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34th Swiss LCA Discussion Forum 'LCA *vs.* GHG footprint'

The Relation between LCA and GHG Accounting

(14040, 14064, GHG protocol, GHG credits accounting)

Content:

1. Starting point and questions
2. A look back
3. LCA (ISO 14040) versus GHG-Protocol (ISO 14064)
4. An example: A company calculating its GHG emissions
5. Conclusion & Outlook

Arthur Braunschweig, Dr. oec. HSG, Managing Partner, E2 Management Consulting AG, 13. 3. 2008
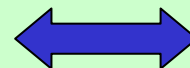
1. The starting point

There are two basic approaches to calculate GHG emissions

- **Product LCA, based on ISO 14040**

- **GHG accounting, based on ISO 14064 (≈ GHG prot.)**

Both methods define how to measure EMISSIONS. ISO 1406x and the GHG-P also define measurement of GHG emission REDUCTIONS.

THE NEW BOARDMAN FACTORY
40.000 SQ. FT. OF FLOOR SPACE

Emission ⬌ **Reduction = credit**

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1. The questions

Practical:

a) To become carbon neutral: Can I use either approach (LCA or GHG-P)?

Methodological:

b) What are the key differences?

c) (How) Can I use data from one approach in an analysis of the other type?

Communication:

d) What are the differences in meaning?

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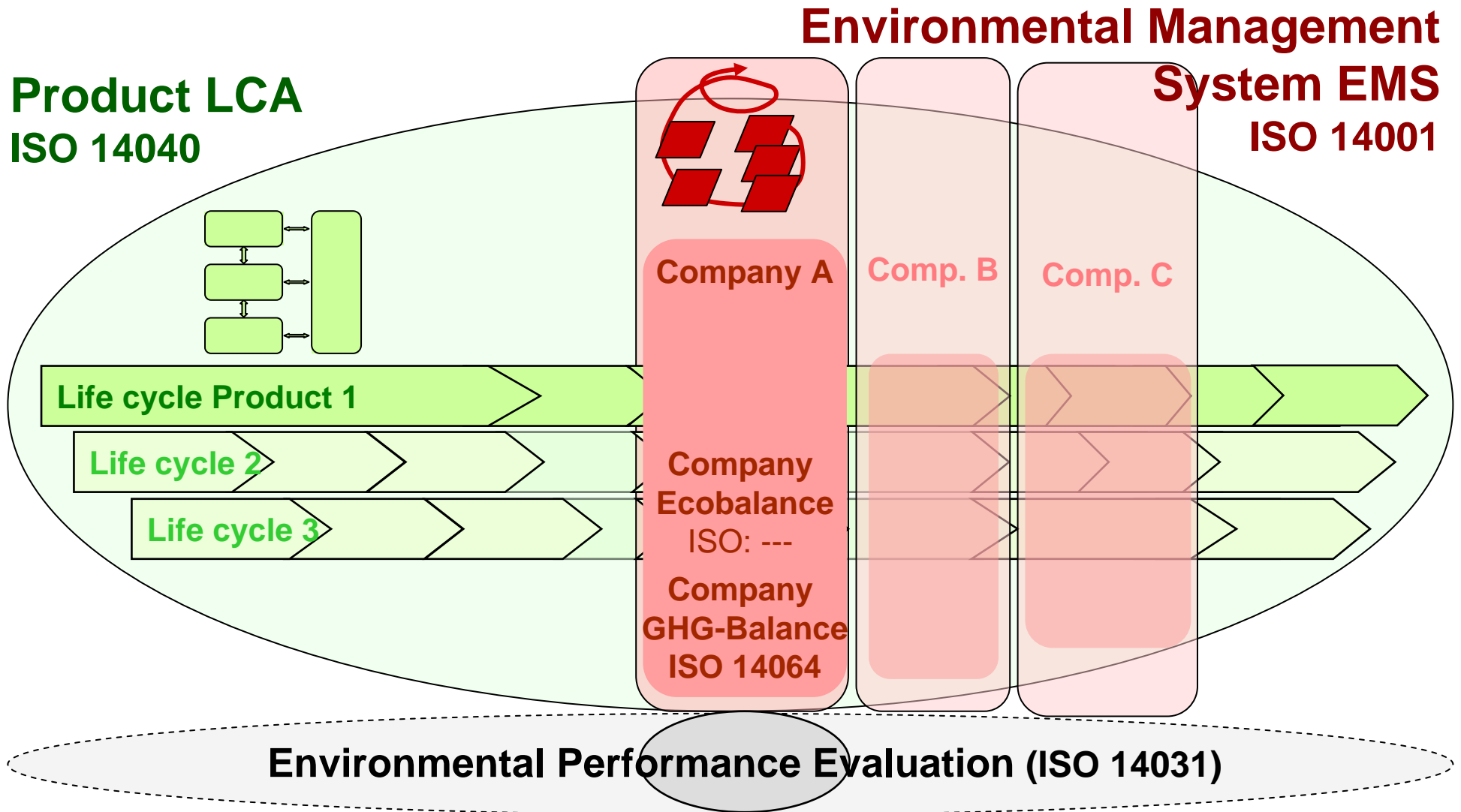
2. A look back

