Production companies

Application guideline

Carbon Added Accounting

Make the CO_2e footprint of products and services demonstrably reliable

Connekt

Topsector Logistiek

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1 Production companies

This guideline describes the application of Carbon Added Accounting for production companies based on the principle:

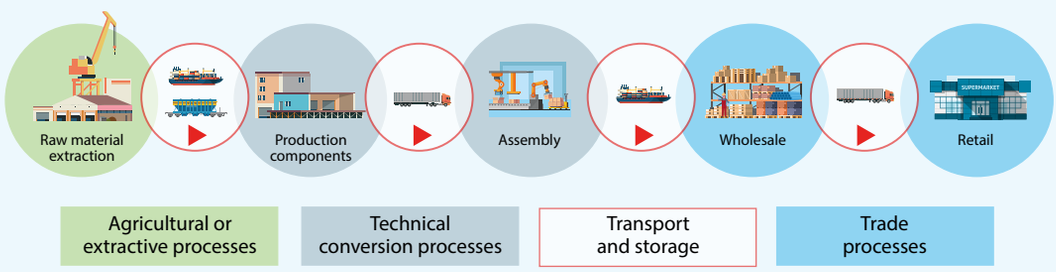
CO_2e input + CO_2e added = CO_2e output

Production companies play an important role in the value chains of physical goods flows. In this guideline, heterogeneous mass production is taken as an example in which the CO_2e output via the recipe and packaging method is allocated to end products. This allows the producer to determine in detail which CO_2e emissions are generated, where the most benefits from emission reductions can be achieved and use this information for marketing purposes and facilitate cross-industry benchmarking.

2 Role in the value chain

Carbon Added Accounting considers, among other things, value chains, such as chains with physical goods flows, which, for example, start with agricultural or extractive processes, the products of which flow via storage and transport to a semi-manufactured producer, a producer of semi-finished products, wholesaler and retail outlets, to eventually reach the consumer. Various organisational typologies have been drawn up for each of these processes from the accountancy perspective as a tool for the administrative organisation and internal control (AO/IC) on the flows of money and goods.

Organisational typologies in a chain of physical goods flows

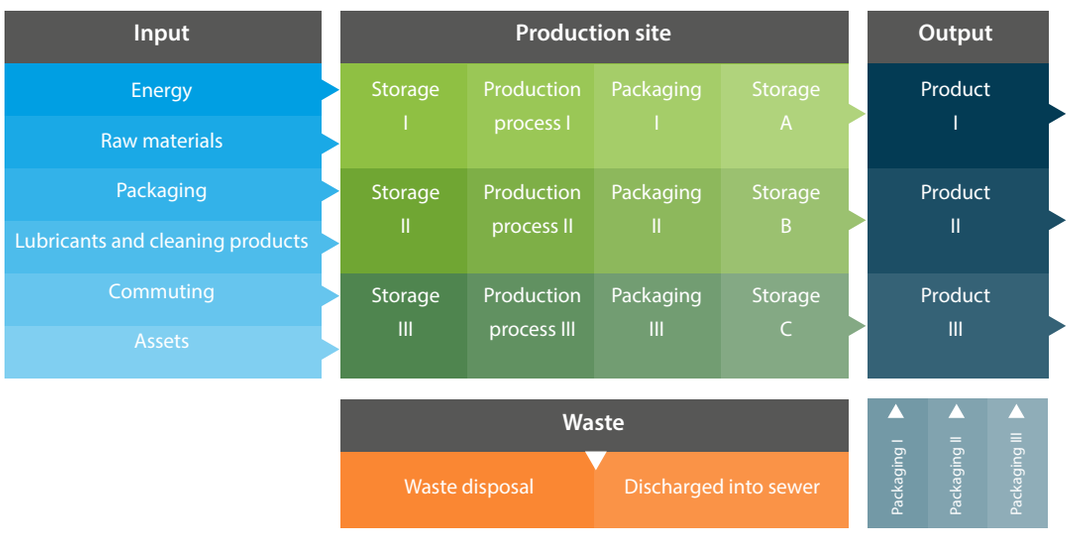


However, these typologies are not only applicable for differences in financial management and audits, but they are also suitable as an aid for CO_2e calculations.

