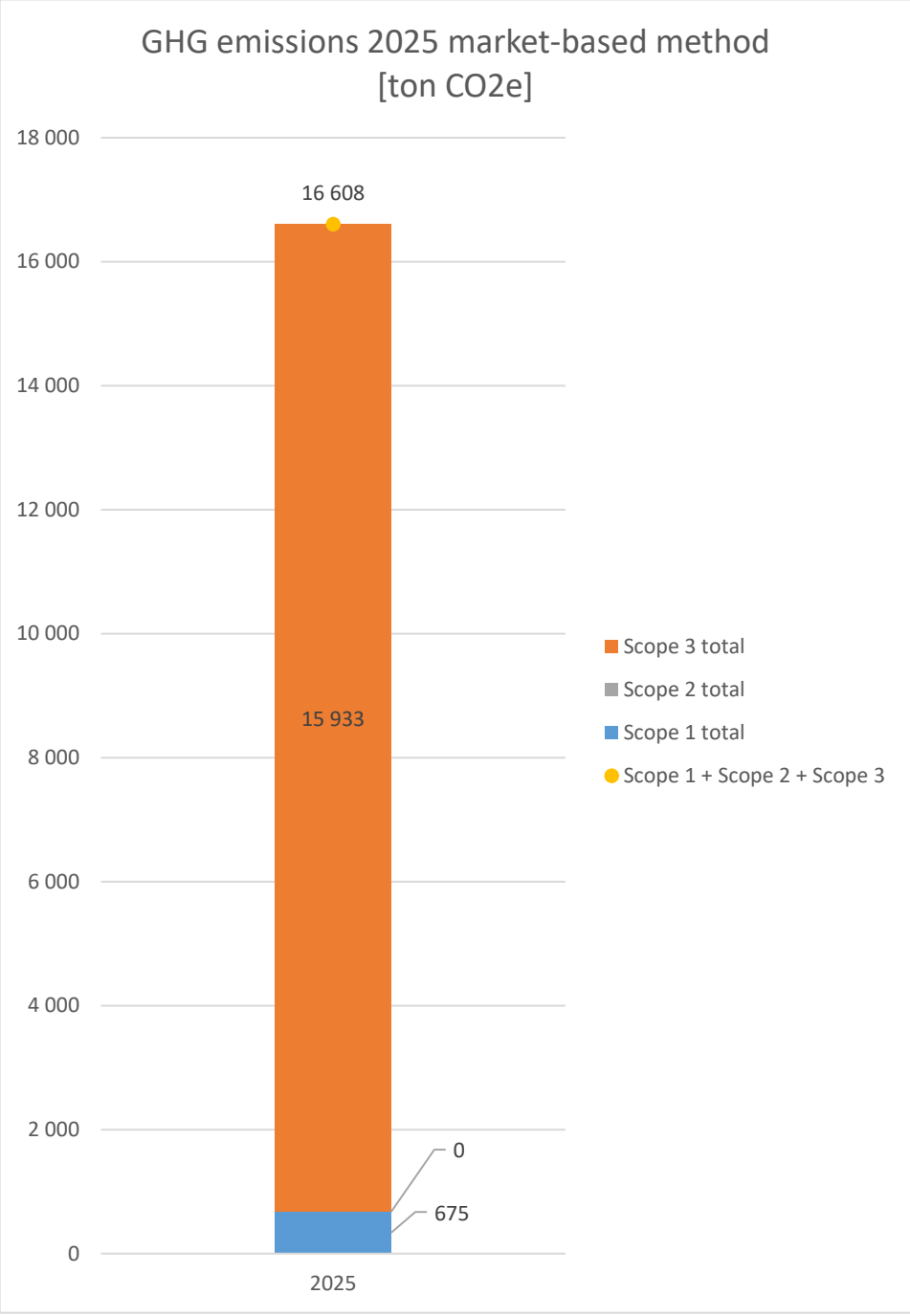

Figure 5 GHG emissions 2025, market-based method. Scope 1, 2, and 3.

