The International Conference on LCA in the Agri-Food sector.
Bari, Italy, 22-24 September 2010

Calculation of CO_2 equivalent emissions in agri-food sector applying different methodologies

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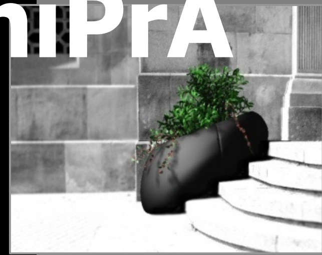
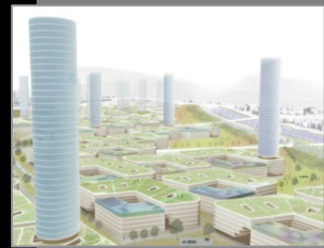
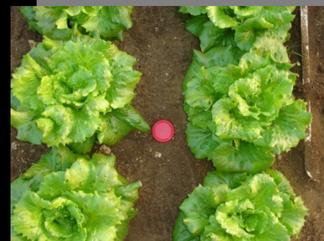
Research group on Sustainability and Environmental Prevention

SosteniPrA







Objective

Promote research projects in the emerging area of tools for sustainability

Topics of interest

- Life cycle assessment
- Industrial ecology
- Ecodesign
- Ecoefficiency
- Material and energy flow analysis

applied to industrial, urban, agricultural & service systems

Centers

- Inst. of Environmental Science & Technology (ICTA, UAB)
- Inst. Food & Agricultural Research and Technology (IRTA)
- Inèdit Innovació SL (spin-off)

Human resources

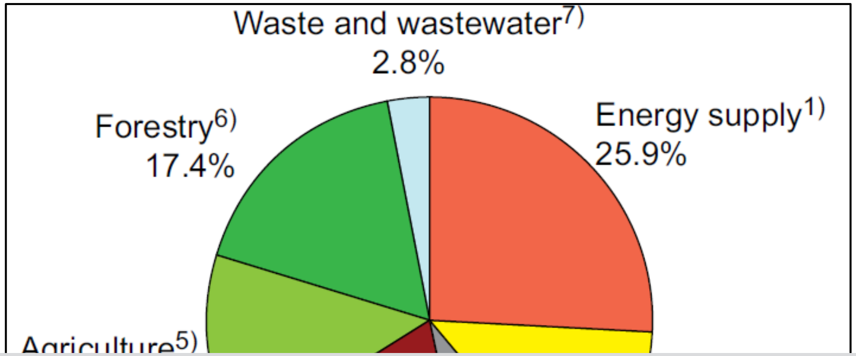
- 9 senior researchers (and 10 external senior researchers)
- 18 junior researchers