3 Calculation and allocation CO_2e based on CO_2e input + CO_2e added

In a production process, the CO_2e input, including from purchased raw materials and semi-finished products (GHG protocol scope III). CO_2e added is the added energy in the production process through the consumption of fuels (GHG protocol scope I) and electricity (GHG protocol scope II). CO_2e added is created by the energy consumption for production and packaging lines and for the heating of the locations.

General schedule of heterogeneous mass production



By means of production recipes, the CO_2e emissions are allocated to end products and via packaging methods also to packaged end products. The principle of homogeneous mass production - with one final product and possibly several packaging methods - is obviously a simplified version of this schedule. Here, at one or more production locations, input is consumed in a technical conversion process and a packaging process to obtain the output of semi-finished products and/or end products.

Determining CO_2e input

The CO_2e of purchased goods such as raw materials and packaging materials, or GHG scope III, can often not be accurately determined After all, this sometimes requires reliable data from suppliers, sometimes from suppliers, sometimes from abroad. Therefore, scope III is usually calculated based on the average emission factor per unit (e.g. taken from technical data sheets) multiplied by the purchased quantity.

Determining CO_2e added

Scope I and II can largely be accurately determined, often even with data quality category gold, on the basis of the monthly energy bills of the chain partner. These accounts are also easy to verify by accountants for accuracy, timeliness and completeness by means of correlation checks with bank payments and meter readings. The application of data quality is even more important in chain administrations. Generally each chain party can establish the consumption of scope I and II accurately and with high data quality, and the data quality of the final footprint in chain administrations will increase automatically.

Allocation of CO_2e input and CO_2e added

The CO_2e emissions of scope I, II and III - plus any (non-captured) CO_2e that is released during biological and/or chemical processes (e.g. fermentation at a beer brewery) - must then to be allocated to end products. Carbon Added Accounting uses, among other things, the mixing ratios (product recipes) to calculate CO_2e to be allocated to end products. This gives the manufacturer insight into the CO_2e generated to make specific products. Preferably the CO_2e should first be allocated to individual production batches, especially if the production batches vary in production quantity. Larger production batches are usually more efficient in terms of energy consumption per production unit. Also, different products are normally produced in separate production batches due to the specific product recipe.

Depending on available measurements, CO_2e can even be detailed to specific production phases, production machines from day to day (or even more detailed). This gives the manufacturer the operating information needed for (continuous) improvements.

Page 7 shows in a simplified way how scope I, II and III can be allocated to end product 1. Scope I and scope II are allocated on the basis of energy consumption and the respective emission factors to the number of kilograms of the total production, being product 1, 2 and 3 together, unless this can be more accurately allocated to product 1 on the basis of measurements per production batch. Scope III is allocated to the number of kilograms of the production of product 1 on the basis of the mixing ratio of the raw materials (the recipe) and the respective emission factors.

Allocation scopes to end product

CO_2e input

CO_2e Scope III			
Raw materials	Product 1: quantity raw materials (kg)	Emission factor raw materials (kg CO_2e/kg)	CO_2e (kg)
Borealis	262,680	1.425	374,319
Rigidex	105,477	1.425	150,305
Admer	16,579	2.900	48,079
Eval	16,831	2.200	37,028
Polywhite	11,221	1.469	16,484
Polyblack	253	1.469	372
Total	**413,041**		**626,586**

Production batches	
Product 1	Production batches
January	2
February	3
March	7
April	4
May	2
June	10
July	2
August	4
September	3
October	2
November	8
December	4
Total	**51**