LCA has been focusing on product (and service) life cycle assessment for 30+ years.

ISO 14001 ➜ need for a framework for organisations
- .   Company approach by Müller-Wenk and myself in 1993
- .   ISO 14031
- .   ISO 14040 'gate-to-gate' analysis
- .   Scandinavian frameworks

Valuable, but no international standard

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2. A look back (ff.)

LCA DF 34
LCA vs. GHG Acc'g

Product LCA
ISO 14040

Environmental Management System EMS
ISO 14001

Company A

Comp. B

Comp. C

Company Ecobalance
ISO: ---

Company GHG-Balance
ISO 14064

Life cycle Product 1

Life cycle 2

Life cycle 3

Environmental Performance Evaluation (ISO 14031)

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3. LCA vs. GHG Accounting

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LCA vs. GHG Acc'g

LCA:
The product or service life cycle (process chain)

Coffee beans	Milk	Packaging Material	Polyste-rene	Aluminium	Steel	Glass

Process'g & Transp. | Process'g & Transp. | | Injection moulding | Extrusion | Pressing & forming | Forming

Assembly and transport

Coffee machine

Water

Production of 1000 Espressi macchiati

Electricity

Rinsing

End-of-life

Example based on:
Pré, Ecoindicator'99,
Manual for designers

GHG Accounting:
The Footprint of the Organisation

Sc.1: 'Us'

Scope 2: Electricity

Scope 3: All other

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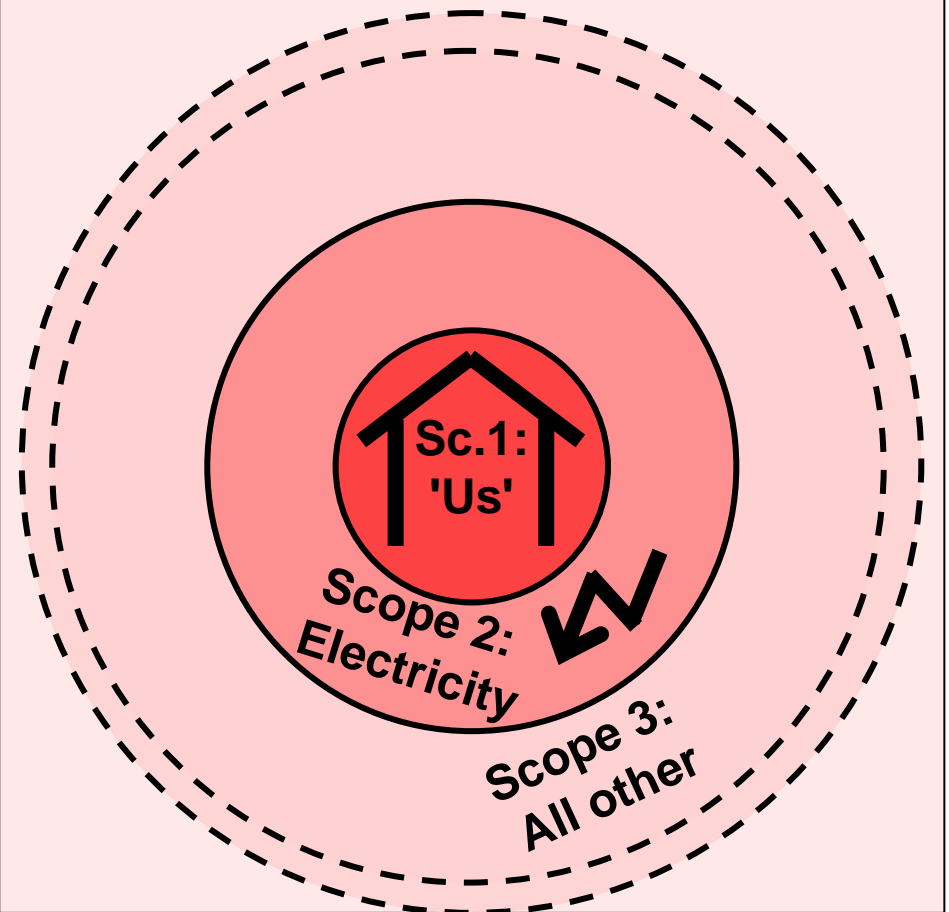
3. LCA vs. GHG Accounting: The basic questions

