Agricultural companies

Application guideline

Carbon Added Accounting

Make the CO_2e footprint of products and services demonstrably reliable

Connekt

Topsector Logistiek

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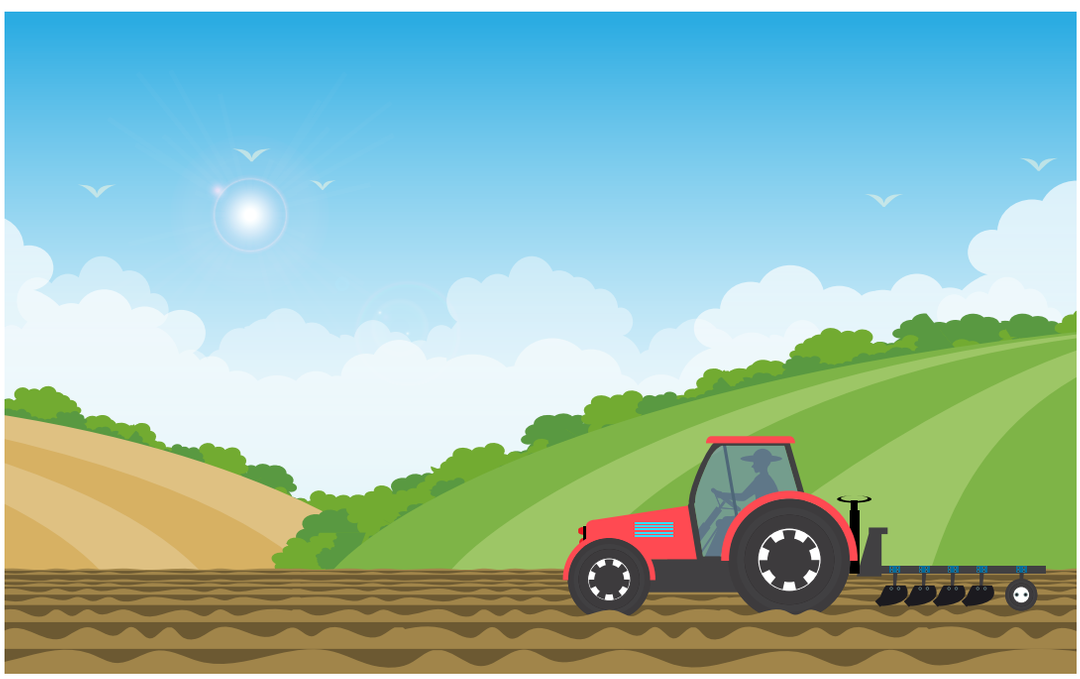
1 Agricultural companies

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

CO_2e input + CO_2e added = CO_2e output

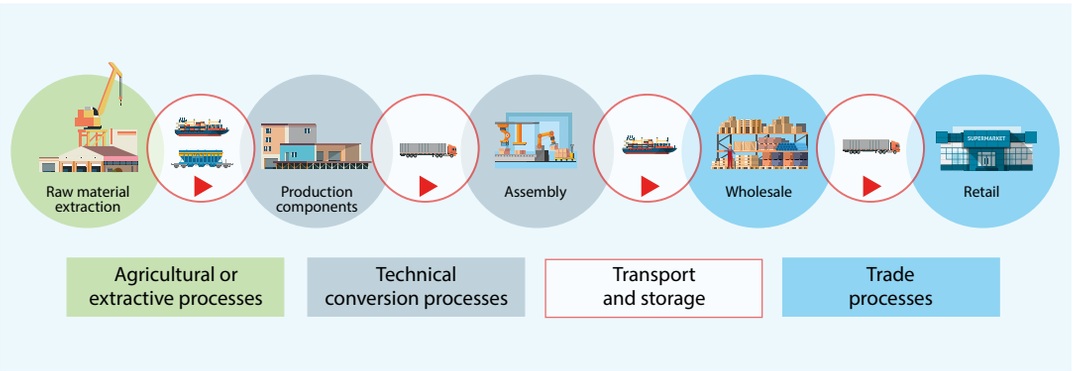
Agricultural companies are often at the start of value chains of physical goods flows. In this guideline, primary agricultural processes in arable farming are taken as an example, including the sorting and packaging of agricultural products. The CO_2e output is calculated based on the CO_2e input and the CO_2e added which is allocated to the outgoing product flow. This allows agricultural companies to determine in detail which CO_2e emissions are generated, where most profit from emission reductions can be achieved and use this information for reporting purposes and benchmarking in the sector.