Direct emissions from renewable energy sources are allowed to be accounted for with zero GHG emissions per kWh in Scope 2. This results in a significant reduction and difference between location- and market-based methods for Åkers Sweden AB's scope 2 emissions.

In category 3, the upstream-based emission factor corresponds to the electricity sources, and it is lower for the hydropower than for the Nordic electricity mix, as presented in the Figure 6 below.

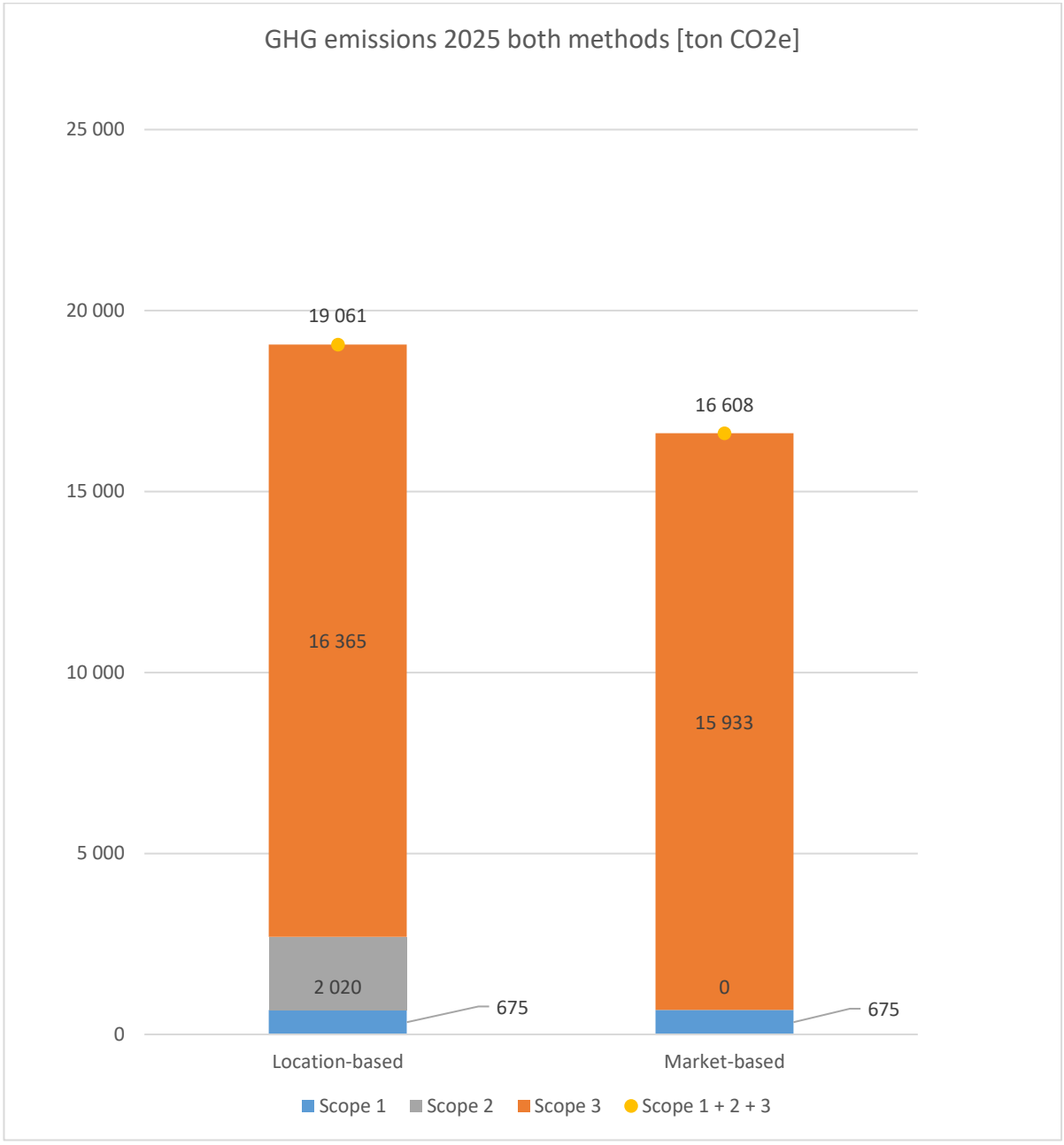

Figure 6 GHG emissions 2025, both methods, all scopes.

