Sustainable malt
A route to carbon net zero

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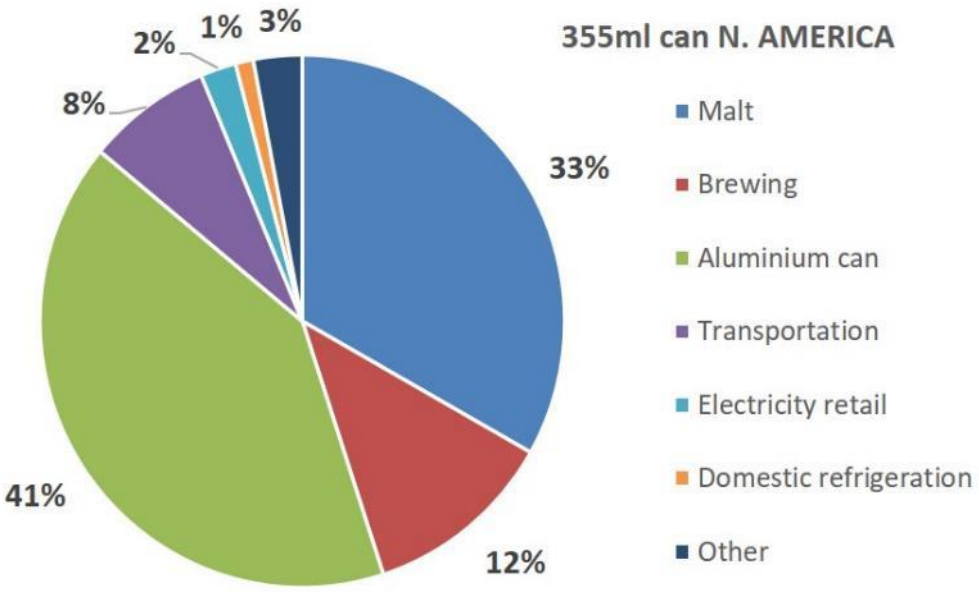
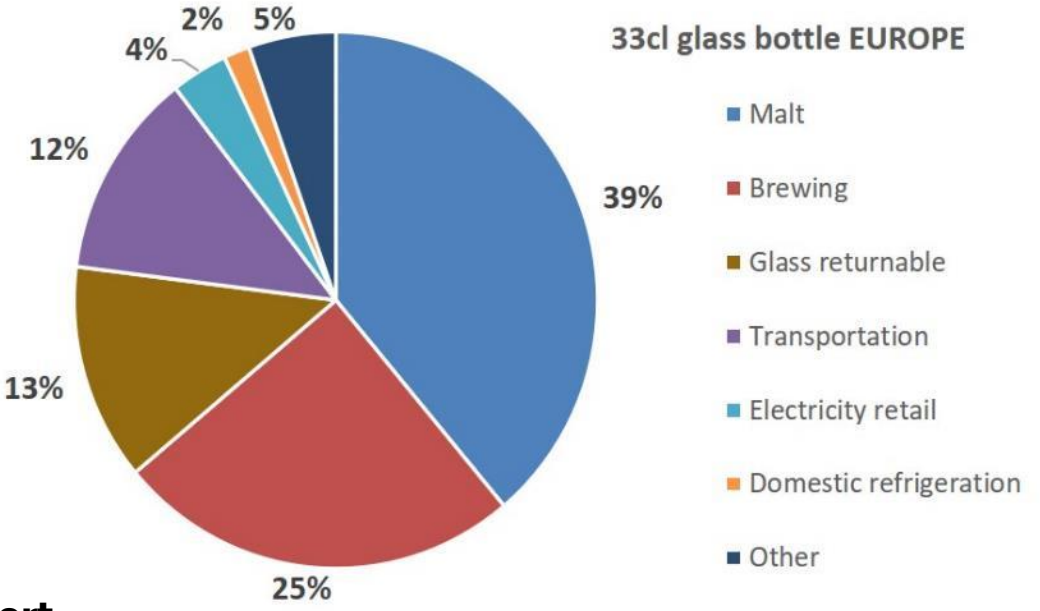
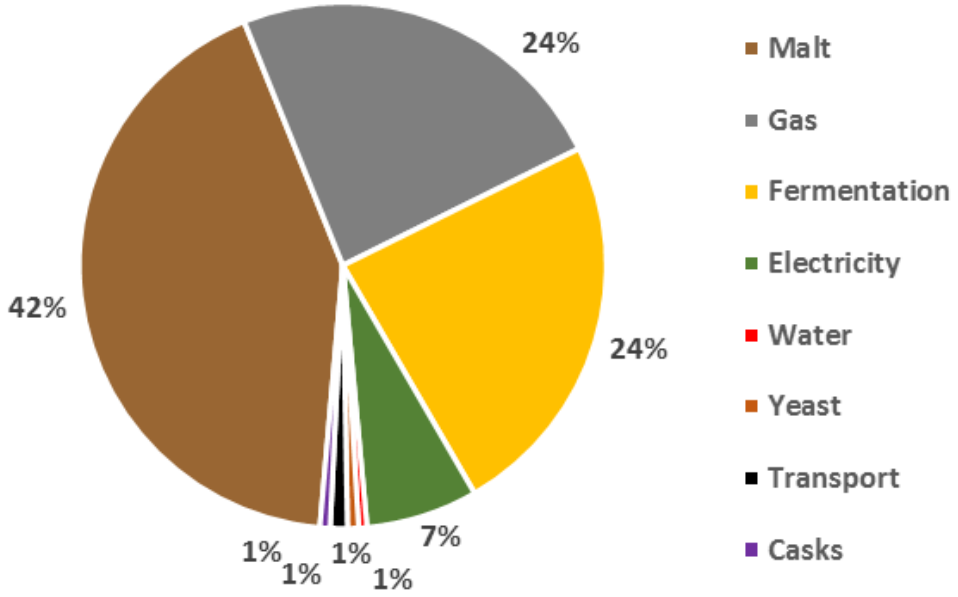
Why brewers and distillers need low carbon malt