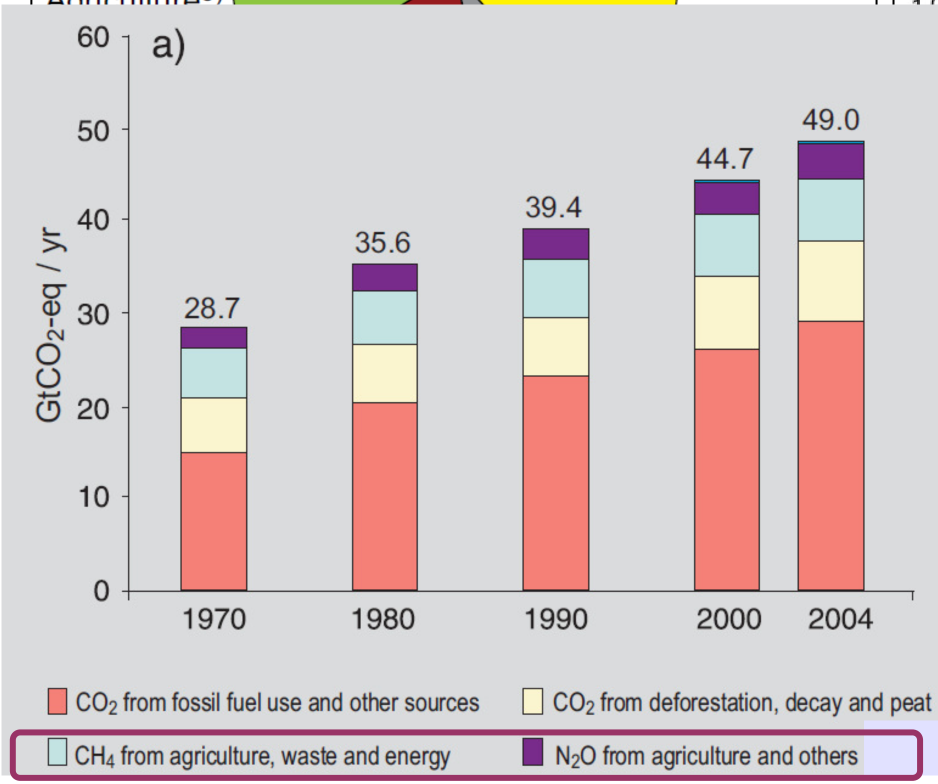
PRESENTATION INDEX

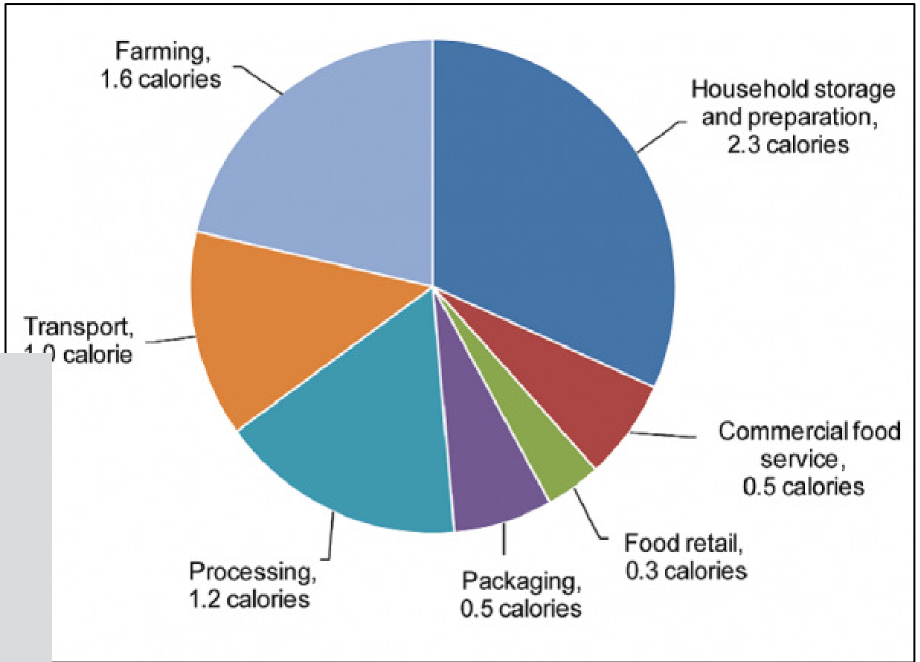
1. Introduction
2. Environmental tools
   2.1. Life cycle assesment
   2.2. Carbon footprint
3. Case study
4. Results
5. Conclusions

1 INTRODUCTION

Agriculture increased pressure on the environment







Energy expended in producing and delivering one food calorie in the U.S.

Source: Heller and Keoleian 2000

Global annual emissions of anthropogenic GHGs from 1970 to 2004

Source: IPCC 2007

1 INTRODUCTION

Social increasing demand for more environmental friendly products

Several tools for quantifying GHG emissions

- **Green House Gas Protocol** (WBCSD - World Business Council for Sustainable Development and WRI - World Resource Institute).
- **Carbon Footprint**, PAS 2050:2008 (BSI - British Standard Institution, Carbon Trust and DEFRA - Department for Environment, Food and Rural Affairs).
- **Bilan Carbone®** (ADEME - French Environment and Energy Management Agency).
- **Climate labelling for food** (KRAV and Swedish Seal (Svenskt Sigill))
- **Life Cycle Assessment**, ISO 14040 – 14044 (ISO – International Standards Organization)

1 INTRODUCTION

Life cycle assessment

Compilation and evaluation of inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

Carbon footprint

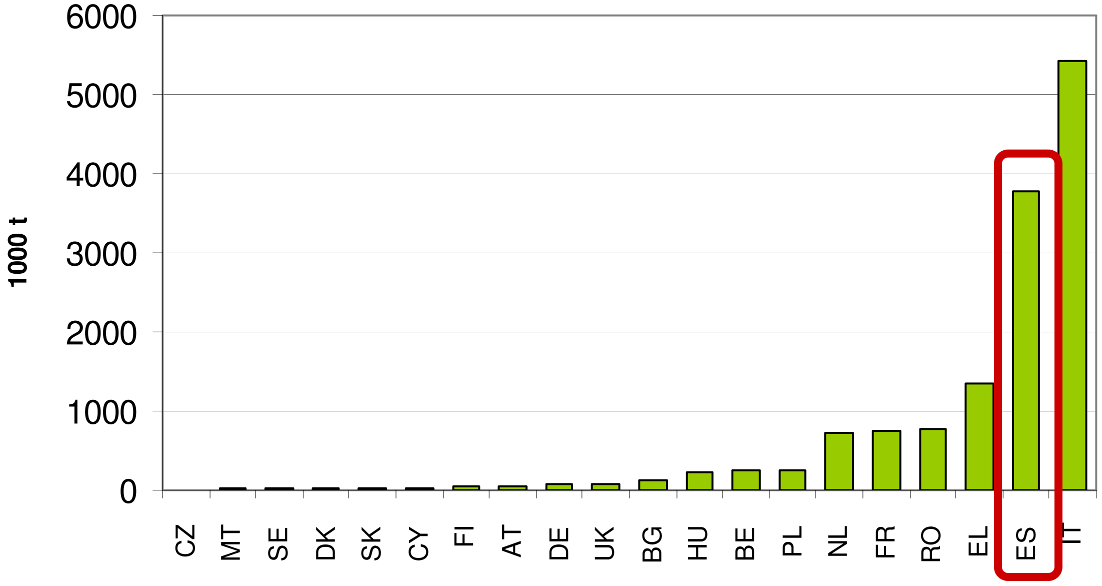
The amount of greenhouse gas (GHG) emissions caused by a particular activity or entity, and thus a way for organizations and individuals to assess their contribution to climate change.

1 INTRODUCTION

Main goal

Mediterranean **tomato production** considering different **cultivation technologies** has been assessed in order to compare **CF** with another **methodology**, LCA, for analysis of **agri-food systems**.