8. Uncertainties, Limitations, and Recommendations

This study is the first inventory and reporting of Åkers Sweden AB's greenhouse gas emissions in accordance with the GHG Protocol Corporate Standard. There is an earlier GHG inventory performed on the holding level, for the reporting year 2024, that included Åkers Sweden AB. The study involves identifying activities within the operation that can impact the climate. Both primary and secondary data have been used to calculate Åkers Sweden AB's climate impact during 2025, and some of the calculations are based on assumptions, proxy values, simplifications, and average data. In addition, there are some uncertainties and limitations related to both the activity data collected and emission factors that will be discussed in the following sections, divided by respective Scope.

In both Scope 1 and Scope 2, primary data that is in line with the GHG Protocol Corporate Standard is used. It should be noted that due to changes in the reduction obligation, the percentage of biofuel additives in vehicle fuel could change and affect upcoming inventories. Additionally, the upstream GHG emissions (scope 3.3) of, for example, HVO are driven mainly by the type and share of feedstocks. Waste and residue streams (e.g., used cooking oil, animal fats) generally have much lower upstream emissions than virgin vegetable oils (especially palm), which incur cultivation and potential ILUC burdens. The specific shares are not taken into account in this study, and the DESNZ (2025) emission factors are used as proxies for biofuels used in Sweden.

As mentioned in the Scope 1 chapter, emissions associated with the melting process should be considered as estimates and an action to maintain the completeness of emission sources. However, the accuracy is deemed medium for CO_2 and low for N_2O. These emissions are not solely determined by the chemical reactions themselves but are also highly dependent on the operational efficiency of the melting process. Åkers Sweden AB could not provide precise information on the process emissions, so these estimates and results should be treated with caution, especially for N_2O, as the values are based on an old report due to the lack of more up-to-date data. The amount of inlet materials required influences the process efficiency and, consequently, the level of associated emissions, as both binding and emissions occur during the process. On the other hand, according to the International Iron Metallics Association (IIMA, 2022), the melting process accounts for 11% of the emissions per tonne of liquid steel in the case where the total emissions account for the production of raw materials and transport of raw materials to the smeltery. Thus, the majority of emissions are associated with raw material production rather than a process related emissions of the melting itself. To report estimated emissions from the melting process based on assumptions is to maintain the completeness of reporting, thus following the main principles of the GHG Protocol Corporate Standard. In the other study (Demus et al, 2012), it was noted that the use of fossil carbon sources (with highlighted coke and coal) stands for 40% to 70% of the total direct emissions of the electric arc furnace. The use of coal and coke is irrelevant for Åkers Sweden's rolls production, as well as the use of natural gas, as other fuels are used.

This information indicates that emissions from the direct melting processes are of low relevance compared to emissions associated with used energy sources and sourced metals, which emissions are tackled in the Scope 3 category 1. However, for the purpose of the GHG inventory, it is recommended to consider these emissions as an area with potential data gaps. Åkers Sweden AB could explore options for internal estimations of process-related emissions or invest in gas measurement systems to better monitor and quantify these emissions in future assessments.

To strategically utilise the results and as a basis for emission reduction efforts, focusing on decreasing indirect Scope 3 emissions may prove more effective (from both climate impact and cost perspectives) than attempting reductions within Scope 1 or 2. A comprehensive analysis and the calculation of potential effects are an important basis for a systematic approach to emission

reduction. Moreover, a prerequisite for more in-depth effect analyses is the improved quality of activity data collected for the Scope 3 categories, with special emphasis on category 1, which contributes 60% of the total impacts (location-based method). The more accurate accounting of indirect emissions, the better the result can support the identification of hot spots, i.e., significant impacts, in the value chain. Such identification supports strategic decisions regarding where to allocate resources in a way that maximises the reduction of greenhouse gases.