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 of whose products continue through storage and transport to successively a semi-manufacture producer, an end-manufacturing producer, trading companies (e.g. wholesale, retail) to finally 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



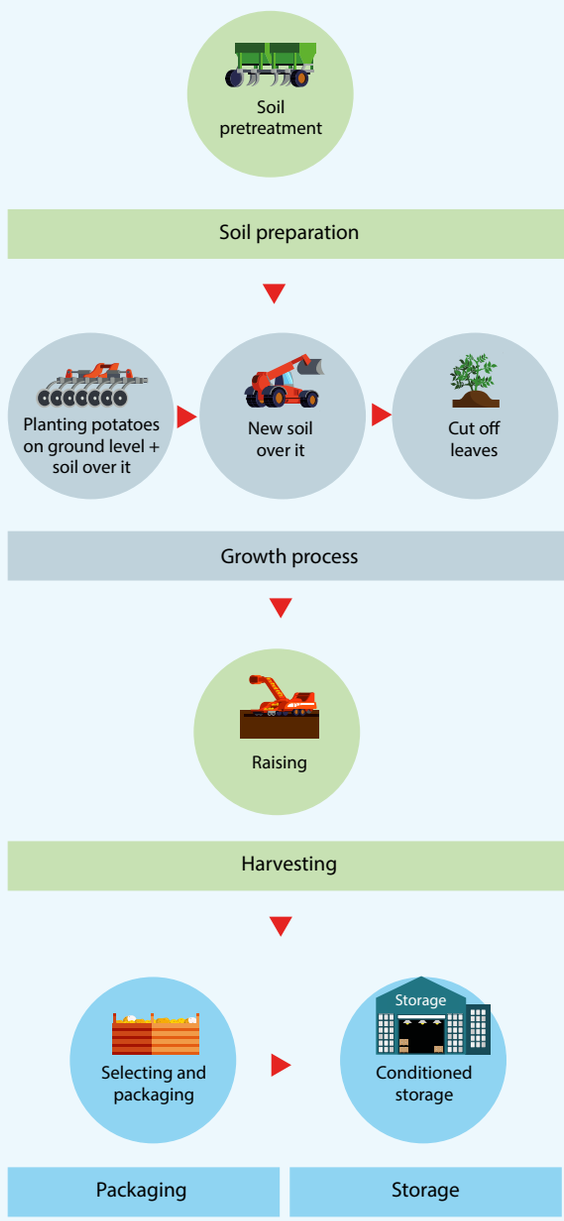
However, these typologies are not only applicable for differences in financial management and audits, but they are also suitable as an aid for CO_2e calculations.

3 Agricultural activities

The best-known forms of agricultural activities are arable farming, horticulture (including fruit growing and the cultivation of flowers, bulbs, plants and trees), livestock farming (all forms of keeping animals for commercial or profit purposes) and forestry (e.g. production of trees and/or or wood). Nowadays, circular agriculture is increasingly being pursued. The aim is to keep raw materials and products in the cycle for a long time and at a high quality. This is achieved through the fullest possible use of raw materials, the high-quality use of biomass and the recycling of residual flows.

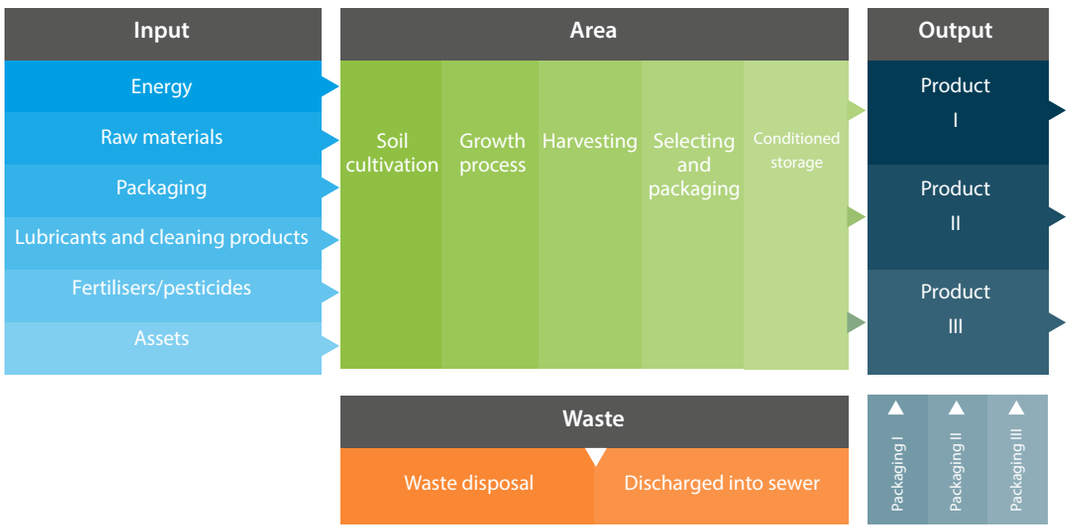
In this guideline, agricultural companies are defined as companies that make significant use of nature as means of production, such as the growth of crops or the natural expansion of livestock. These companies are characterised by production that is strongly influenced by uncontrollable environmental factors such as climatic, biological or geological conditions. The added value does not only arise from the deployment of employees and fixed assets (as with regular production companies), but also to a considerable extent from natural increase.