Total production	Raw materials
Product 1	Total consumed (kg)
Product 1	413,040

Emission factor	Product 1
(kg CO_2e/kg)	
Scope III	1.517

+

CO_2e added

**) Emission factor 2.085 kg CO_2e/Nm^3*

CO_2e Scope I		
Gas	Quantity (Nm^3)	CO_2e* (kg)
January	7,521	15,681
February	9,921	20,685
March	7,874	16,417
April	4,220	8,799
May	2,730	5,692
June	777	1,620
July	303	632
August	716	1,493
September	688	1,434
October	1,705	3,555
November	3,103	6,469
December	6,446	13,439
Total	**46,003**	**95,917**

Production batches	
Product 1, 2 and 3	Production batches
January	15
February	15
March	21
April	18
May	29
June	30
July	22
August	20
September	32
October	33
November	34
December	24
Total	**293**

Total production	Raw materials
Product 1, 2 and 3	Total consumed (kg)
Product 1	413,040
Product 2	2,609,920
Product 3	19,500
Total	**3,042,460**

Emission factor	Product 1
(kg CO_2e/kg)	
Scope I	0.032

**) Emission factor 0.523 kg CO_2e/kWh*

CO_2e Scope II		
Electr.	Quantity (kWh)	CO_2e* (kg)
January	185,987	97,271
February	187,488	98,056
March	237,038	123,971
April	211,338	110,530
May	293,924	153,722
June	297,940	155,823
July	233,873	122,316
August	227,166	118,808
September	310,390	162,334
October	323,178	169,022
November	328,683	171,901
December	266,913	139,595
Total	**3,103,918**	**1,623,349**

Production batches	
Product 1, 2 and 3	Production batches
January	15
February	15
March	21
April	18
May	29
June	30
July	22
August	20
September	32
October	33
November	34
December	24
Total	**293**

Total production	Raw materials
Product 1, 2 and 3	Total consumed (kg)
Product 1	413,040
Product 2	2,609,920
Product 3	19,500
Total	**3,042,460**

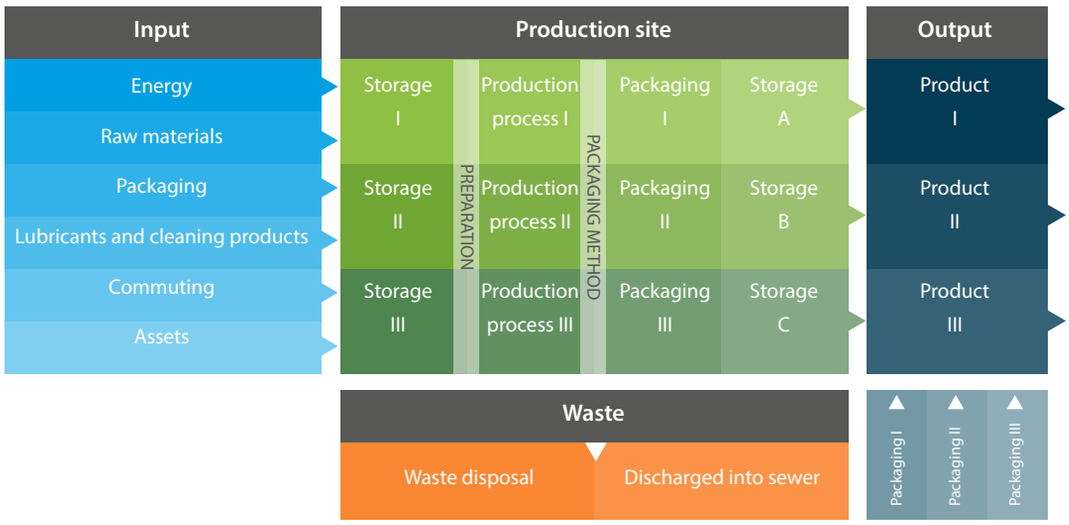
Emission factor	Product 1
(kg CO_2e/kg)	
Scope II	0.534

=

CO_2e output

Emission factor	Product 1
(kg CO_2e/kg)	
Scope I	0.032
Scope II	0.534
Scope III	1.517
Total	**2.082**

Allocation via the recipes and packaging methods



During such CO_2e allocation, both the data quality and the GHG scope in the calculations must be traceable, so the end products do not only contain the calculated CO_2e values, but also the breakdown of these according to both data quality level (Bronze, Silver, Gold and Gold+) and GHG scope (I, II and III) which demonstrate the context of the CO_2e values (see: Carbon Added Accounting Application Guideline Data Quality).