The greatest uncertainties regarding activity data are found in Scope 3. At the same time, this Scope has the largest impact on the total emissions.

In this inventory, category 1 has been identified as the one that contributes the most to total emissions, especially activities related to raw materials and spend-based data. Emissions from raw materials are based on an average value of various emission factors based on the DESNZ methodology, as well as proxy values, which led to limitations in the form of uncertainties about representativeness. It is recommended to continue working actively with suppliers of supplied materials to obtain supplier-specific data. Most of the purchased metal (by mass) is scrap-based, associated with low emissions. It must, however, be stressed that the use of proxy emission factors for a sizeable share of the remaining alloying materials means that the result is very sensitive to the choice of proxy emission factors and thereby increases the uncertainty. The proxy emission factors are chosen to be conservative to avoid underestimating the emissions.

Regarding the data quality of spend-data, there are certain limitations regarding the transparency and reliability of the spend analysis and selected emission factors. Spend-based data is inherently different and does not reflect the "physical reality" of a process or material; it is rather a representative for an activity/industry/product's share of the economy. Spend analysis is used to calculate impacts within scope 3 categories 1, 2, and 4. The spend analysis is tied to uncertainties around currency and price fluctuations, as well as changes in purchase volumes. Additional uncertainty is associated with the usage of US-based emission factors, where additional inaccuracy due to currency exchange is present. Moreover, the US-based emission factor may not be fully representative of Swedish geography. However, no better alternatives for emission factor sources were available; thus, it is deemed acceptable to use these factors rather than leave the data gaps. The emissions estimated with the spend-based method should be seen as a relative result indicating the possible size of emissions. Consequently, the result should be interpreted with caution.

For future inventories, it is recommended to request LCA and Carbon Footprint studies and EPDs from suppliers, thereby avoiding using spend-data and instead collecting data based on physical amounts. Specific supplier data would increase the proportion of primary data, thereby improving the data quality, accuracy, relevance, and completeness of the result. To facilitate the calculation of GHG impact from purchased goods and services, as well as capital goods, it is easiest if the supplier can summarise the GHG impact for the purchased goods for the reference year, and share results of LCAs, climate impact, Carbon Footprint, or EPDs for their products with Åkers Sweden AB.

In addition to the materials, it is recommended to collect specific transport distances for purchased goods and services. Further in category 4, a significant amount of activity data is based on supplier data. As mentioned in sections 6.4 and 6.5, it was impossible to check the quality of the used emission factors by the supplier. As suppliers might have better access to transportation data on laden percentage, utilisation rate, distances, transport modes, and used fuels, it is not certain if their emission factors can represent blends of biofuels. However, the supplier emissions reported for the activities are seen as primary data, thus it raises the data quality, accuracy, relevance, and completeness of the result.

Results obtained with DESNZ (2025) emission factors in category 4 should be seen as emission estimates. These factors reflect estimated figures from the UK statistics that consistently show lower truck fuel efficiency, on average, for large rigid HGVs compared to large articulated HGVs, when the relative degree of loading is accounted for. It is observed that heavier transport has lower emission factors. As mentioned in the DESNZ methodology paper, this is likely due to usage patterns for different types of HGVs, where large rigid HGVs may spend more time traveling at lower, more congested urban speeds, operating at lower fuel efficiency, while articulated HGVs tend to spend more time traveling at higher speeds under uncongested traffic conditions on motorways where fuel efficiency is higher.

9. References

Demus, Thorsten & Echterhof, Thomas & Pfeifer, Herbert & Schulten, Marc & Quicker, Peter. (2012). Investigations on the use of biogenic residues as a substitute for fossil coal in the eaf steelmaking process. https://www.researchgate.net/publication/231367477_INVESTIGATIONS_ON_THE_USE_OF_BIOGENIC_RESIDUES_AS_A_SUBSTITUTE_FOR_FOSSIL_COAL_IN_THE_EAF_STEELMAKING_PROCESS

DESNZ (2025). Department for Energy Security and Net Zero. Conversion factors 2025 full set for advanced users.