LCA:
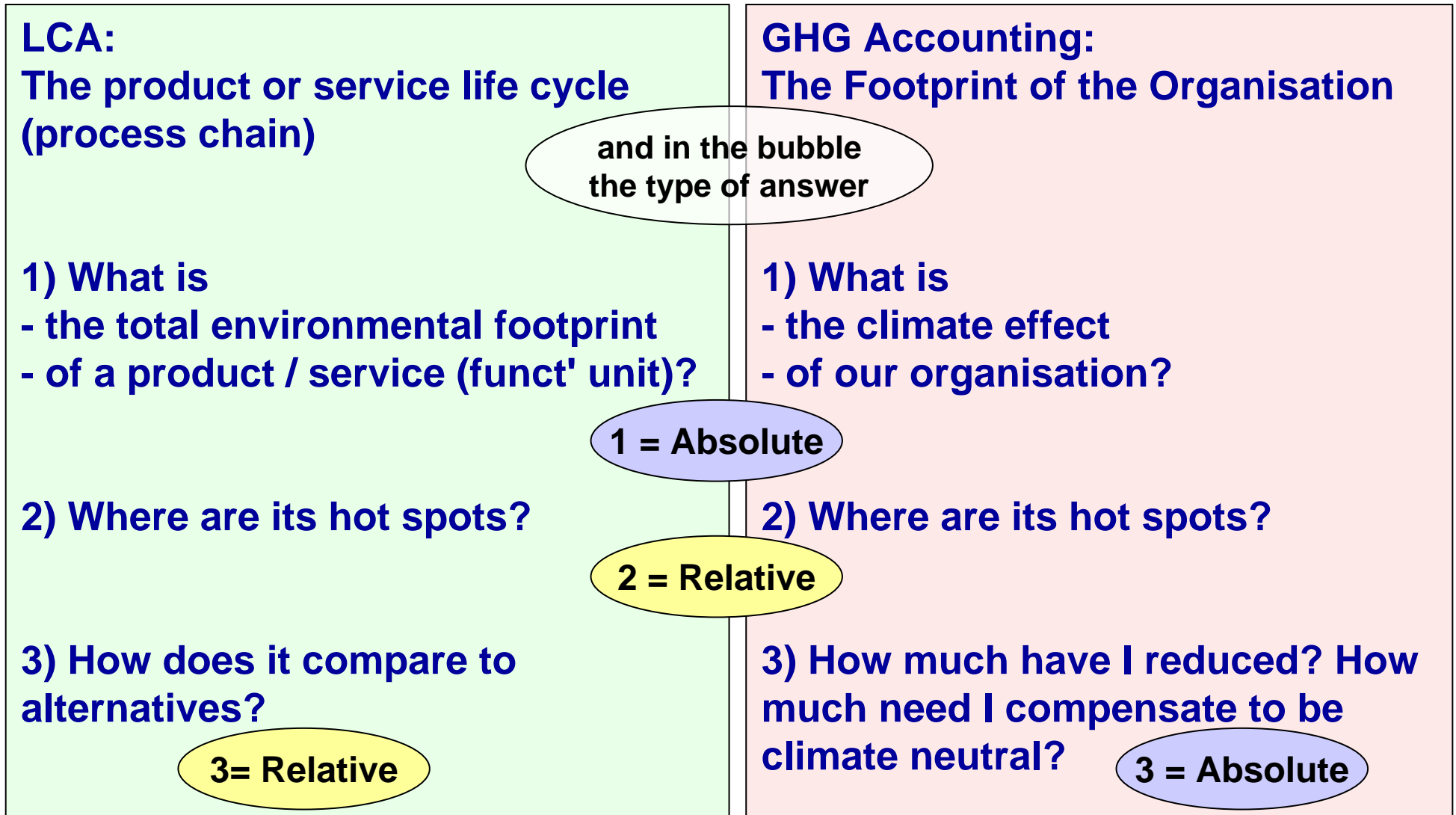**The product or service life cycle (process chain)**