Schematic representation of the main activities potato cultivation



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

General diagram of potato cultivation



The largest emission sources in potato cultivation are the production of nitrogen fertiliser, nitrous oxide emissions from the soil through fertiliser use and electricity use for cold storage. The reduction potential of the carbon footprint can therefore mainly be found in these sources.

Determining CO_2e input

The CO_2e of purchased raw materials and materials needed, or GHG scope III, can often not be accurately determined in practice. After all, this sometimes requires reliable data from suppliers, sometimes from abroad. Therefore, scope III is usually calculated based on the average emission factor per unit (e.g. taken from data sheets) multiplied by the purchased quantity. However, as the principle of Carbon Added Accounting becomes more widely adopted in the value chain, the reliability and understanding of the CO_2e of purchased goods and packaging increase.

Determining CO_2e added

The CO_2e of purchased raw materials and materials needed, or GHG scope III, can often not be accurately determined in practice. After all, this sometimes requires reliable data from suppliers, sometimes from abroad. Therefore, scope III is usually calculated based on the average emission factor per unit (e.g. taken from data sheets) multiplied by the purchased quantity. However, as the principle of Carbon Added Accounting becomes more widely adopted in the value chain, the reliability and understanding of the CO_2e of purchased goods and packaging increase.

Energy consumption

For agricultural companies, the energy consumption of scope I and II can be determined accurately most of the time, often even with data quality category gold, based on monthly energy bills and the (administrated) fuel consumption (e.g. diesel) of the company. Accountants are generally able to simply verify these bills for correctness, timeliness and completeness by means of correlation checks with bank payments, meter readings and machine use.

Emissions in the primary process

Additionally, CO_2e emissions can also occur due to changes in vegetation and soil organic matter content[1]. In a natural forest or grassland, dead plant remains are left on the soil (mulch). They are partly converted into CO_2e in a natural decomposition process and partly converted into soil organic matter which itself is also broken down. The soil organic matter formed from mulch is ultimately converted into stable humus and CO_2e.

In a natural forest or grassland, growth and death of plants, build-up and breakdown of the mulch layer, soil organic matter and humus are in balance with each other. However, removing plants or crop residues from forest, grassland or arable land for the production of bio-based raw materials (or biofuels) will change the balance and the amount of soil organic matter and humus will decrease. After all, fewer plants then remain to form mulch, soil organic matter and humus.

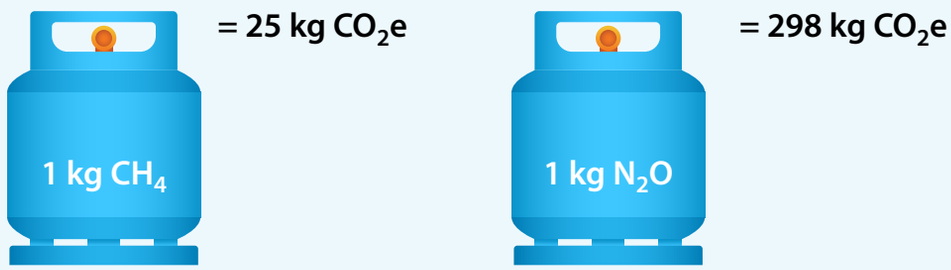
The processes outlined above also play a role in arable farming, even though the crop is of course removed there anyway. Here, soil organic matter is built up from crop residues such as roots and leaves and from any organic substances added by the arable farmer, such as animal manure, compost or green manure. The decrease in the amount in mulch, soil organic matter and humus is therefore regarded as CO_2e emission under the UN Climate Treaty. Reductions must therefore be settled as CO_2e emission and increases as CO_2e registration, or negative emission.