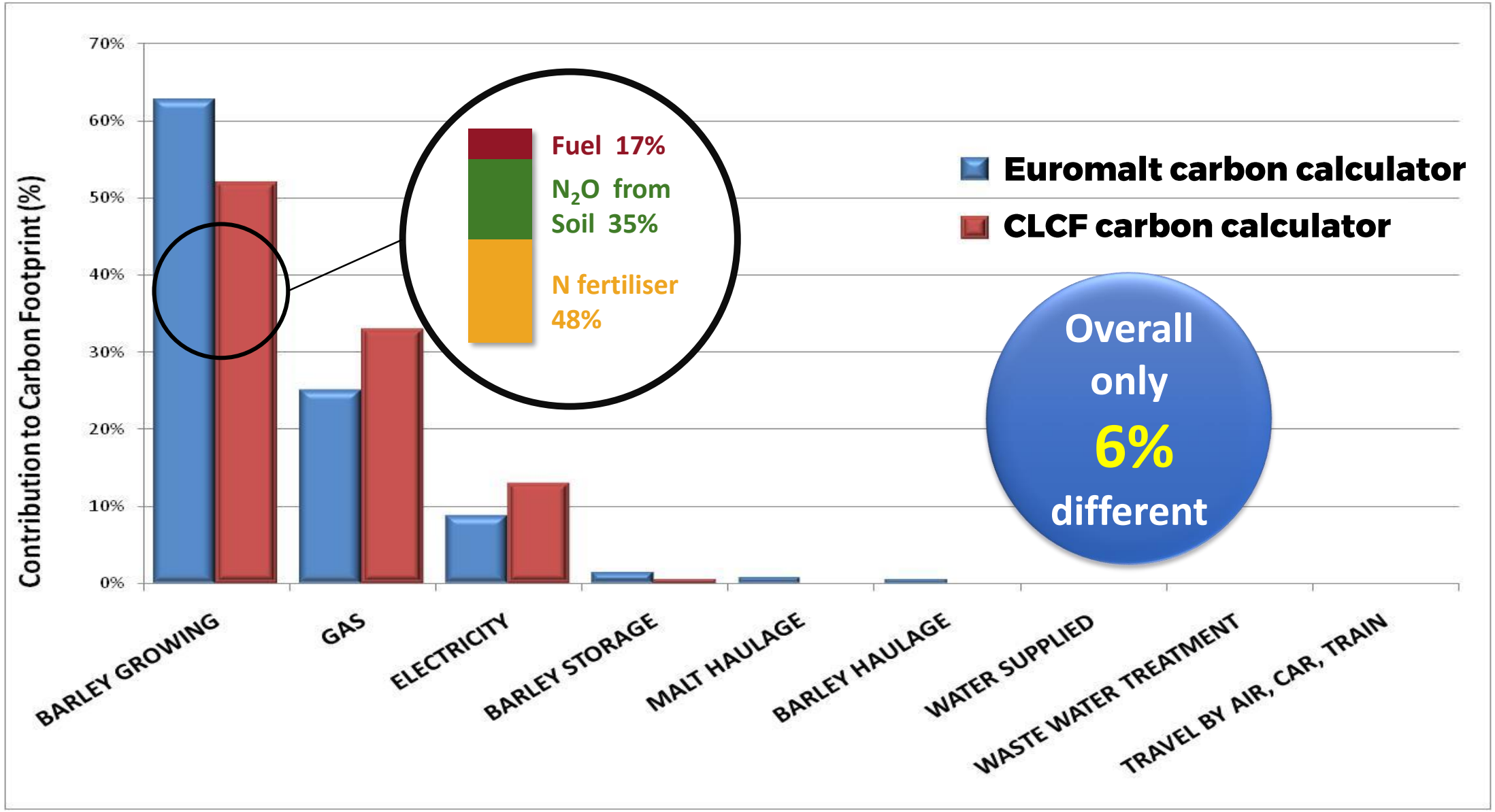






Bier Roundtable report

Where is the carbon intensity in malt?