Drivkraft Sverige (2025). Renewable fuels (Swe: Förnybara drivmedel) https://drivkraftsverige.se/fakta-statistik/drivmedel/fornybara-drivmedel/

EEA European Environment Agency (2006). Emission Inventory Guidebook. Technical report 11/2006. https://www.eea.europa.eu/en/analysis/publications/emepcorinair5/B427vs3.3.pdf/@@download/file

Energimyndigheten. (2025). Reduction Obligation (Swe: Reduktionsplikt) https://www.energimyndigheten.se/klimat/transporter/reduktionsplikt/

EPA (2025). United States Environmental Protection Agency, Emission Factors for Greenhouse Gas Inventories. https://www.epa.gov/climateleadership/ghg-emission-factors-hub

German Environment Agency. (2021) Probas database. https://data.probas.umweltbundesamt.de/index.xhtml?stock=PUBLIC

Holmberg, P., & Tangerås, T. P. (2023). The Swedish electricity market–today and in the future. Sveriges Riksbank. https://www.riksbank.se/globalassets/media/rapporter/pov/artiklar/engelska/2023/230512/2023_1-the-swedish-electricity-market--today-and-in-the-future.pdf

IIMA. (2022). Jeremy A. T. Jones. An assessment of future challenges for the EAF process resulting from efforts to reduce the carbon footprint. https://metallics.org/wp-content/uploads/2025/01/IIMA_Decarbonisation_Whitepaper2_EAF.pdf

IMOA International Molybdenum Association: Life Cycle Inventory of Molybdenum Products for Metallurgical Applications. Summary report 2024. https://www.imoa.info/news-events-blog/latest-news-details.php?objectID=786&lang=en

Ingwersen, W. & M. Li. (2020) Supply Chain Greenhouse Gas Emission Factors for US Industries and Commodities. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-20/001.

Johansson, J. (2024). Miljöspendanalys, kategoriträd och miljöindikatorer process-LCA-metod. Upphandlingsmyndigheten, Solna. https://www.upphandlingsmyndigheten.se/om-hallbar-upphandling/miljomassigt-hallbar-upphandling/analysera-inkopen-med-miljospendanalys/miljospend--metod-och-material/

Johansson N.C & Sandgren, A. (2025). Emissionsfaktor för nordisk elmix år 2021 – 2023 https://ivl.diva-portal.org/smash/get/diva2:1998248/FULLTEXT01.pdf%20Scope%202%20f%C3%B6r%20ink%C3%B6pt%20el.3-%C3%A5rs%20snitt%202021-2023

Raabe, D. (2023). The Materials Science behind Sustainable Metals and Alloys. Chemical Reviews 2023, 123, 2436-2608. https://pubs.acs.org/doi/10.1021/acs.chemrev.2c00799?ref=PDF#article__left-side

Saevarsdottir, G., Kvande, H., Magnusson, T. (2021). Greenhouse Gas Emissions from Silicon Production -Development of Carbon Footprint with Changing Energy Systems. SSRN Electronic Journal. 10.2139/ssrn.3926088. https://www.researchgate.net/publication/354774370_Greenhouse_Gas_Emissions_from_Silicon_Production_-Development_of_Carbon_Footprint_with_Changing_Energy_Systems

Sveriges Riksbank. (2025). Sweden's central bank. Annual and monthly average exchange rates Sweden's central bank. https://www.riksbank.se/en-gb/statistics/interest-rates-and-exchange-rates/search-annual-and-monthly-average-exchange-rates/?a=Y&y=2022&m=Select+month&s=g130-SEKUSDPMI&c=Min&c=Max&c=Ultimo&fs=3#result-section

Upphandlingsmyndigheten. (2019). Miljöspendanalys - Beskrivning av en metod för att integrera klimatpåverkan i allmänna inköpsanalyser. REPORT 2019:4 https://www.upphandlingsmyndigheten.se/globalassets/dokument/publikationer/miljospendanalys-rapport_2019_4.pdf

Vattenfall AB. (2026). EPD® of Electricity from Vattenfall’s Nordic Hydropower. EPD Registration number: S-P 00088. EPD International AB. https://www.environdec.com/library/epd88

World Resources Institute & World Business Council for Sustainable Development (WRI & WBCSD). (2004). The Greenhouse Gas Protocol. A Corporate Accounting and Reporting Standard. Revised Edition. Washington: World Resources Institute & World Business Council for Sustainable Development.