Harvested production of tomato in EU-27 (2008)



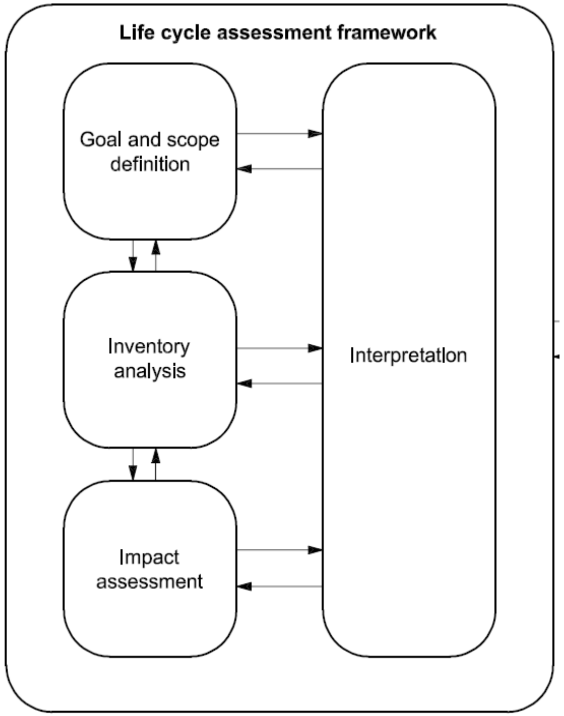
Source: EUROSTAT



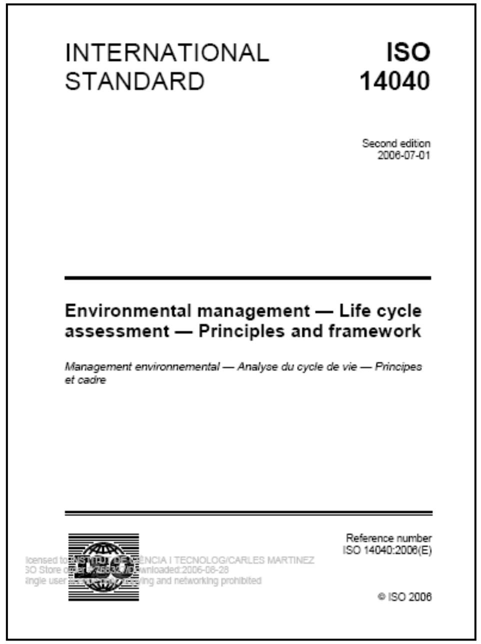


LCA considers the entire life of a product, service or process

LCA is divided into four main steps



Following the ISO 14040 series


INTERNATIONAL STANDARD

ISO 14040

Second edition 2006-07-01

Environmental management — Life cycle assessment — Principles and framework

Management environnemental — Analyse du cycle de vie — Principes et cadre

Reference number ISO 14040:2006(E)

© ISO 2006

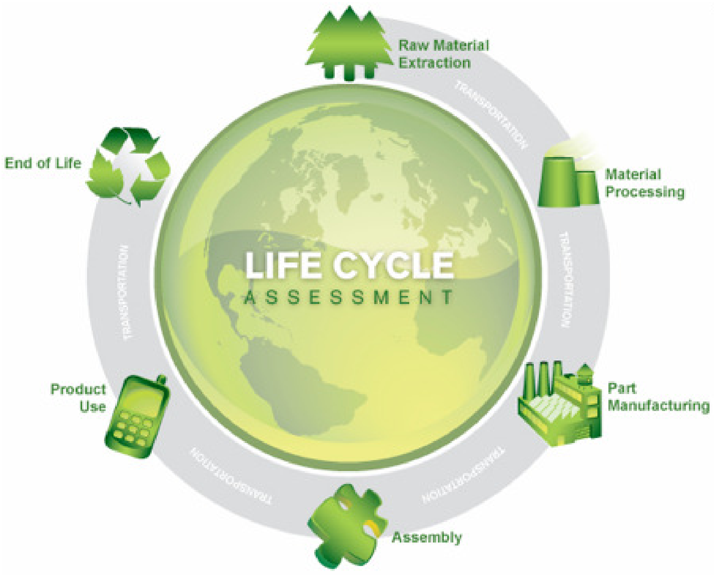
Only the GWP category is considered

- Abiotic depletion potential
- Eutrophication potential
- Acidification potential
- Photochemical oxidation potential
- Ozone layer depletion potential
- **Global warming potential**

2 ENVIRONMENTAL TOOLS

2.2. Carbon footprint

CF considers the entire life of a product, service or process apart from infrastructures



CF is divided into four main steps

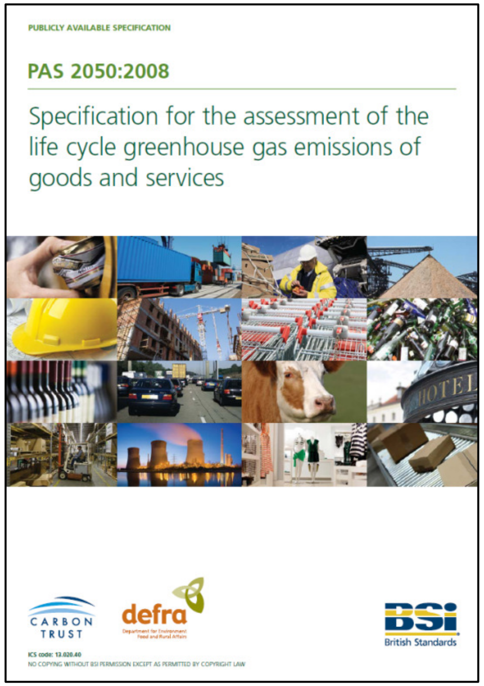
(1) Build a process map

(2) High-level footprint calculation to help priority efforts

(3) Collect data across all the life cycle stages

(4) Calculate the CF

Following the PAS 2050:2008



Developed by BSI and co-sponsored by the Carbon Trust and the Department for Environment, Food and Rural Affairs of the UK