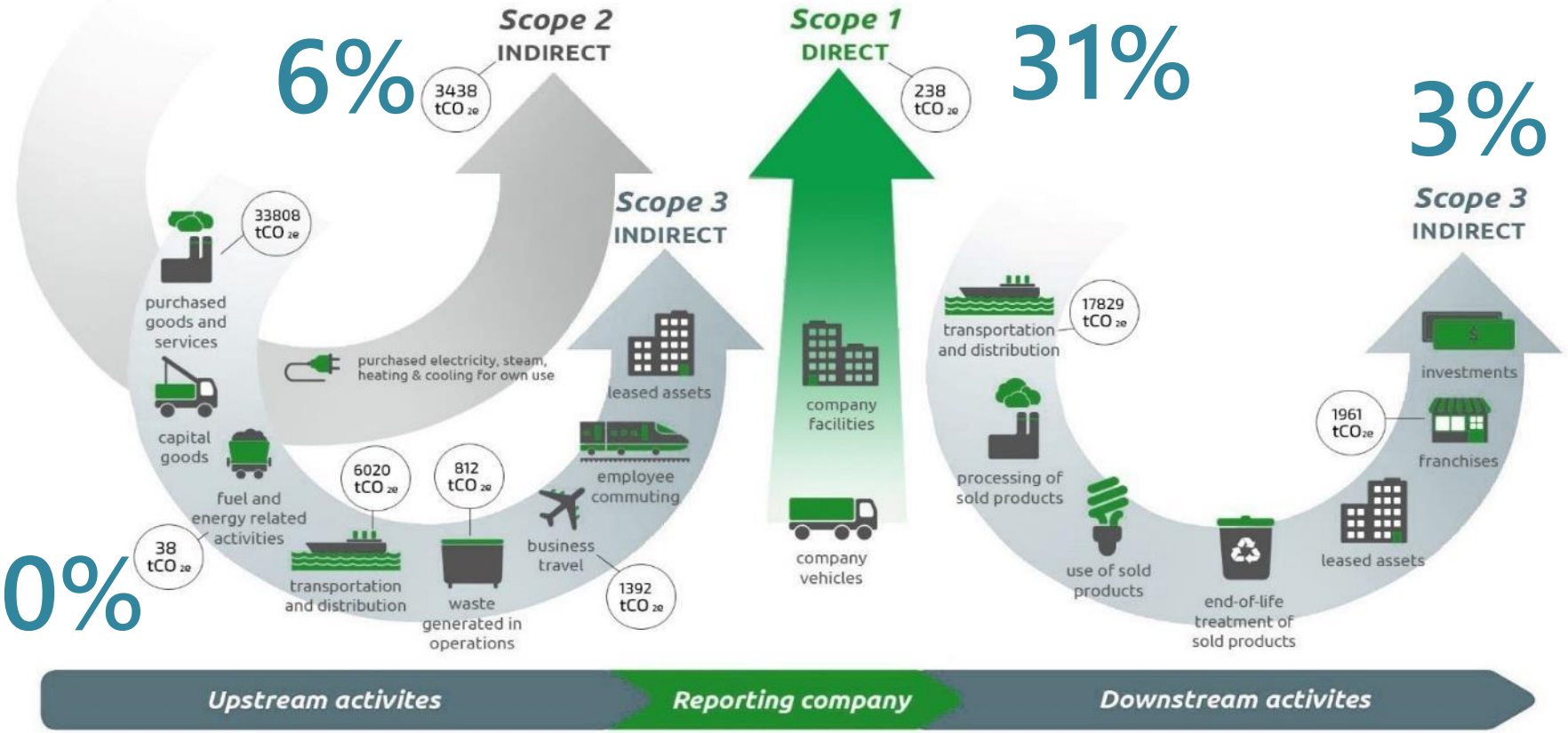


Explaining Carbon Footprint

uncertainty should not stifle action

Relative heating impact in the atmosphere

1	28	265	23,500	4-12,400	7190-17400
CO_2	CH_4	N_2O	HFCs	PFCs	SF_6



Levels of GHG conversion factor accuracy

1) Supplier specific method
2) Hybrid method
3) Average data method
4) Spend-based method

Net zero maltings vs Net zero supply chain

Scopes 1 and 2 route to net zero already possible

Scope 1:

- Switch heating from hot water boilers to Indirect exhaust gas Heat Exchanger (Flucorrex/Varicon)
- Switch gas supply from Natural Gas to:
  - Green Gas
  - Biomass
  - Electric heating if green sourced
  - Hydrogen

Scope 2:

- Switch electricity to green electricity
- Check the suitability of the technology behind green generation
- Generate green electricity yourself on site

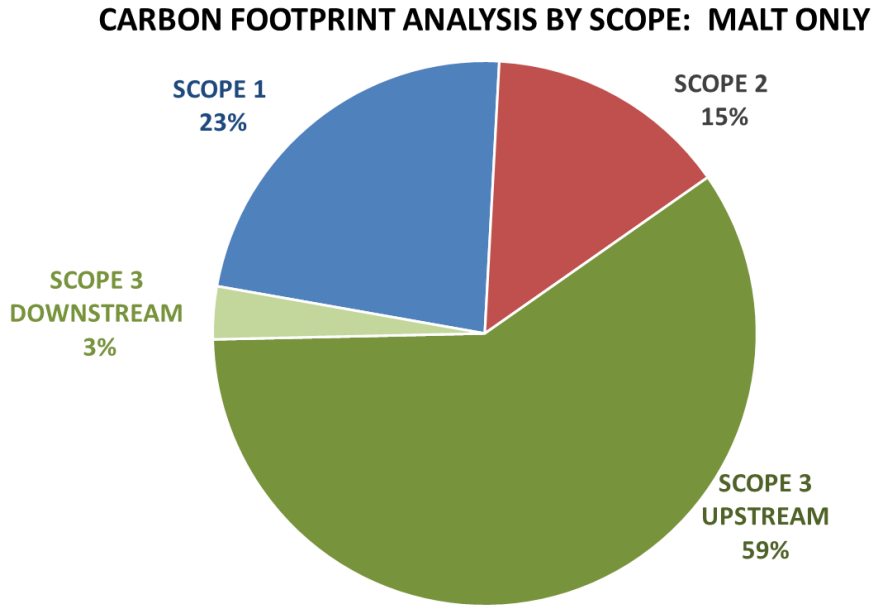



Net zero maltings vs Net zero supply chain

Is Scope 3 full of uncertainty?