1 Source: Manual CO_2 values for bio-based raw materials according to MJA3/MEE method (CE Delft).

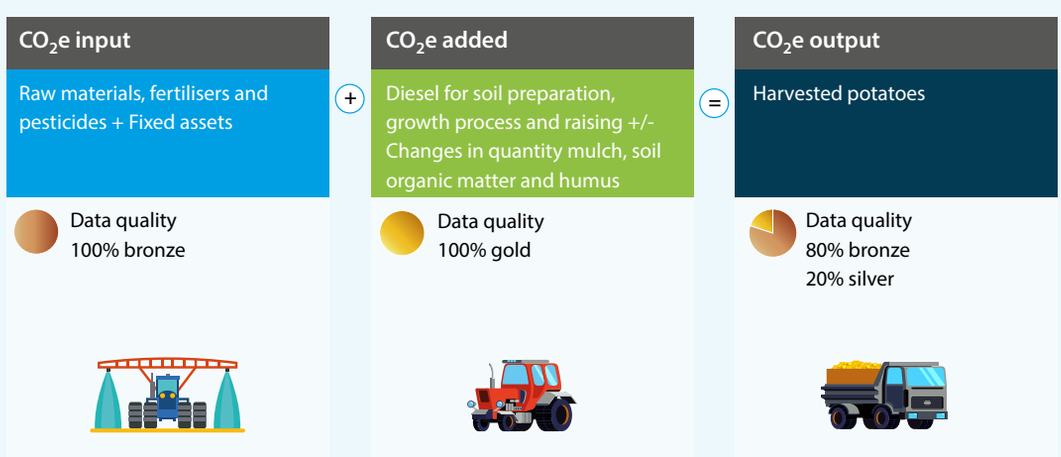
Allocation of CO_2e input and CO_2e added to CO_2e output

Soil preparation

In this guideline, soil preparation refers to various mechanical operations on the land, including digging and levelling the soil, raising the soil, mowing the foliage and digging up the potatoes. These operations are normally carried out by tractors and specially equipped harvesting machines that as such add CO_2e based on fuel consumption (GHG scope I), lubricants and cleaning agents, any pesticides and deployed fixed assets (GHG scope III).



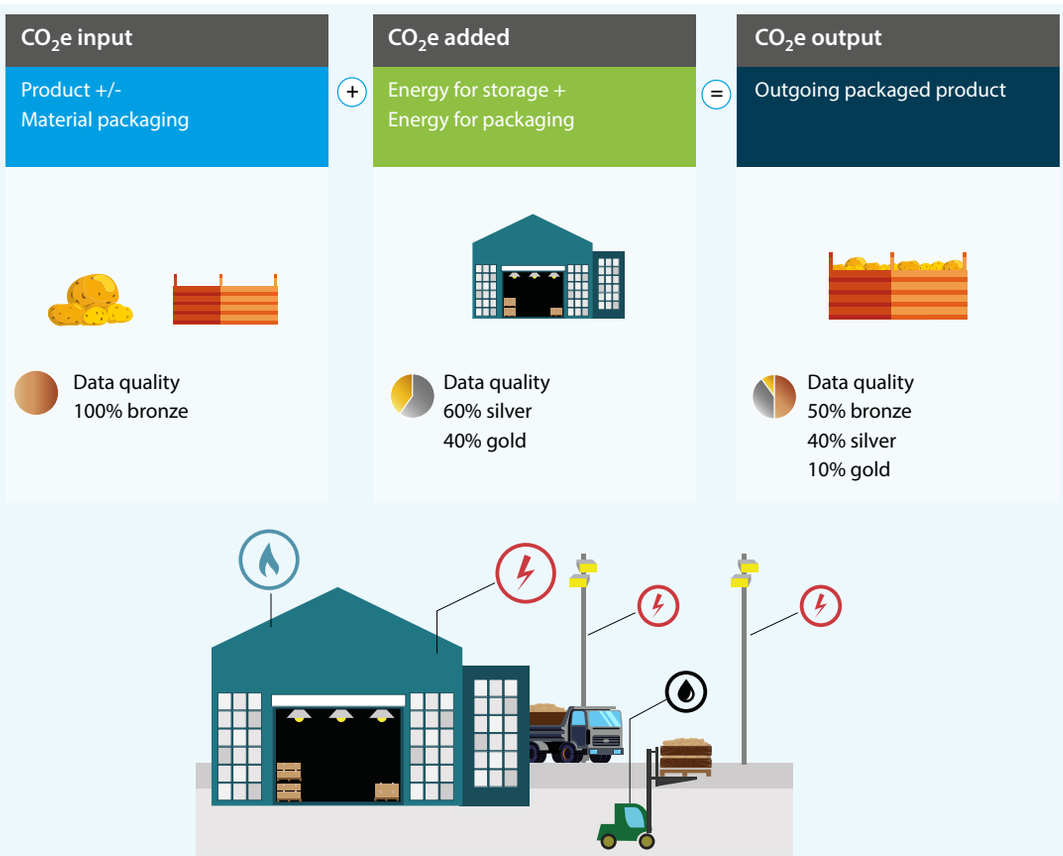
A second source of greenhouse gases is the use of fertilisers and pesticides. These products can contribute significantly to emissions because per kilogram, some of these products can produce a considerably higher greenhouse effect than regular CO_2e. Greenhouse gases that are normally released in the agricultural sector include carbon dioxide (CO_2e), methane (CH_4) and nitrous oxide (N_2O). To be able to compare them properly and add them up, methane and nitrous oxide are converted into CO_2e equivalents. The emissions of CH_4 and N_2O are equal to 25 and 298 kg of CO_2e respectively. The use of fertilisers and pesticides in the reported period must therefore be counted and allocated to the products produced in the same period per unit weight.