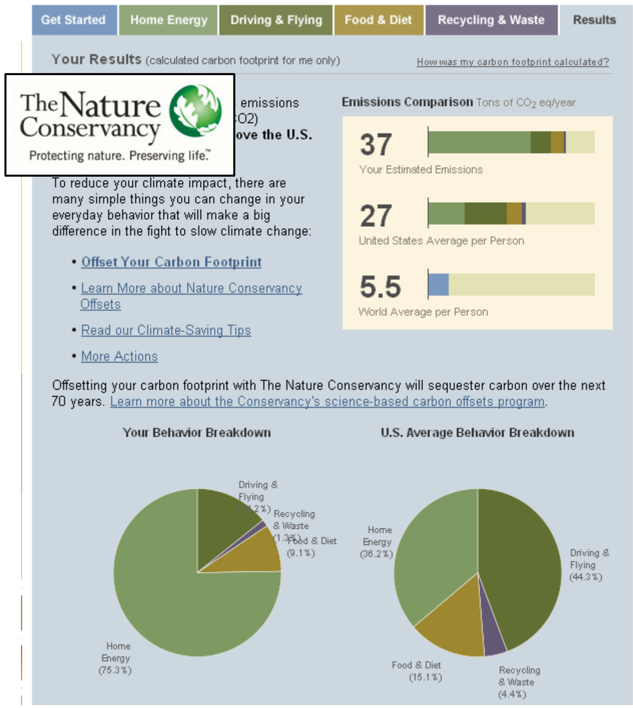
Two approaches can be made

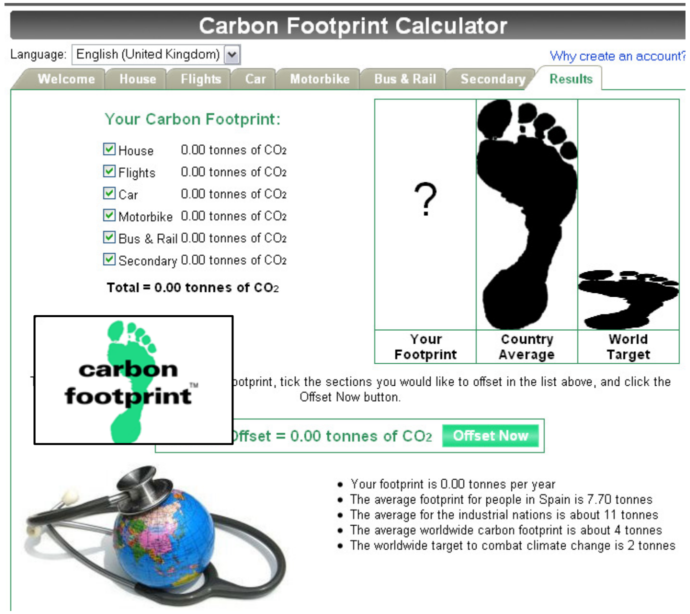
Business-to-consumer: from raw materials extraction to consumer use and final disposal/recycling

Business-to-business: CF stops when the product is delivered to other manufacturer

Nowadays CF is becoming a popular tool for several reasons

- Spreading of various **on-line calculators** that have sprung up the estimation of 'personal footprints' for the laypeople.
- Analysis is limited to emissions that have some effect on climate change, which make the study **easier, shorter and cheaper**.
- Results can be easily used in an **eco-label**.





3 CASE STUDY

3.1. Briefly scope definition

Functional unit

One **ton** of commercial **tomato**.

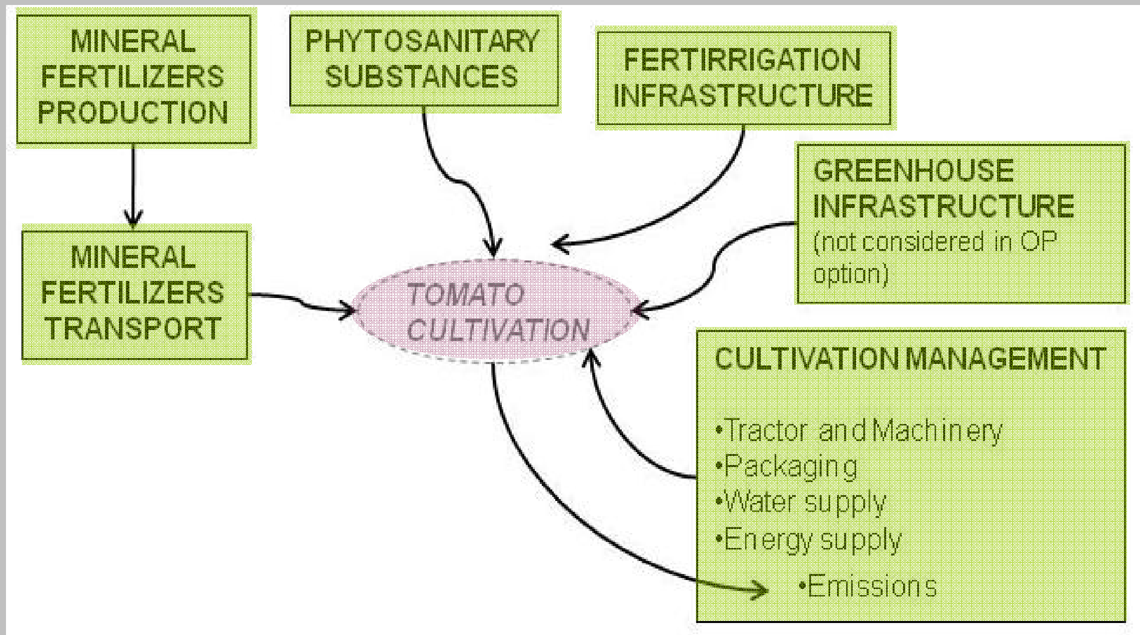
System description

Cultivation options:

Open field (OP)

Greenhouse (GH)

Mediterranean tomato production system:



Mineral fertilizers production	• Raw materials production and transport • Electricity and diesel • Chemical plant and machinery production, maintenance and waste disposal • Emissions
Mineral fertilizers transport	• Diesel • Lorry and road production, maintenance and waste disposal • Emissions
Phytosanitary substances	• Production and transport
Greenhouse - fertirrigation infrastructure	• Production, construction, maintenance and transport • Waste disposal
Cultivation management	• Diesel, electricity (pump and windows) and irrigation water consumption • Tractor and associated machinery production and maintenance • Packaging • Fertirrigation emissions

3 CASE STUDY

3.3. Main differences between CF and LCA in the case study

		CF	LCA
Mineral fertilizers production	Raw materials production and transport	Yes	Yes
	Electricity and diesel	Yes	Yes
	Chemical plant and machinery production, maintenance and waste disposal	No	Yes
	Emissions	Yes	Yes
Mineral fertilizers transport	Diesel	Yes	Yes
	Lorry and road production, maintenance and waste disposal	No	Yes
	Emissions	Yes	Yes
Phytosanitary substances	Production and transport	Yes	Yes
Greenhouse - fertirrigation infrastructure	Production, construction, maintenance and transport	No	Yes
	Waste disposal	No	Yes
Cultivation management	Diesel, electricity (pump and windows) and irrigation water consumption	Yes	Yes
	Tractor and associated machinery production and maintenance	No	Yes
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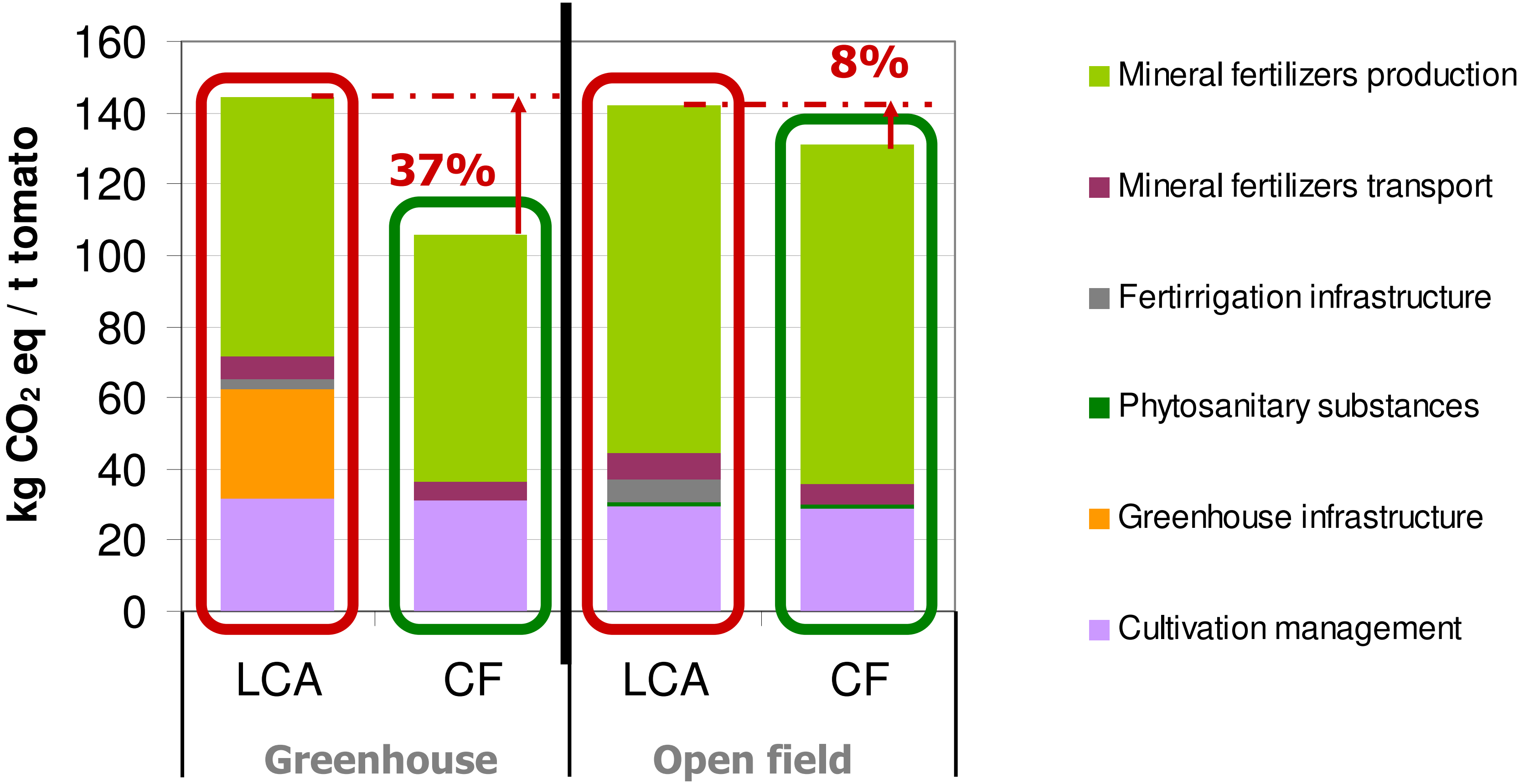
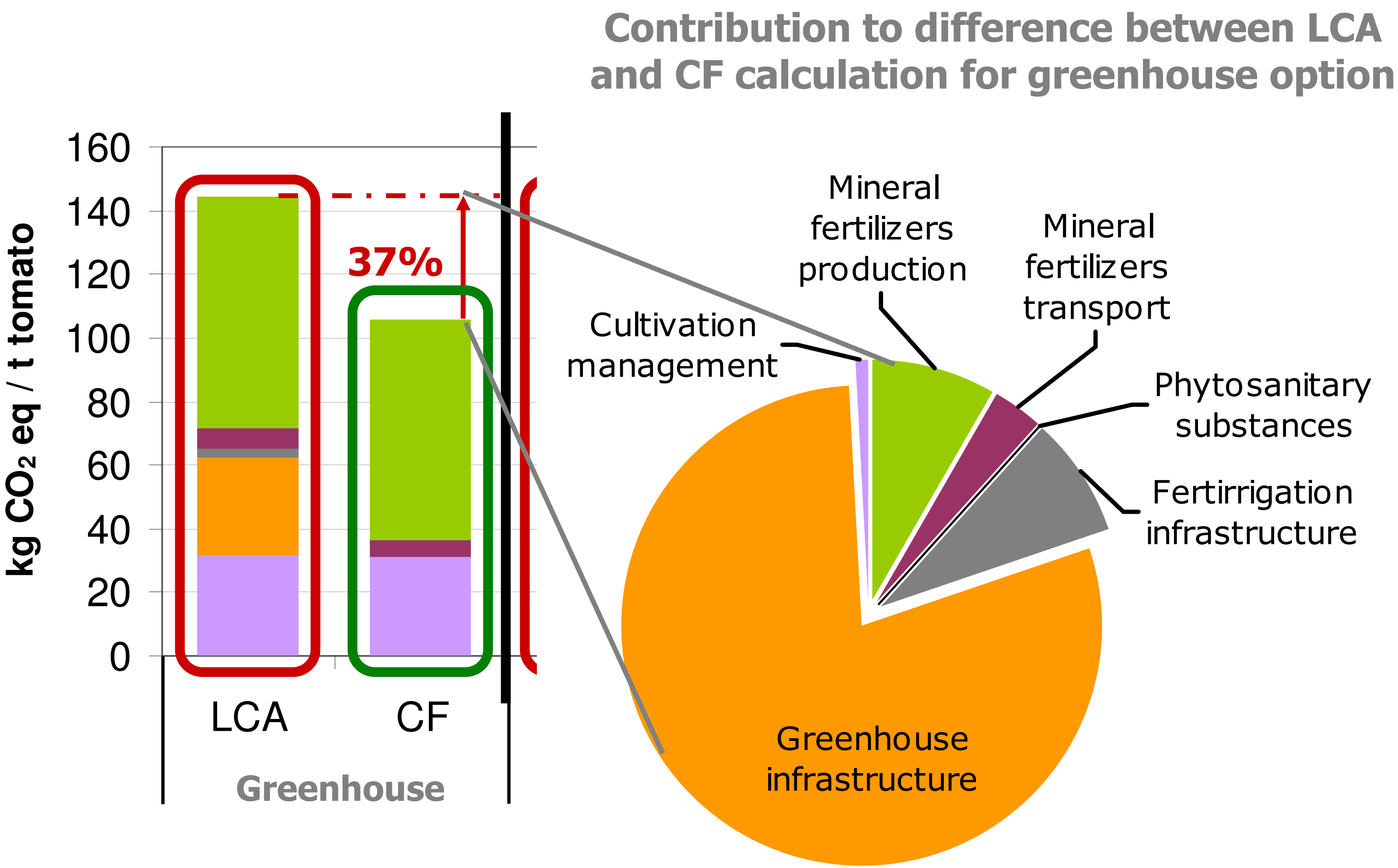
CO_2 equivalent emissions for cultivation options applying LCA and CF