Scope 3:

- How to calculate it?
- Could be 60-90% of the total carbon footprint: initial calculation from financial prediction models
- It's mainly in the barley: we have calculators
- Green fertiliser production helps
- How can we estimate: we have to predict the most significant areas from spend



Supply chain emission factors for spending on products: kgCO2e per £ or €

				£	€
SIC code (SIC 2003)	Code	Product category	Category description		
01	UK-1	Agriculture products	Products of agriculture, horticulture, including living plants, unmanufactured tobacco; live animals and animal products	1.876	2.082
02	UK-2	Forestry products	Wood in the rough, other forestry products	0.280	0.311
05	UK-3	Fish products	Aquatic animals, live, fresh or chilled, not prepared for consumption	0.504	0.559
10	UK-4	Coal, lignite, peat		4.291	4.763
11	UK-5	Crude petroleum, natural gas		0.504	0.559
13	UK-6	Metal ores		0.861	0.956
14	UK-7	Stone, sand and clay, other minerals		0.756	0.839
15	UK-8	Food and drink products	Prepared meat, fish, fruit, vegetables etc; dairy products; beverages; oils and fats	0.679	0.754
16	UK-9	Tobacco products		0.091	0.101
17	UK-10	Textiles	Preparation & spinning of textile fibres, textile weaving, finishing of textiles & wearing apparel, manufacture of made-up textile articles, except apparel	0.224	0.249
18	UK-11	Wearing apparel	e.g. PPE	0.203	0.225
19	UK-12	Leather products	Includes footwear and imitation leathers or leather substitutes, such as rubber footwear, textile luggage e.g. PPE	0.210	0.233
20	UK-13	Wood and wood products	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials e.g. PALLETS	0.560	0.622
21	UK-14	Pulp and paper products	e.g. Malt sacks	0.546	0.606
22	UK-15	Printing and publishing		0.252	0.280
23	UK-16	Refined petroleum and other fuels	Fuel oil and gas; lubricating oils. Petroleum gases and other gaseous hydrocarbons, except natural gas. Waste oil . Radioactive elements, isotopes and compounds; radioactive residues. Fuel elements (cartridges), non-irradiated, for nuclear reactors. Coke oven prods.	0.742	0.824
24.11,24.12	UK-17	Industrial gases and dyes	Industrial gases, dyes, pigments.	0.742	0.824
24.13	UK-18	Inorganic chemicals	Chemical elements n.e.c.; inorganic acids and compounds. Metallic halogenates; hypochlorites, chlorates and perchlorates.	0.952	1.057
24.14	UK-19	Organic chemicals	Hydrocarbons/derivatives. Alcohols, phenols, phenol-alcohols and halogenated/ sulphonated/nitrated/nitrosated derivatives; industrial fatty alcohols. Industrial monocarboxylic fatty acids; carboxylic acids& derivatives. Organic compounds with nitrogen functions. Organo- sulphur compounds and other organo-inorganic compounds; heterocyclic compounds n.e.c.. Ethers, organic peroxides, epoxides, acetals and hemiacetals; other organic compounds.	0.742	0.824
24.15	UK-20	Fertilisers		1.575	1.748
24.16,24.17	UK-21	Plastics & synthetic resins etc		0.756	0.839

Science Based Targets (SBTs)

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

CDP DISCLOSURE INSIGHT ACTION · UN GLOBAL COMPACT · WORLD RESOURCES INSTITUTE · WWF

Align with 1.5C global temperature rise scenario

Provide companies with a clearly defined pathway to future growth

Specify how much & how quickly you need to reduce GHG emissions

2940 signed up:

Only 46% have agreed targets
Only 35% have net zero target

Potential Target

Malting and Brewing categorised under 'Other Industry':