1) What is
- the total environmental footprint
- of a product / service (funct' unit)?

2) Where are its hot spots?

3) How does it compare to alternatives?

GHG Accounting:
The Footprint of the Organisation

1) What is
- the climate effect
- of our organisation?

2) Where are its hot spots?

3) How much have I reduced? How much need I compensate to be climate neutral?

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3. LCA vs. GHG Accounting: The basic questions

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LCA vs. GHG Acc'g

LCA:
The product or service life cycle (process chain)

GHG Accounting:
The Footprint of the Organisation

and in the bubble
the type of answer

1) What is
- the total environmental footprint
- of a product / service (funct' unit)?

1) What is
- the climate effect
- of our organisation?

1 = Absolute

2) Where are its hot spots?

2) Where are its hot spots?

2 = Relative

3) How does it compare to alternatives?

3) How much have I reduced? How much need I compensate to be climate neutral?

3= Relative

3 = Absolute

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3. LCA vs. GHG Accounting: Structural differences

	LCA:	**GHG Accounting:**
Basis for comparison	<u>Functional</u> unit, defined by the study	<u>Annual</u> activity, defined per organigram or ownership
Reponsibility	Spread over multiple org's	<u>The</u> organisation
Time frame	**synthetic** (processes ran at undefined times)	A <u>specific</u> year
Geographic frame	Disperse, global, or unspecified (even where relevant)	specific (but irrelevant)
Environmental Scope	'All' impacts, incl. all GHG	Six GHG (possibly all GHG)
Cut-off appr.	Mass, impact or value	'Materiality' of GHG emissions

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3. LCA vs. GHG Accounting: Inventory questions

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LCA vs. GHG Acc'g

	LCA:	**GHG Account'g (Sc. 1 + 2):**
Allocation needs	**Co-production processes**	**Partly owned subsidiaries**
Electricity models	**. Various grid models;** **. Emission factors at Consumption** ('EFC', emissions per electricity arriving at the <u>consumer</u>, i.e. incl. transmission losses)	**. Various grid models;** **. Emission factors at generation** ('EFG'; emissions per electricity <u>produced</u>, i.e. excl. transmission losses)
Fuel emissions	**Full supply chain**	**Own emissions only**
Process emissions	**Own emissions & supply chain of materials** (if relevant)	**Own emissions only**
E-o-life issues (recycl., waste)	**Considered; often relevant** (e.g. for water pollution)	**Usually not considered; mostly no big GHG issue**

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4. Hypothetical Case Study 'Hotel Alpina'

(all data are assumptions!)

Key figures:
- 30'000 guest nights p.a.
- 4,5 Mio CHF turnover

Guest F&B Services:
- 30'000 breakfasts
- 75'000 hot meals

Staff services:
-   7'000 staff nights
- 21'000 staff meals

Input & Output:
- 75'000 l heating oil
- 1 Mio kWh electricity CH-grid
- 10'000 m3 fresh water
-          6 t cleaning agents
-        150 t waste
- 4'000 l fuel (hotel bus/cars)

How much GHG (CO2-eq.) does this system emit?

The answers based on an LCA approach and the GHG-Protocol, respectively.