4 RESULTS

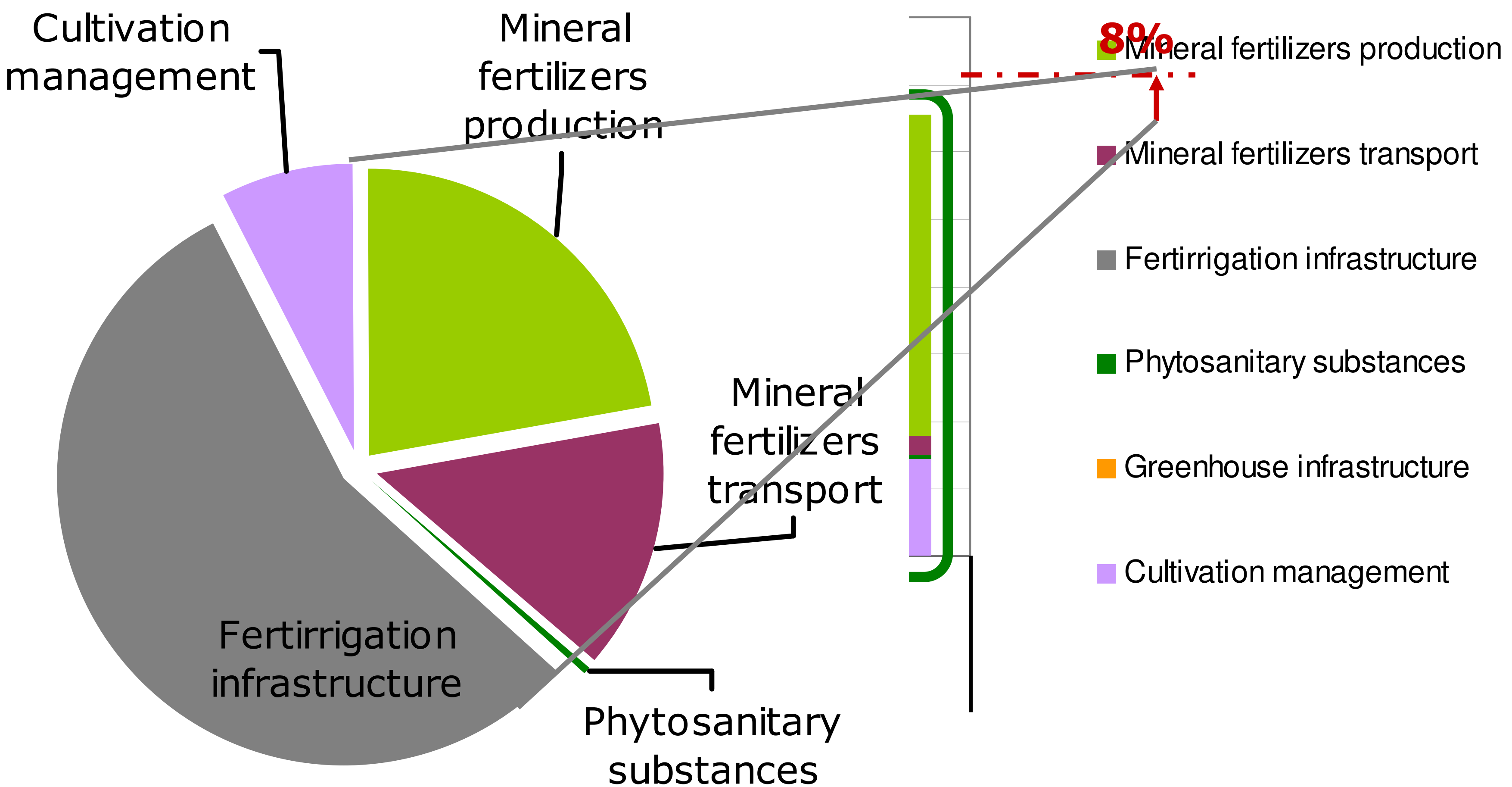
4.2. Source of difference



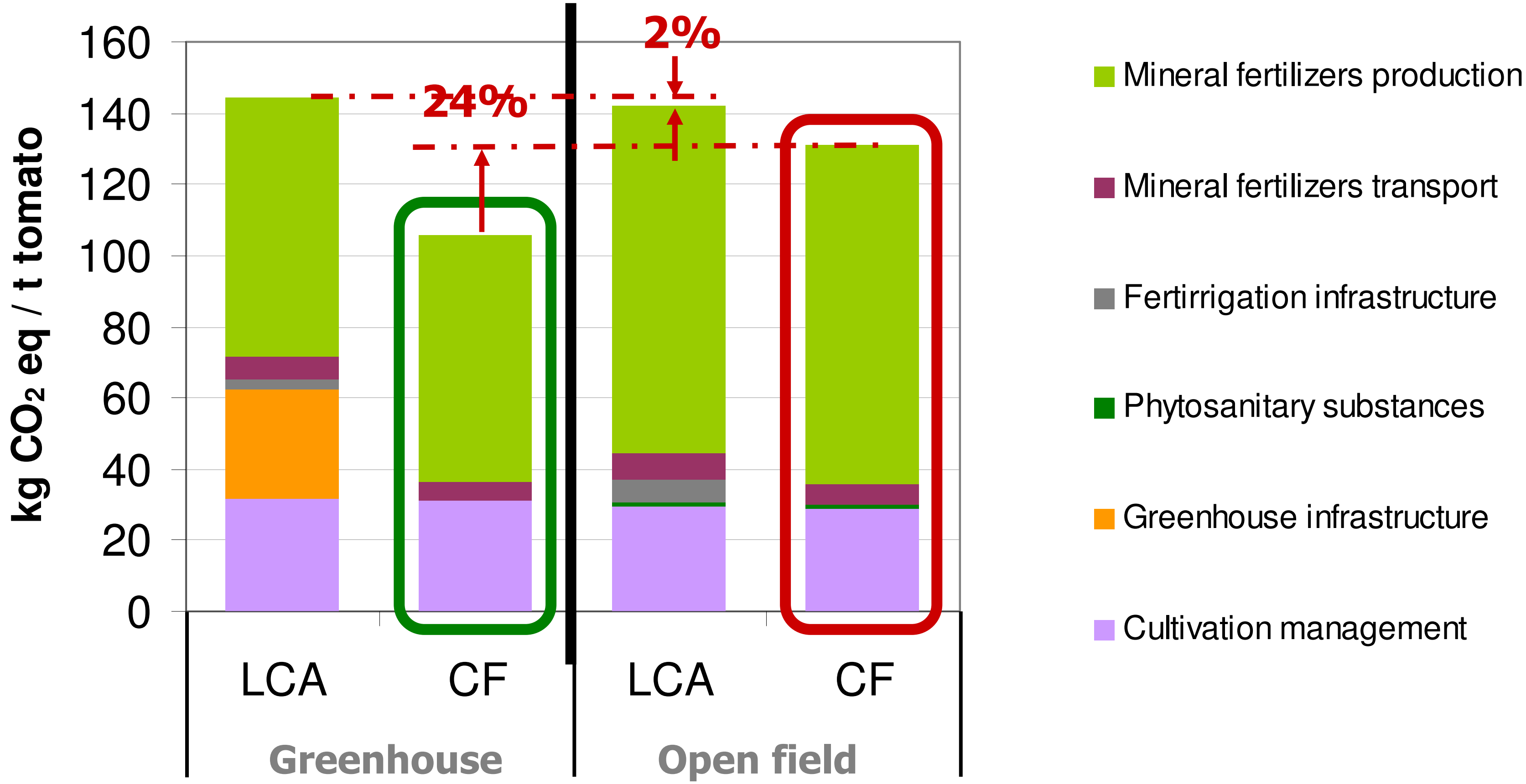
4 RESULTS

4.2. Source of difference

Contribution to the difference between LCA and CF calculation for open field option



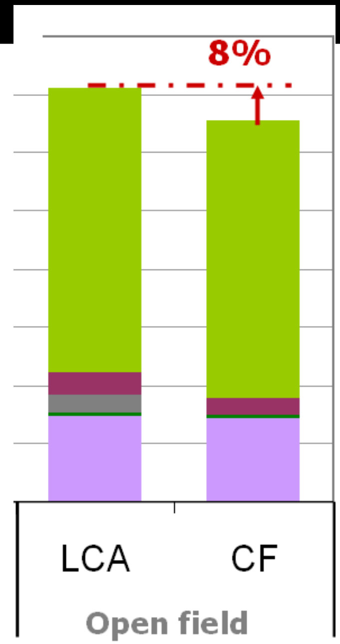
CO_2 equivalent emissions for cultivation options applying LCA and CF



5 CONCLUSIONS

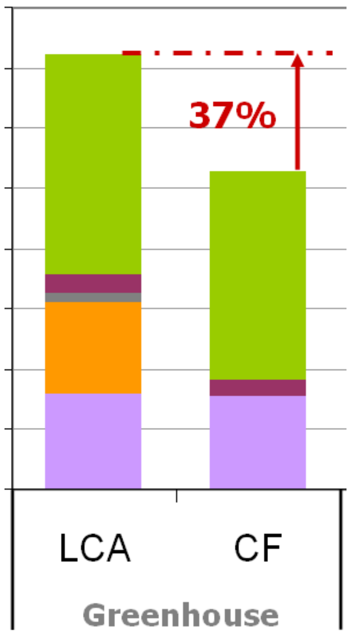
CF **excludes GHG emissions** arising from the production of **capital goods**.

It is correct for systems with **low infrastructure contribution** (as the OP option).



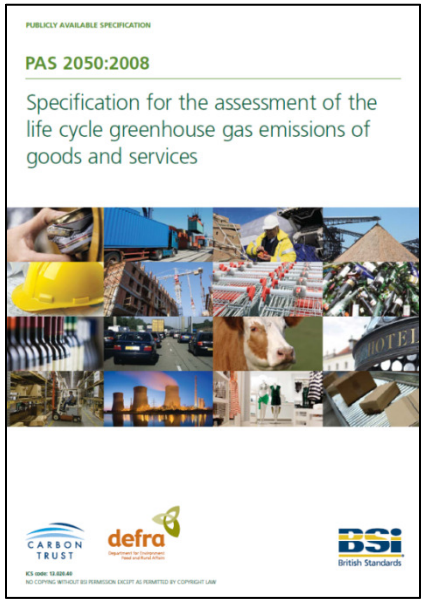
The **variability of production processes** and the different use of capital goods in the agri-food sector mean that **they should be included**.

The exclusion of capital goods in the study leads to a decrease in GHG emissions by up to 30%, giving to a **misleading result**.

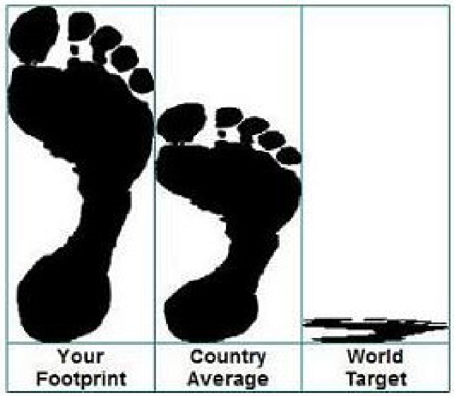


5 CONCLUSIONS

PAS 2050 clearly **excludes** GHG emissions arising from **capital goods**, it also indicates that these emissions could be included in **future revisions** (BSI, 2008). **ISO/WD Standard 14067, Carbon Footprint of Products** under development.



CF could be used to **complement LCA** and serve companies as a decision making measure and communication environmental tool.



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