Target 80%+ reduction

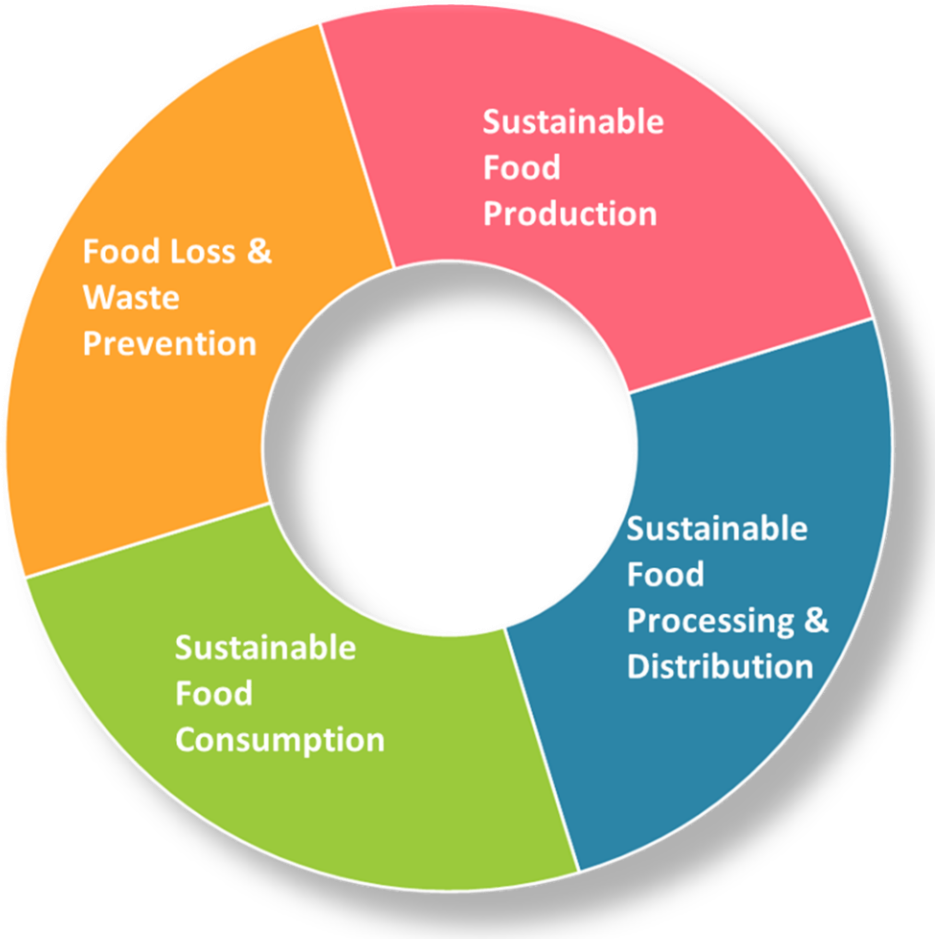
Credit is given for earlier emissions reduction actions

Carbon Farming

agricultural sequestration of atmospheric carbon into soil, roots, wood and leaves

Methods that can be used:

- Sustainable afforestation and reforestation
- Agroforestry
- Use of catch crops, cover crops
- Targeted conversion of cropland to fallow (grassland)
- Restoration of peatlands



UK soil: carbon stocks being depleted at 0.6% p.a.

Paris Agreement aim: Soil Carbon gain of 0.4%.