WRI & WBCSD. (2011). Greenhouse Gas Protocol. Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Supplement to the GHG Protocol Corporate Accounting and Reporting Standard. World Resources Institute & World Business Council for Sustainable Development.

WRI & WBCSD. (2013). Greenhouse Gas Protocol. Technical Guidance for Calculating Scope 3 Emissions (Version 1.0). Supplement to the Corporate Value Chain (Scope 3) Accounting and Reporting Standard. World Resources Institute & World Business Council for Sustainable Development.

WRI. (2015). GHG Protocol Scope 2 Guidance. An amendment to the GHG Protocol Corporate Standard. World Resources Institute.

10. Appendix I Materiality assessment of scope categories

Below is a summary of the materiality assessment of Scope 3 categories. The materiality analysis was conducted in collaboration with Ramboll and Åkers Sweden AB (Erica Vigholm). The process took place alongside the data collection process and consisted of qualitative and quantitative data.

Category	Relevance	Included in the inventory (X)	Assessment	Data availability and quality
Upstream				
3.1 Purchased products and services	High	X	This category includes purchases of both raw materials and consumables, as well as services. Raw materials consist of various types of metals, which tend to have significant importance in GHG inventories. At the same time, purchases of raw materials account for a large proportion of total purchases and presumably contribute significantly to the impact. This category is assessed as highly relevant to Åkers Sweden AB's operations.	Data for purchased raw materials during 2025 is of high quality and consists of physical quantities (kg) of raw materials. Data on consumables and services exist in the form of paid invoices during 2025, whose data quality is somewhat lower because some accounts contain a mix of different materials and possibly services. For spend data, 60% of the largest spend for all accounts was categorized into principal purchasing categories and subcategories. The remaining 40% of accounts were divided into services (assumed 40%) and supplies (assumed 60%) based on the suppliers and internal knowledge within Åkers.
3.2 Capital goods	Medium	X	Vehicles, equipment for facilities, spare parts for machines, and the machines themselves are counted as capital goods in this category. Since there are some purchases of capital goods, this category is assessed as moderately relevant.	Spend data has been collected for identified capital goods. Note that the spend is divided over more years that the purchase year and is based on financial accounting. Spend data itself is associated with some uncertainty and is assessed to be of lower quality than physical quantities. Partly, there is additional information in the data regarding how many pieces the spend data represents.
3.3 Energy-related emissions	Medium	X	Upstream impact from purchased energy - electricity, vehicle fuel, and oils. Grid losses are included.	Very good quality of data - based on Scope 1 and Scope 2 (measurements and invoices)
3.4 Upstream transportation	Medium	X	Relevant for Åkers Sweden AB's operations due to large quantities of purchased raw materials and rolls transported to customers, partly paid by Åkers Sweden AB.	Mixed quality of data: Very good quality on data based on supplier data, good quality for raw materials based on weight, acceptable quality for spend-based data.
3.5 Waste management	Low		Preliminary results indicated low relevance compared to the other categories. It was decided not to include this category in the 2025 inventory. Tracking the impact of waste management is part of Åkers' key performance indicators. However, it is assessed that the GHG inventory is not the	Very good quality of data - statistics from the waste contractor.

