

Land occupation and land transformation in life cycle inventories

Rolf Frischknecht, Project Manager,
Members of the Project Leaders Group,
ECOINVENT 2000

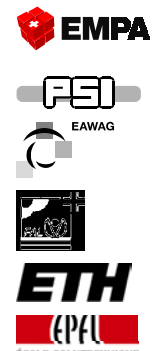
SETAC Europe Annual Meeting

May 13, 2002, Vienna

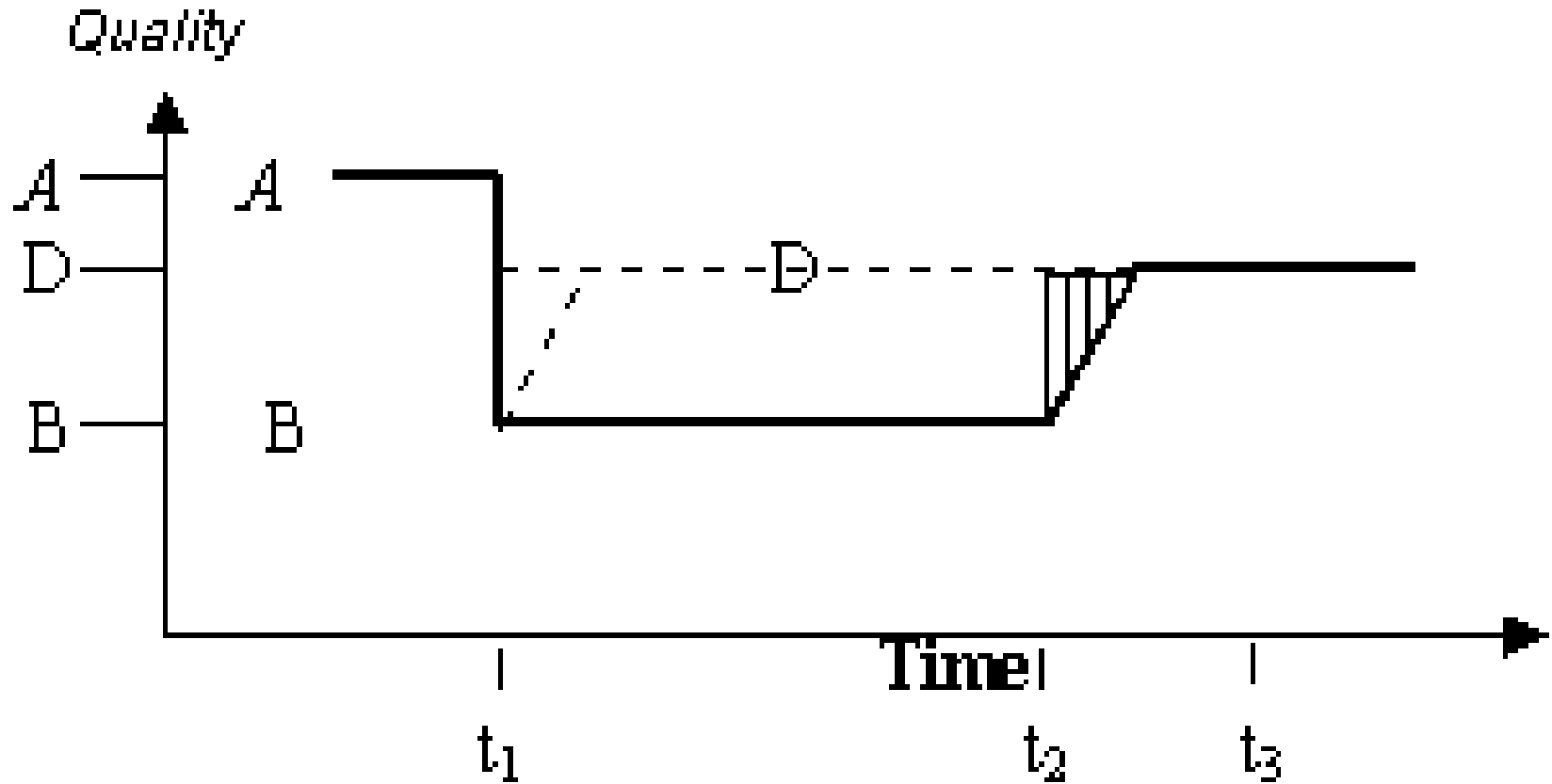


Problem setting

- New findings in land use impact assessment, but no consensus reached yet
 - Harmonisation and actualisation of Swiss LCI database (ECOINVENT 2000)
- => flexible inventory items with “low” data collection effort required