4 CO_2e output

The outcome of the CO_2e allocation to end products provides the final emission factors per finished product in the reported period. These must be subdivided by GHG scope, where scopes I and II are the CO_2e added forms and scope III the CO_2e input.

Total emissions (kg CO_2e/l) broken down per product by GHG scope

Product Family	Scope I kg CO_2e/l	Scope II kg CO_2e/l	Scope III kg CO_2e/l	Total kg CO_2e/l
1 Lacquer paint - SB, opaque	0.06	0.15	1.77	1.97
2 Lacquer paint - SB, transparent	0.06	0.15	1.37	1.58
3 Lacquer paint - WB, primer	0.06	0.15	1.60	1.81
4 Lacquer paint - WB, finish	0.06	0.15	1.80	2.01
5 Latex/wall paint - WB, pigmented	0.06	0.15	2.20	2.40
6 Latex/wall paint - WB, unpigmented	0.06	0.15	2.07	2.28
7 Colour paste - SB, transparent	0.06	0.15	2.96	3.17
8 Colour paste - WB, finish	0.06	0.15	3.64	3.84

The emission factors must also be subdivided by data quality level (Bronze, Silver, Gold and Gold+) to ensure the data reliability of the calculated CO_2e output.

CO_2e emissions product families (kg CO_2e/l) per scope and total

Data Quality	Total kg CO_2e	Bronze kg CO_2e	Silver kg CO_2e	Gold kg CO_2e	Gold+ kg CO_2e
Product A	2.118 (100.0%)	1.605 (75.8%)	0.032 (1.5%)	0.481 (22.7%)	0.000 (0.0%)
Product B	2.112 (100.0%)	1.600 (75.8%)	0.032 (1.5%)	0.480 (22.7%)	0.000 (0.0%)
Product C	2.100 (100.0%)	1.591 (75.8%)	0.032 (1.5%)	0.477 (22.7%)	0.000 (0.0%)

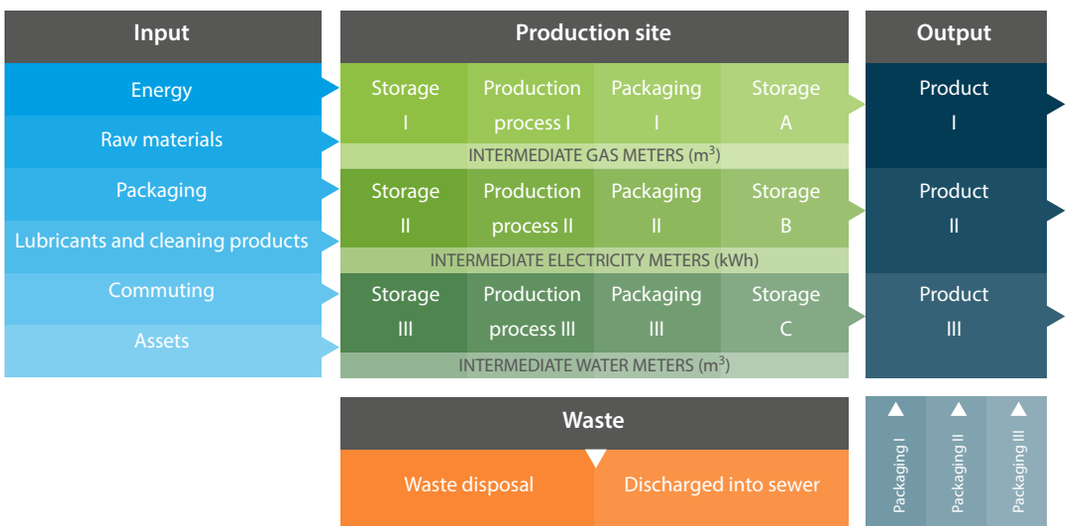
If the producer passes on the emission factors of the end products, including subdivision by GHG categories and data quality level, to the next chain partner, the CO_2e insight into the chain increases and the reported CO_2e values continue their context (reliability, added CO_2e).