			most optimal method for actively addressing waste environmental issues and evaluating which treatment methods are most environmentally friendly. For this reason, this category is not included in the 2025 report.	
3.6 Business travel	Low		Business travels are relevant for fewer than 10 people in the entire organization and occur infrequently. It is assessed that the preliminary emissions are negligible and that the category is not relevant in 2025. It is recommended to evaluate the category's significance for the next reporting period.	
3.7 Employee commuting	Low		Preliminary results indicated low relevance compared to the other categories. It was estimated based on a standard value, as there is no available data. According to Åkers Sweden AB, the result was probably somewhat overestimated, as it does not take into account local conditions, such as the proximity to the workplace for most employees. It was decided not to include this category in the 2025 inventory.	Data is missing; for preliminary calculations, data based on the travel habit survey conducted by Origo Group on behalf of Region Sörmland was used.
3.8 Upstream leased assets	Not relevant		Åkers Sweden AB does not lease assets.	
Downstream				
3.9 Downstream transportation	Medium	X	Relevant for Åkers Sweden AB's operations due to the rollers that are transported to customers but where the transport is not purchased by Åkers.	Service Supplier Data is available.
3.10 Processing of products	Not relevant		No unfinished rolls are sold to end customers.	
3.11 Use of products	Not relevant		There are no direct emissions from the use of rollers. Indirect emissions are linked to the machines in which the rolls are used (e.g., for rolling). The type of rolls used in the machine does not affect the size of the indirect emissions. It was decided not to include the indirect emissions, as it is not required by the standard.	

3.12 End-of-life treatment of sold products	Low		Preliminary results showed low relevance compared to other categories. The final processing of rollers mostly involves recycling in the form of remelting used rollers, which usually takes place in the customers' facilities. According to the GHG methodology, the recycling process is not included within our system boundaries. Therefore, it is deemed that this category should not be included in the 2025 inventory. The assessment should be reviewed if more detailed information on final processing is available, and it turns out that most are disposed of instead.	Limited information regarding processing methods. The assessment is based on previous internal inventories of rolls' final processing.
3.13 Downstream leased assets	Not relevant		Åkers Sweden AB does not lease out assets.	
3.14 Franchises	Not relevant		Åkers Sweden AB has no franchise companies.	
3.15 Investments	Not relevant		Åkers Sweden AB does not have joint ventures or investments.	

11. Appendix II Outside the scope of the study

This section presents emissions from direct carbon dioxide (CO_2) emissions from biologically bound carbon (for example, CO_2 from the combustion of biomass/biofuels), which are to be reported separately. The use of emission factors from DESNZ (2025) allows the separation of biogenic CO_2 emissions from total CO_2e emissions, and for it to be reported separately. These emission factors have been used below to calculate the biogenic carbon related to activities in Scope 1 and 3. However, due to the use of emission factors from various sources, it was not possible to report and account for biogenic CO_2 separately for transportation connected to category 4. The used emission factors account for the Well-To-Wheel system boundaries and take weight into account, which limits the possibility of a correct estimation of shares of biogenic CO_2 in this context. DESNZ (2025) has not provided out-of-scope emission factors for freight activities. The Transport Service Supplier data did not include biogenic carbon dioxide emissions.

Table 17 Assessed biogenic carbon dioxide emissions

Activities in scope	Category	Activity	Emission (ton CO_2)
Scope 1	Vehicle fuel	FAME	5.8
Scope 1	Vehicle fuel	HVO	0.85
Scope 1	Vehicle fuel	Bioethanol	0.97
Scope 2	Electricity consumption	No activity	0
Scope 3.1	Purchased goods and services	No activity	0
Scope 3.2	Capital goods	No activity	0
Scope 3.3	Fuel and energy-related activities	No activity	0
Scope 3.4	Truck fuel	Biofuel share	Data gap
Scope 3.5	Not included category	Not included category	Not included category
Scope 3.6	Not included category	Not included category	Not included category
Scope 3.7	Not included category	Not included category	Not included category
Scope 3.8	Not included category	Not included category	Not included category
Scope 3.9	Truck fuel	Biofuel share	Data gap
Scope 3.10	Not included category	Not included category	Not included category
Scope 3.11	Not included category	Not included category	Not included category
Scope 3.12	Not included category	Not included category	Not included category
Scope 3.13	Not included category	Not included category	Not included category
Scope 3.14	Not included category	Not included category	Not included category
Scope 3.15	Not included category	Not included category	Not included category
Assessed Total			**7.7**

12. Appendix III Data quality

According to the standard, there is no obligation to report an assessment of the data quality for activity data and emission factors for Scope 1 and 2, as it is required to use primary data. However, the discussion regarding data quality and data gaps, along with the used emission factors and their quality are described in Chapter 8 . Here, the data quality assessment is reported only for the categories that are included in the study for Scope 3.