50-250 years before most arable soils reach Carbon saturation

EU 2030 aims

Nutrient loss: reduced by **50%** from agriculture

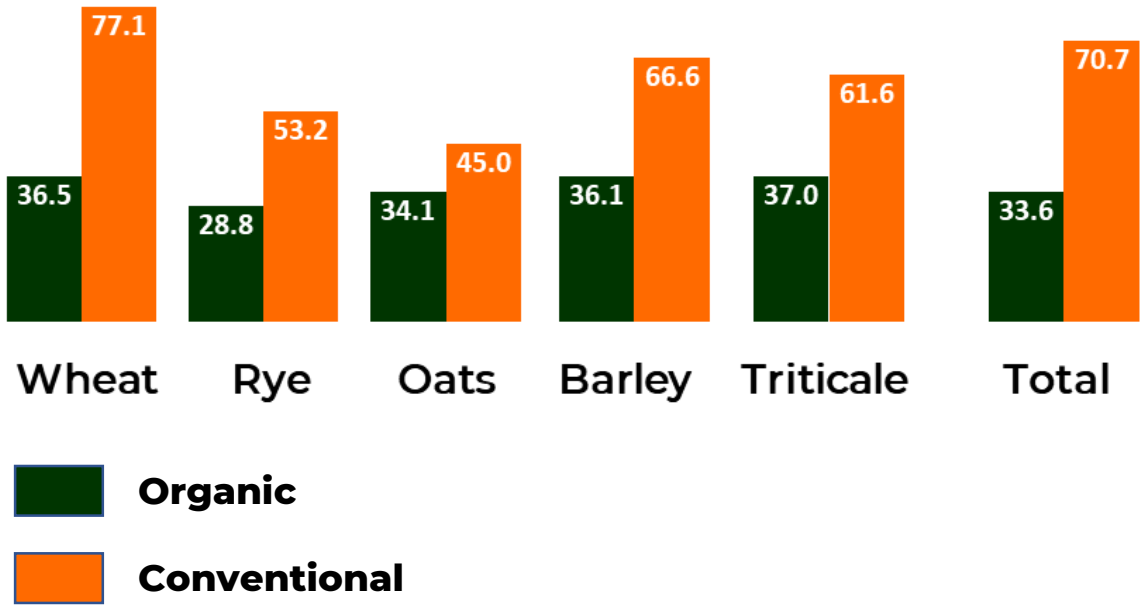
Organic farming: Increasing EU farmland under organic farming to **25%**

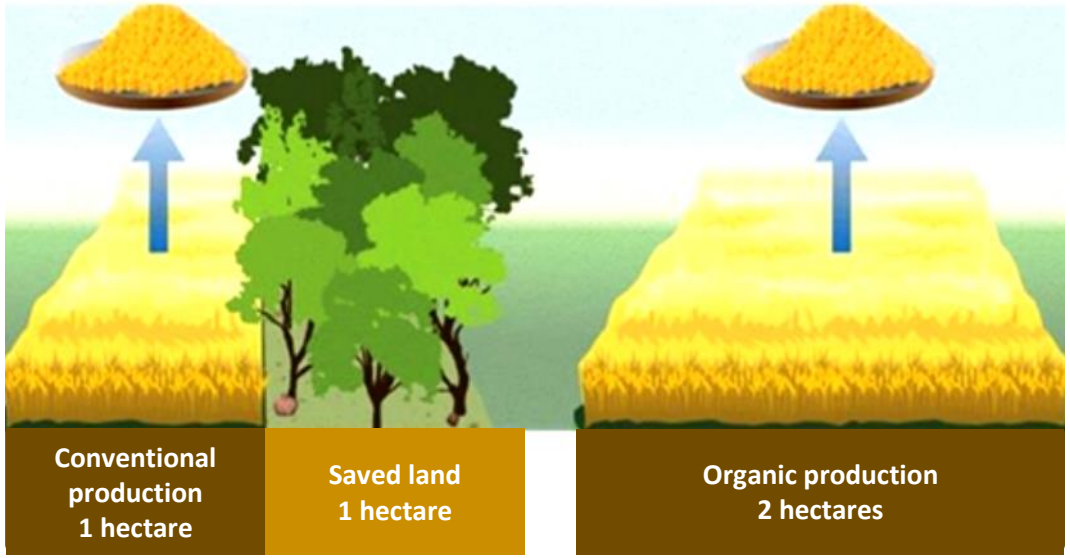
Organic: improves nature but is impeded by yield

The yields of organic grains Are half as big as conventional ones

AMI

Average yields of organic and conventional grain types 2012-2020 in Germany, in dt/ha, difference in %





Yield 100 1ha

Yield 50 1ha + **Yield 50 1ha**

Data verified via Prof Dr Holger Kirchmann - **Swedish University of Agricultural Sciences**
The carbon flow in Swedish agriculture and food systems (in Swedish)
https://issuu.com/ksla-publ/docs/kslat_2-2021_koll_p_kolett

Carbon Sequestration: trees or crops?