2 A harvester is a machine for picking up crops whose yield is in or close to the ground, such as potatoes, sugar beets and mangold, onions and carrots.

5 Storage

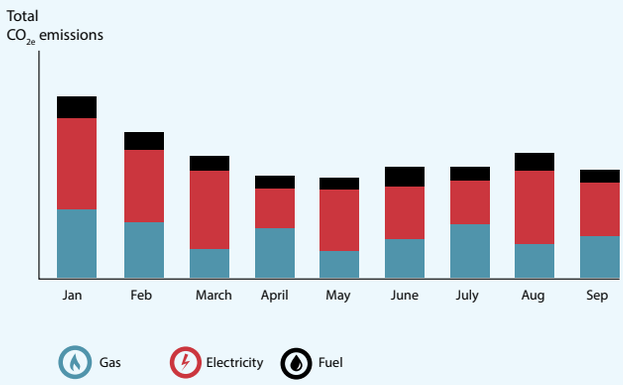
With storage, the aim is to store the produced products conditioned or otherwise[3] for final transport to the customers. In principle, the CO_2e of the outgoing goods flow is made up of the CO_2e input of the relevant product plus the CO_2e added and any changes in packaging (e.g. from large packaging to small packaging).



The CO_2e emissions from conditioned storage naturally consist of the energy and fuel used for storage, including gas (e.g. heating) and electricity (e.g. refrigeration, lighting) for the buildings and any selection and packaging lines, but also the fuel or electricity that is used for (mobile) internal transport such as pallet trucks and forklifts.

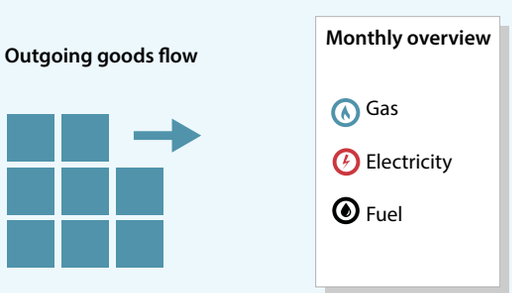
In most cases, the contribution of storage to the total emissions in the value chain will be relatively small, except for storage where refrigerated (or frozen) products are kept for a longer period of time.

3 Potatoes are normally stored in bulk in special wooden potato boxes, which can be stacked and are suitable for ventilation.



The energy consumed in a reporting period can be determined from the energy bills (e.g. gas, electricity) of that period plus the fuel consumption (e.g. diesel) for soil preparation and internal transport. In practice, more and more use is made of electrified internal transport, which normally forms part of the periodic electricity bill. With modern measuring equipment (e.g. smart meters, fleet software), periodic energy consumption can be determined more and more accurately, sometimes even on a weekly, daily or hourly basis, which increases the data quality of the energy data. This energy consumption is relatively easy to convert into CO_2e emissions. The CO_2e emissions are calculated based on the amount and type of energy consumed. The Dutch emission factors for each form of energy consumption per unit can be found at www.co2emissiefactoren.nl.