This appendix contains categories where emission factors have been used together with a quality ranking according to the GHG Protocol's categories: Technology, Time, Geography, Completeness, and Reliability. Each emission factor per category is rated with the following score: Very Good, Good, Fair, Poor. These scores are rated based on how representative the used data is compared to "reality".

Table 18 Data quality assessment

Scope 3 category	Source	Techno-logy	Time	Geo-graphy	Comple-teness	Reliability
Scope 3.1	DESNZ 2025	Fair	Very good	Good	Fair	Very good
Scope 3.1	German Environmental Agency, 2021	Fair	Good	Good	Fair	Very good
Scope 3.1	Nickel Institute	Very good	Very good	Very good	Very good	Very good
Scope 3.1	the International Molybdenum Association (IMOA)	Very good	Very good	Very good	Very good	Very good
Scope 3.1	Ingwersen, W. AND M. Li. (2020) Supply Chain Greenhouse Gas Emission Factors for US Industries and Commodities. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-20/001	Fair	Good	Very poor	Good	Good
Scope 3.1	Johansson, J. (2024). Miljöspendanalys, kategoriträd och miljöindikatorer process-LCA-metod. (2020-2021)	Fair	Very good	Very good	Poor	Fair

Scope 3 category	Source	Techno-logy	Time	Geo-graphy	Comple-teness	Reliability
Scope 3.2	Johansson, J. (2024). Miljöspendanalys, kategoriträd och miljöindikatorer process-LCA-metod. (2020-2021)	Fair	Very good	Very good	Poor	Fair
Scope 3.3	DESNZ 2025	Good	Very good	Fair	Very good	Very good
Scope 3.3	Johansson N.C, & Sandgren, A.(2025). Emissionsfaktor för nordisk elmix år 2021 – 2023	Very good	Very good	Very good	Very good	Very good
Scope 3.3	EPD hydropower	Very good	Very good	Very good	Very good	Very good
Scope 3.4	DESNZ 2025	Good	Very good	Fair	Fair	Very good
Scope 3.4	Supplier-specific data	Very good	Very good	Very good	Very good	Very good
Scope 3.4	Ingwersen, W. AND M. Li. (2020) Supply Chain Greenhouse Gas Emission Factors for US Industries and Commodities. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-20/001	Fair	Good	Very poor	Poor	Good
Scope 3.9	DESNZ 2025	Good	Very good	Fair	Fair	Very good

13. Appendix IV Share of primary data

This appendix presents the proportion of primary and secondary data used in the Scope 3 calculation. According to the GHG Protocol, there are no requirements to report primary and secondary data for Scope 1 and 2, as all Scope 1 and 2 data must be primary data.

The GHG Protocol Scope 3 Guidance defines primary data as primary activity data or emissions data calculated by suppliers that are specific to the suppliers' operations and which are related to specific activities in the reporting company's value chain. Supplier-specific emissions are collected from distribution actors and are considered primary data.

Secondary data is further defined as industry-average data, financial data, proxy data, or generic data. In some cases, a hybrid method is used to calculate emissions, meaning supplier-specific data (e.g., mass, distance, energy amount) is combined with DESNZ (2025) database emission factors. All spend-based calculations are regarded as secondary data.

The primary data in Scope 3 accounts for 3.3% of the total Scope 3 impact.

Table 19

Category	Primary data %	Secondary data %
3.1 Purchased goods and services	0	100%
3.2 Capital goods	0	100%
3.3 Fuel- and energy-related activities	0	100%
3.4 Upstream transportation and distribution	37%	63%
3.9 Downstream transportation and distribution	0%	100%
Total Scope 3	**3.3%**	**96.7%**