Carbon Capture avr rate= **4.75 tCO_2e ha/yr**

Remove 8M tCO_2e in 100 years

25 years to have a positive impact

High risk of loss of sequestration

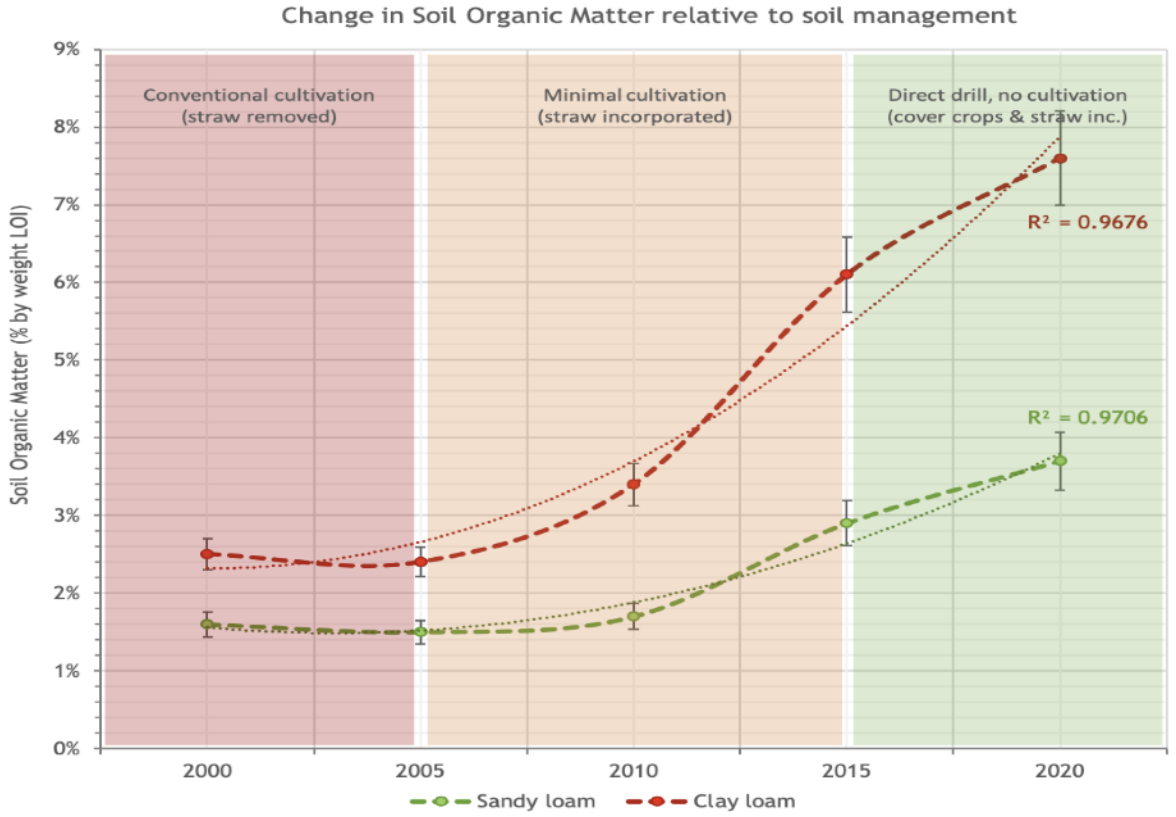
Use fast-growing plants, in the intervening time between crops when soils are most vulnerable to nutrient loss and erosion.

70-90 days plants accumulate above/below ground biomass of **15 to 25 tCO_2e per hectare**

Carbon negative malting barley: really?

REGEN AG:
COVER CROPPING PLUS MIN TILL

- Delivers soil carbon gains within weeks
- Far lower cost than tree planting
- Without long-term land use change
- Increases Soil Organic Matter (SOM) content: 1% SOM increase decrease drought stress by 5-10 days



! CAUTION: SOIL DISTURBANCE !

1kg N released from SOM emits 10-15 kg of Carbon

Ploughing releases 30 kg of N from SOM
Therefore releases 300-450 kg Carbon
(1100-1650 kg CO_2e)

VERIFIABLE CARBON CREDITS GENERATED FOR INSETTING

In summary

On site operations

- Carbon net zero (scopes 1 & 2) malt process is within our grasp
- We need more renewable generation installed
- Fuel substitution for greener alternatives is a key benefit
- We need investment in new technology: hydrogen should not be our only option

Wider supply chain

- Regen ag can deliver carbon negative barley now: needs to move at scale
- It could provide the majority of carbon neutralisation and de-risk the supply chain without paying a premium

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