5 Correlation checks

Partly from an accountant's perspective, the data must be correct (read: the data is accurate), complete (read: all data is available) and timely (read: the data relates to the intended reporting period). Moreover, this prevents carbon leakage because CO_2e would not be calculated or allocated.

In the figure below, the (intermediate) meters of the gas, electricity and water consumption have been added to illustrate this, with which the consumption of these utilities can be determined and possibly even allocated to production locations and/or processes or even phases. Any data differences in the correlation checks must be explained and and, where necessary, supplemented by modelling, which naturally leads to data completeness and thus lower data quality.

Correlation checks between utility bills and the (intermediate) meters



6 Insight

CO_2e insight provides added value for the producer

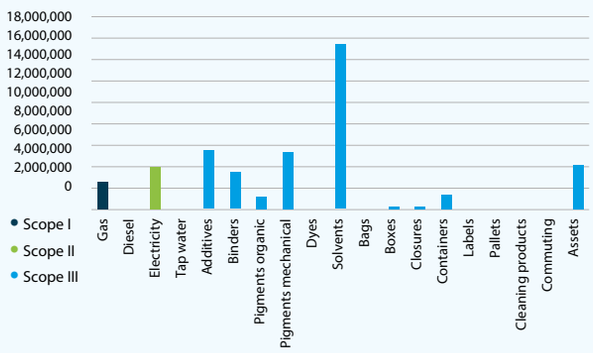
The Carbon Added Accounting method uses product recipes to allocate CO_2e from all three GHG scopes to end products, while maintaining data quality category. This provides insight into the CO_2e emissions generated to make specific products. In the case of mass production, CO_2e can also be allocated to production batches. And depending on the available measurements, CO_2e even be detailed down to specific production stages, day-to-day production machines (or even per hour). This gives the manufacturer the detailed operating information needed for (continuous) improvements.

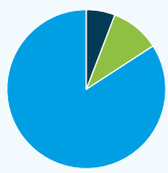
7 Management information

Based on the calculations for the allocation of CO_2e to end products, it is possible to prepare management information as shown below.

Management report of CO_2e emissions per period

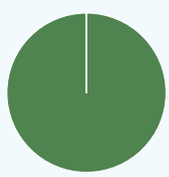
Greenhouse gas (kg CO_2e)