A third source of greenhouse gases is refrigerant leakage from conditioned storage. Refrigerants can make a significant contribution because some of these agents have a significantly higher greenhouse effect per kilogram than regular CO_2. Such a contribution is expressed in CO_2 equivalents, abbreviated as CO_2e. The CO_2e factor can range from 1 to 4,470 kg, in which case the leakage of 1 kilogram of refrigerant is equivalent to the emission of 4,470 kg of regular CO_2. The leakage of refrigerants in the reported period must therefore also be counted and allocated.



There is (as yet) no COFRET guideline for calculating the allocation of energy consumption in storage activities. In practice, the following method is both defensible and accepted: allocation to the cargo takes place on the basis of the outgoing goods flow in the same period as the energy and fuel was measured. In practice, the weight of the outgoing goods flow is the most common unit for the CO_2e to be allocated to.

Below is a simple example of the CO_2e allocation of energy to the outgoing flow of goods.

500 potato crates

15,000 kWh

3,400m^3 natural gas

From a 10,000-m^2 potato shed, 500 potato crates are loaded for transport to a customer in the month of March.
In the same month, 15,000 kWh of electricity was consumed and 3,400 m^3 natural gas.
Based on this, the total emissions from the potato shed are:

Electricity:	15,000 kWh x 475 gram per kWh = 7,125 kg CO_2e,
	+
Gas:	3,400 m^3 x 1,890 gram per m^3 gas = 6,426 kg CO_2e,
	=
Total:	13,551 kg CO_2e or 27,1 kg per box.

(source: www.co2emissiefactoren.nl)

6 Packaging

Packaging includes activities such as packing, crating and palletising. This can be done both by hand and with (semi) automatic packaging lines. In the latter case, in the case of significant (material) energy consumption, the energy consumption of the packaging line must be allocated to the products that are packaged with it in the same way as is done at production companies. The energy consumption of the packaging line must be measured separately, which often happens in operational excellence-oriented companies, or is estimated on the basis of the specifications of the supplier(s) of the packaging line.

Packaging also adds CO_2e footprint to the end products. Normally, the packaging method (e.g. type of packaging, quantity of product) leads to unique product codes, making these product codes a good starting point for similarly calculating the allocation of CO_2e emissions to end products in their specific packaging via the packaging batches. Insight into CO_2e emissions (and other waste) gives parties new insights and dimensions with regard to process efficiency, decision-making and focus with regard to reducing emissions. When packaging products, the CO_2e of the material of the packaging can be attributed to the packaged products and the original packaging often leads to - whether or not recyclable - waste.

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).

7 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.

Agricultural companies are characterised by the fact that production is strongly influenced by uncontrollable environmental factors, including those of natural growth (e.g. growth of crops, birth of young livestock), which means CO_2e calculations and financial management can be based to a much lesser extent on the relationships within the money and goods movement. This means that support within agricultural companies must be found in key figures that are published by (independent) external bodies (e.g. the average number of calves per cow and the average yield per hectare of land per type of crop). Farms can also rely on the available land surface - the acreage - for the primary processes. In both arable farming and livestock farming, the size of the area is related to the yield of the harvest or the size of the livestock, respectively. An indirect connection can be made with the costs (read: invoices) that agricultural companies incur for large equipment that is not theirs and which is often used by contracting companies or cooperatives.

Similar to the use of a recipe in production companies, agricultural companies must draw up a mass balance to determine the use of energy, raw materials, packaging, lubricants and cleaning products, fertilisers and pesticides and fixed assets for each part of the production chain. A mass balance must also be drawn up for the same period for the produced end product, which must be equal to the mass balance of the input. Partly measured values per period can be used, supplemented with key figures for aspects where measured values are missing.

Based on this, correlation checks can be made. If the data differences in the correlation checks are small, the data quality is often high. Data differences in the correlation checks must be explained and, where necessary, supplemented by modelling, which then leads to a lower data completeness and thus lower data quality.

8 Insight

The Carbon Added Accounting method uses logical methods to allocate CO_2e of all three GHG scopes to end products, whilst preserving the data quality category. This provides insight into the CO_2e emissions generated to produce and - whether or not conditioned - stock agricultural products, to pack them if necessary and to be able to deliver them to customers. This gives agricultural companies the detailed operating information needed for (continuous) improvements. It can also be used to determine which CO_2e emissions are generated per delivered end product and packaging unit, which can be used for reporting and benchmarking purposes.

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