4. Hypothetical Case Study: Processes of Scopes

	LCA approach		GHG-P approach		
			Scope 1	Scope 2	Scope 3
Guest Breakfasts (F&B)	X				X
Guest Hot Meals (F&B)	X				X
Staff Hot Meals (F&B)	X				X
Heating oil	X		X		
Heating Oil Precombustion	X				X
Electricity	X			X	
Electricity Precombustion	X				X
Cooling Agents emission	X		(x)		
Water use, waste water	X				X
Municipal Waste treatment	X				X
Cleaning agents production	X				X
Hotel bus fuel use	X		X		
Staff cars fuel use	X		X		
Fuel Precombustion	X				X

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4. Case Study: The functional units

	LCA approach		GHG-P approach		
			Scope 1	Scope 2	Scope 3
Guest Breakfasts (F&B)	X				X
Guest Hot Meals (F&B)	X				X
Staff Hot Meals (F&B)	X				X
Heating oil	X		X		
Heating Oil Precombustion	X				X
Electricity	X			X	
Electricity Precombustion	X				X
Cooling Agents emission	X		(x)		
Water use (delivery)					X
Municipal Waste treatment					X
Cleaning agents production					X
Hotel bus fuel use					
Staff cars fuel use			X		
Fuel Precombustion	X				X

The **function** 'Hotel stay'

The **organisation** 'Hotel'

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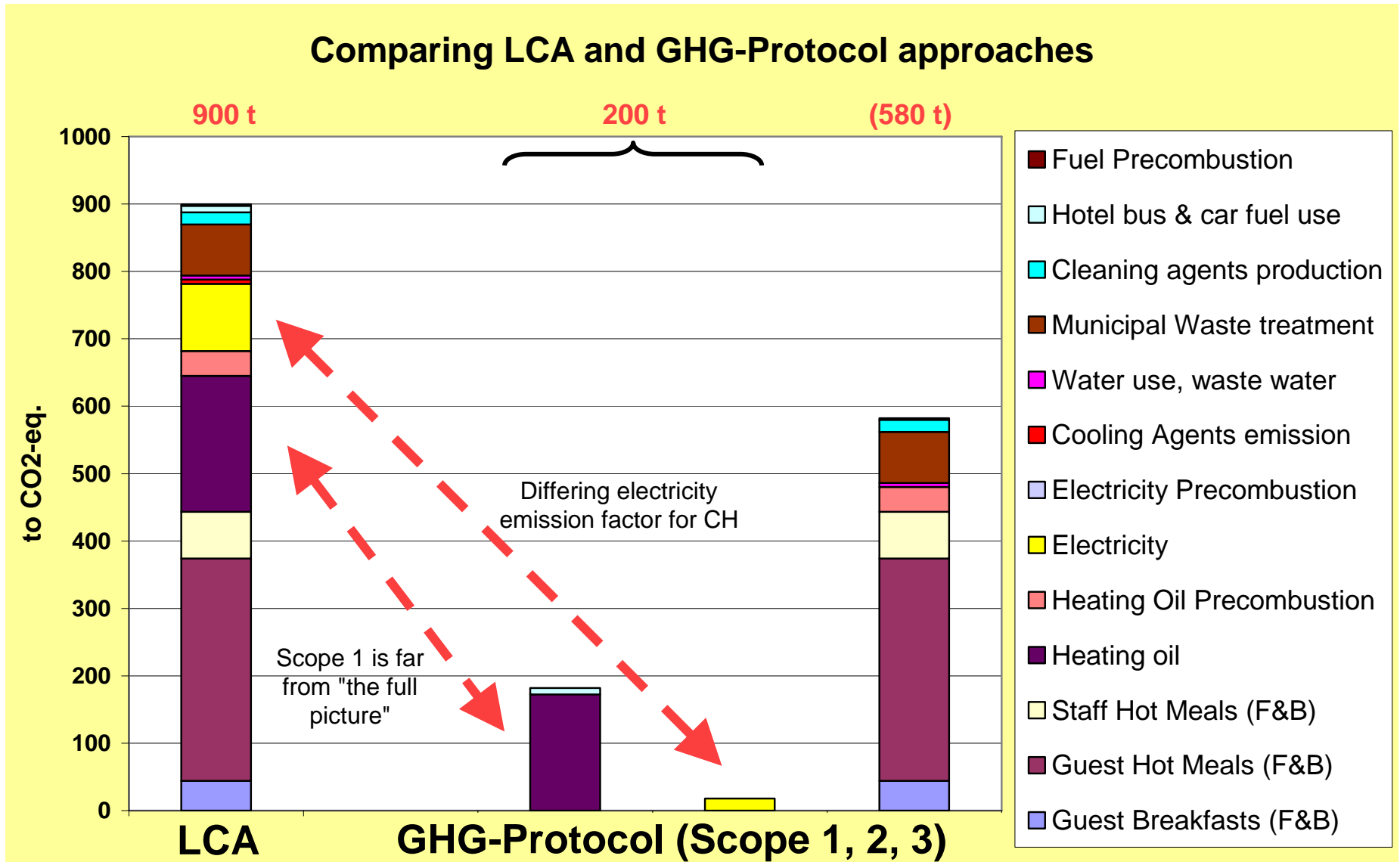
4. Case Study: Emission factors