Land use impact





Environmental effects

- Increase of land competition

Impacts on

- biodiversity
- Life support function
- Man-made environment



Land cover qualities

Inventory param. based on CORINE Land cover categories:

121: industrial area

131: mineral extraction site

132: dump site

21: arable

22: permanent crop

31: forest

etc.



transformation – occupation

Distinction between

- Land transformation

e.g., conversion of agricultural land to built land

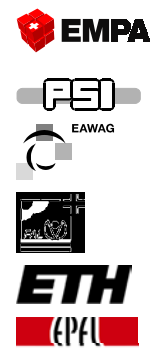
- Land occupation

e.g., postponing relaxation of built land to its “natural” state



Land occupation

- Amount of surface
- Duration of occupation
- Amount of products / services manufactured / delivered
- Land quality during occupation
e.g., road, industrial area, arable land, etc.



Land occupation

Land occupation recorded as

m^2 times year per unit output

Example:

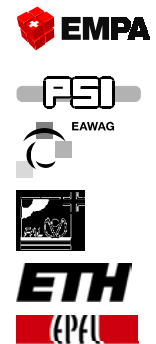
0.3 m^2a occupation, mineral extraction site (CORINE 131) per kg gravel



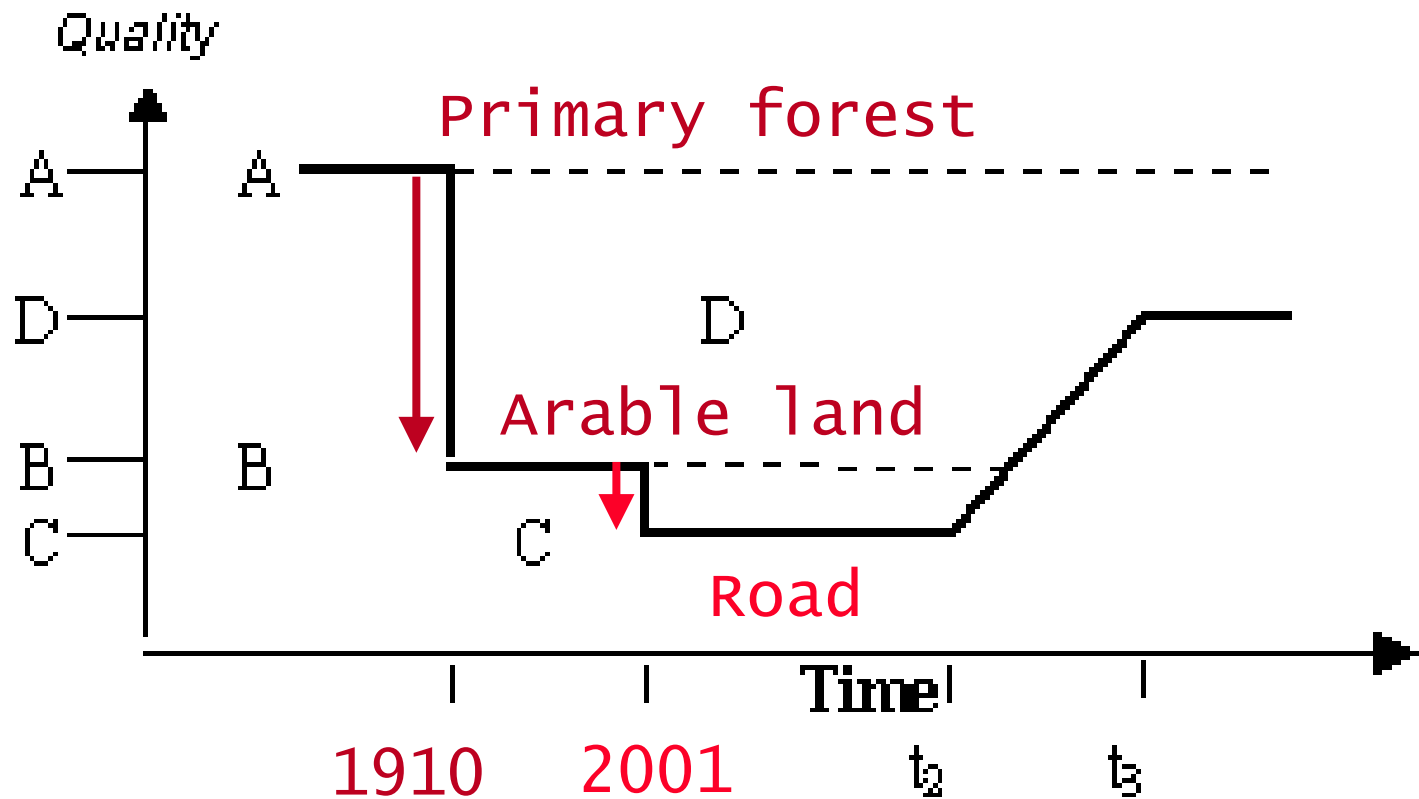
Temporary land occupation

Examples: natural gas pipeline construction, active restoration of mining sites

- Duration of temporary occupation
- Lifetime production of equipment, e.g. total natural gas transported, total ore extracted
- Land cover type: construction site



Land transformation



Main difficulty:

Definition of reference state



Land transformation

occurs

- Before an industrial process
(road, power plant construction, etc.)
- During an industrial process
(lignite open cast mining)
- After an industrial process
(conversion to another ind. use, active
restaurations, natural succession)



Land transformation recording

Two directions are recorded:

- Land transformation from condition A
- Land transformation to condition B

Information required:

- Amount of surface & land cover types
- Amount of products / services manufactured / delivered



Particularities

- Time period for which land transformation is made
 - => defines amount of products / services
 - => standard “lifetimes” for ECOINVENT

Examples:

- Industrial areas: 50a
- roads, railways: 100a
- agriculture (grain, vegetables): 1a
- agriculture (permanent crops): 20–30a



Particularities

- Active restoration:
separate technical process with
corresponding land transformation
- If change or restoration is not