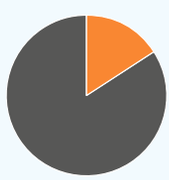
Emissions (kg CO_2e) per scope

- Scope I 6%
- Scope II 10%
- Scope III 84%



Origin of carbon

- Fossil 100%
- Recycled 0%
- Biomass 0%
- CO_2 source 0%
- N/A 0%



Data quality

- Gold 16%
- Silver 0%
- Bronze 84%

Total produced (hl)
184,013

Total produced (tons)
24,343

Production batches
8,146

Total kg CO_2e
38,453,621

Average emissions (kg CO_2e) per hl
208.97

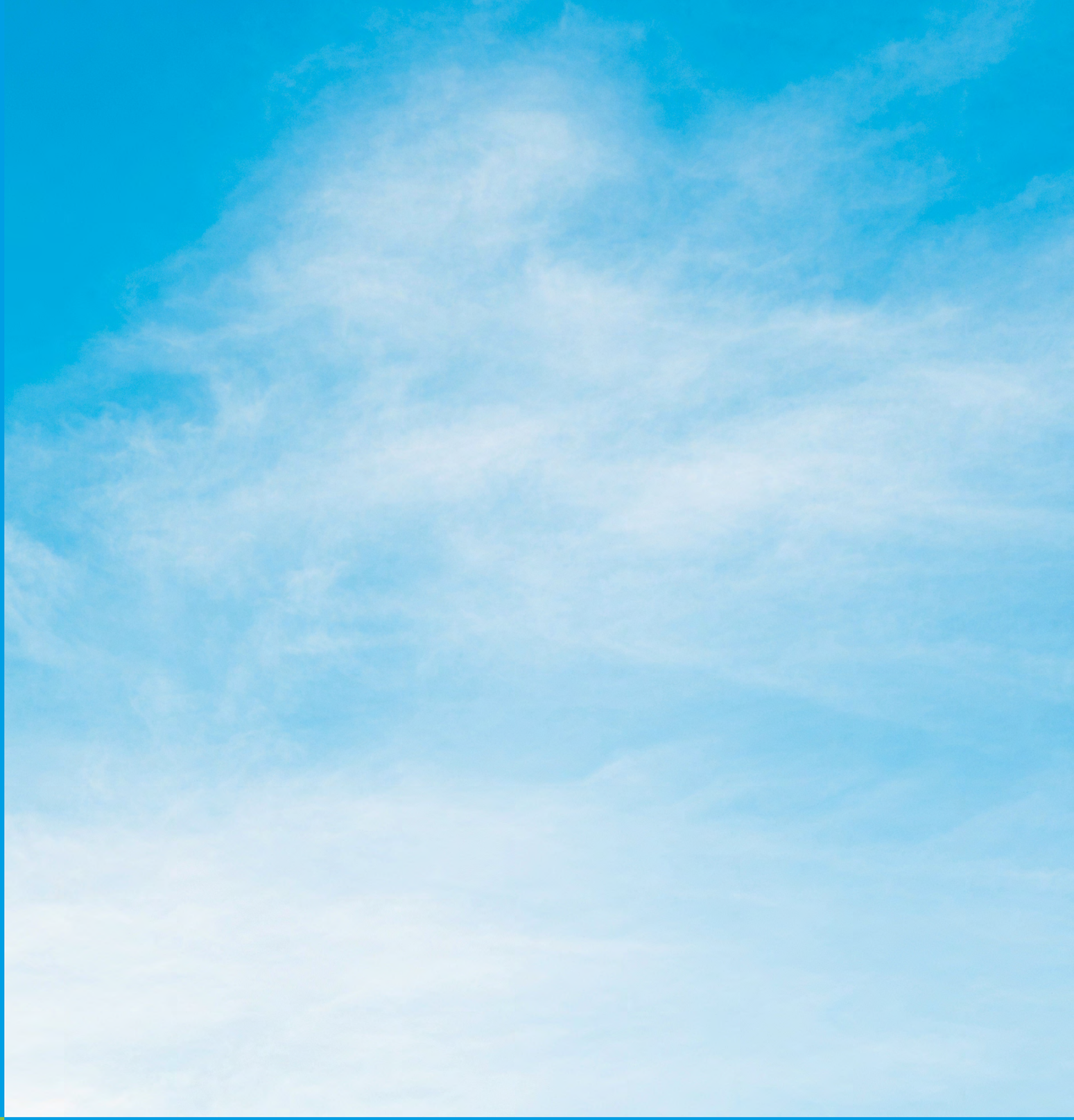
Data completeness
86%

Consumption versus purchasing
-3%

CO_2e components
19

Waste (tons)
1,457

The above information shows, among other things, the total CO_2e emissions of the producer, the data quality, how the emissions are made up of components per GHG scope and what the average CO_2e emissions per unit of production is. Such management information, and the underlying details, can periodically provide insight into where the most CO_2e profit can be achieved and where actual emission reductions have been achieved. The producer can also use it to determine which CO_2e emissions are generated per end product and packaging unit, which can be used for mutual be used for mutual benchmarking or for marketing purposes.



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