

“Market leakage”

(Market Leakage)

Definition: If new carbon sequestration practices (e.g. direct seeding or catch crops) or agronomic recommendations lead to a decline in yield compared to the 5-year average prior to joining the scheme, it is assumed that market demand for that crop remains the same.

To compensate for the shortfall from that particular field, new land will have to be cleared or more fertiliser applied somewhere else (perhaps on the other side of the world).

This indirectly generates emissions elsewhere – this is known as ‘market leakage’.

Calculation of the Baseline $Y_{(base)}$

$Y_{(base)}$ - Calculation of the average historical yield over a five-year period by crop, prior to joining the programme.

After calculating the average yields by crop for the previous 5 years, a comparison and calculation are made using the following formula for market leakage: (Market Leakage - MLK (yield)).

$$MLK_{(yield)} = (Y_{(95\%)} - Y_{(proj)}) \times A \times EF_{crop} \times \beta$$

Main components of the formula:

A: Plot area (in decares);

$Y_{(95\%)}$: Net yield loss (how many kg/decare you have lost below the 95% threshold, relative to **$Y_{(base)}$**), compared to the average yields for the region ;

$Y_{(proj)}$: Your actual yield of the specific crop during the project year;

EF_{crop} : Emission factor for the crop (how much CO₂ is emitted on average to produce 1 tonne of the specific crop);

β : Standard market leakage coefficient (20% Market Leakage Discount).

The formula is triggered only if the yield falls below 95% of the baseline. This 5% drop in yield is the limit of natural variation, or so-called statistical noise. In agriculture, yields vary from year to year due to weather conditions. A drop of up to 5% is considered a ‘normal deviation’, which may not be caused by the new technology and/or agronomic recommendations, but by the climate.

Trigger: If the decline is below 5%, we assume that there is no need for complex calculations regarding ‘leakage’, as the effect on the global market is negligible.

Administrative convenience: This saves the farmer unnecessary paperwork if the technology works well and yields are stable.

Market leakage deduction (β): The fixed coefficient of 0.2 (or 20%) is known as the Market Leakage Deduction. It has not been arbitrarily invented, but is derived from economic studies of the global market:

1. The economic theory of ‘Substitution’

It is assumed that if you produce 10 tonnes less of, say, barley, the world will not be 10 tonnes hungrier. The market will react in two ways:

- a) Reduced consumption (80%): Due to the higher price or the shortage, some consumers will reduce their consumption or switch to substitutes that do not require new land.

- b) New production (20%): It is assumed that only 20% of your shortfall will be offset by expanding farmland elsewhere (e.g. clearing forest for new fields).

2. Conservativeness

Carbon markets operate on the principle of caution. To ensure that credit buyers are confident that your project is genuinely helping the environment, Carbonsafe states: "We do not know exactly where this shortfall of 10 tonnes will be produced, so we assume that at least 20% of your yield decline will result in emissions elsewhere."

3. Global economic models

The 0.2 coefficient for market leakage is a 'default value' based on models such as GTAP (Global Trade Analysis Project). These models calculate how a change in the yield of a single crop in one country affects land use change worldwide.

EFcrop: Emission factor for the crop (how much CO₂ is emitted on average to produce 1 tonne of a specific crop). The emission factor for crops is not a fixed figure for the whole world, but is calculated using the IPCC methodology. Other sources are also used, such as the official reports of Fertilizers Europe (the Association of European Fertiliser Manufacturers) and Ecoinvent / Agri-footprint: the world's largest databases on agricultural footprints. The aim is to determine an emission factor for the relevant crop, taking into account N₂O, which is 273 times more harmful than CO₂, and its conversion to CO₂ from various production activities reported by:

1. **Emissions from the production and use of fertilisers – IPCC calculation;**
2. **Emissions from crop residues – IPCC calculation;**
3. **Field emissions (from the soil) – IPCC calculation:**
 - ✓ Direct emissions kg CO₂e;
 - ✓ Indirect emissions from volatilisation (kg CO₂e);
 - ✓ Indirect emissions from leaching (kg CO₂e);
 - ✓ Emissions from organic fertiliser
4. **Emissions from diesel used for field/soil operations (sowing, harvesting, etc.)**

Scenario matrix:

Scenario	Project yield kg/ decare	% of baseline	Credit status	Penalty (Leakage)
Green area	 kg/decare	>= 95%	Approved	0% (Full marks)
Yellow zone	 kg/decare	<95%	Approved with a deduction	A 'leakage' formula applies

Important conditions:

1. If the yield for a specific crop has fallen by more than 5%, this does not automatically result in the status 'Approved with deduction'. First, a check is carried out to compare the average yields in the area for the same crop from official sources. A comparison is made between the average official yields by Planning Region and official regional data (if available). Bulgaria is divided into 6 planning regions (NUTS 2 level), which are used

for statistical purposes. These regions are extremely large and may sometimes include as many as five NUTS 3 administrative districts, which does not provide representative information on the regional average yield. Where official data on average yields by municipality are available, these are included in the comparison. If the reduced yield is characteristic of the region, no deduction is applied. If the actual yield is below the regional average, a correction is made.

2. A check is carried out to ensure that the reduced yield is not a deliberately desired yield by the farmer for economic reasons. The rise in the price of fertilisers, plant protection products, fuel and electricity on the one hand, and the constant price of produce on the other, leads to the economic logic of efficiency and effectiveness in production. It is possible and economically justified to reduce costs and achieve a lower yield in the face of a clearly negative market situation linked to lower purchase or market prices for produce. The farmer must declare such a situation before the end of the expenditure phase of the production cycle. This circumstance cannot be declared after the harvest.

The actual yield (kg/ decare) per crop, as specified in the cultivation technological map, is compared with the farmer's target yield for the relevant year and the officially available data on average yield (the minimum of the yield data in kg/ha by NUTS 2, regional/municipal data and the farmer's target yield) and is compared with the baseline yield Y(Base). If the actual yield is lower, a correction is made.

Practical example (Calculation)

Let us assume we have 10,000 decare of sunflowers and **Y(base) = 185 kg/ decare**, but during the year the yield falls to **Y(proj) = 130 kg/ decare** (this is a drop of around 70.27% – right in the 'yellow zone').

The threshold below which penalties apply is **Y_(95%) = 175.75 kg/ decare** (185 kg/da minus 5% = 175.75 kg/ decare). A comparison is made with the official average yields and the farmer's target economic average yield. The minimum of these comparisons indicates an average yield of 170 kg/ decare. In this case, **Y(95%) = 175.75 kg/ decare** is taken as 170 kg/decare.

Step A: We find the 'missing' tonnes below the threshold:

Y(95%) - Y(proj) or 170 kg/ decare – 130 kg/ decare = 40 kg/ decare × 10,000 decare = 400 tonnes of missing production.

Step B: We calculate the emissions for these tonnes:

400 tonnes × 1.5 EFcrop = 600 tCO₂e (These are the emissions that would be generated elsewhere).

Step C: Apply a 20% (β) standard market leakage discount.

$$\beta = 600 \text{ tCO}_2\text{e} \times 0.2 = 120.0 \text{ tCO}_2$$