Below are the GHG emission factors according to available sources, for an LCA and a GHG-P approach respectively. The GHG-Protocol gives specific data for Scopes 1 and 2. As there is no mandatory guidance for scope 3, we may use the identical LCA data there.

Input / Process	Unit	LCA Data		GHG-P Data	Values		
	(kg CO2eq per…)	Source	Values	Source	Sc 1	Sc 2	Sc 3
Breakfasts	unit	(Ademe)	1.5	id.			1.5
Guest Hot Meals	unit	(Ademe)	4.4	id.			4.4
Staff Hot Meals	unit	(Ademe)	3.3	id.			3.3
Heating Oil use	kWh	EMIS	**0.27**	GHG-P	**0.23**		
Heating Oil precombust.	kWh	EMIS	0.05	id.			0.05
Electricity Swiss	kWh	EMIS	**0.13**	GHG-P		**0.024**	
R134a emission	kg	EMIS	1300	id.	*1300*		
Fresh water prep. & waste water treatm't	m3	EMIS	0.59	id.			0.59
Municipal waste incineration	kg	EMIS	0.51	id.			0.51
Cleaning Agents	kg	(EMIS)	3	id.			3
Fuel use (Euro3)	liter	EMIS	**2.4**	GHG-P	**2.34**		
Fuel Precombustion	liter	EMIS	0.59	id.			0.59

Notes:
- Ademe = Data adapted from ADEME, Bilan Carbone Entreprises et Collectivités, Guide des facteurs d'émissions, V5, Jan. 2007
- EMIS = LCA Data from Swiss LCA Software EMIS (by Carbotech), containing e.g. the ecoinvent 2.0 data
- GHG-P = Data from excel worksheets from www.ghgprotocol.org
- Sc = Scope
- id = identical sources and values used for both approaches
- Bold values = differing values
- Values in brackets, (Ademe) and (EMIS), are assumed averages, based on various data from these sources
- R134a emission: For GHG-P either Scope 1 or 3, as it is no Kyoto gas

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4. Case Study: Function = 900 t, organisation = 200 t

LCA DF 34
LCA vs. GHG Acc'g

Comparing LCA and GHG-Protocol approaches

5. Conclusions & Outlook

- Emission factors for similar systems differ (ecoinvent, GHG-P, Adème, ..)

- Both approaches make sense, but they express different concepts:

  .. LCA   = <u>full supply chain</u> responsibility

  .. GHG-P = <u>own process</u> responsibility

- With the GHG-P, many decision responsibilities are hidden in Scope 3 (e.g. own selection of 3rd party transport means)

- LCA creates stronger communication basis towards clients

- GHG-P is budgetary correct, as organisations can be added up

- LCA covers additional environmental issues

- GHG-P covers reduction calculation (relative to baseline technology, additionality check, annual values)

5. Conclusions & Outlook

- Use Scope 1 & 2 for defining minimal GHG compensation

- Use LCA approach (or "supply and consumption scope 3") for marketing claims on products & services

- LCA can be structured along 'Scopes 1, 2, 3'
  Possibly this could create compatibility.

- No single data base contains all data one would want.

- Data bases are of differing quality (sources, data age, transparency). There is a need for reviews and standardisation.

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