foreseeable (e.g., roads,
hydroelectric power plants):
no land transformation at the end of
its initial use



Example: Gravel extraction

- total surface: 10'000m²
- site lifetime: 20 year
- gravel extracted : 1'000 tons per year
- duration active restauration: 2 years
- Diesel consumption:
 - extraction: 200'000MJ/year
 - restauration: 40'000MJ



Example: Gravel extraction

			unit process raw data		LCI result
			gravel, crushed, at mine t	restauration, gravel extraction m ²	gravel, crushed, at mine t
resource, land	occupation, mineral extraction site	m ² a	10		10
	occupation construction site	m ² a		2	1
	transformation, from unknown	m ²	0.5		0.5
	transformation, to resource extraction	m ²	0.5		0.5
	transformation, from resource extraction	m ²		1	0.5
	transformation, to forest	m ²		1	0.5
resource, in ground	gravel, in ground	t	1		1
Technosphere inputs	restauration, gravel extraction	m ²	0.5		0.5
	diesel, burned in building machine	MJ	200	4	202
			
Reference product	gravel, crushed at mine	kg	1		1
	restauration, gravel extraction	m ²		1	



Example: Gravel extraction

ETH EPFL			unit process raw data		LCI result
			gravel, crushed, at mine t	restauration, gravel extraction m ²	gravel, crushed, at mine t
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	occupation construction site	m ² a		2	1
	transformation, from unknown	m ²	0.5		0.5
	transformation, to resource extraction	m²	0.5		0.5
	transformation, from resource extraction	m²		1	0.5
	transformation, to forest	m ²		1	0.5
resource, in ground	gravel, in ground	t	1		1
Technosphere inputs	restauration, gravel extraction	m ²	0.5		0.5
	diesel, burned in building machine	MJ	200	4	202
			
Reference product	gravel, crushed at mine	kg	1		1
	restauration, gravel extraction	m ²		1	



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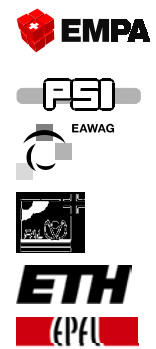
LCI results

- Σ “transformation, from ...” =
 Σ “transformation, to ...”
- “transformation, to forest” minus
“transformation, from forest”:
 - negative: loss of forests
 - positive: gain of forestscaused by product system



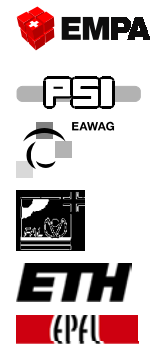
Summary

- Transformation and occupation separated
- “Transformation, from” and “transformation, to” separated
- 35 different land use classes (based on CORINE land cover categories)
- Open for different impact assessment approaches (reference state!)

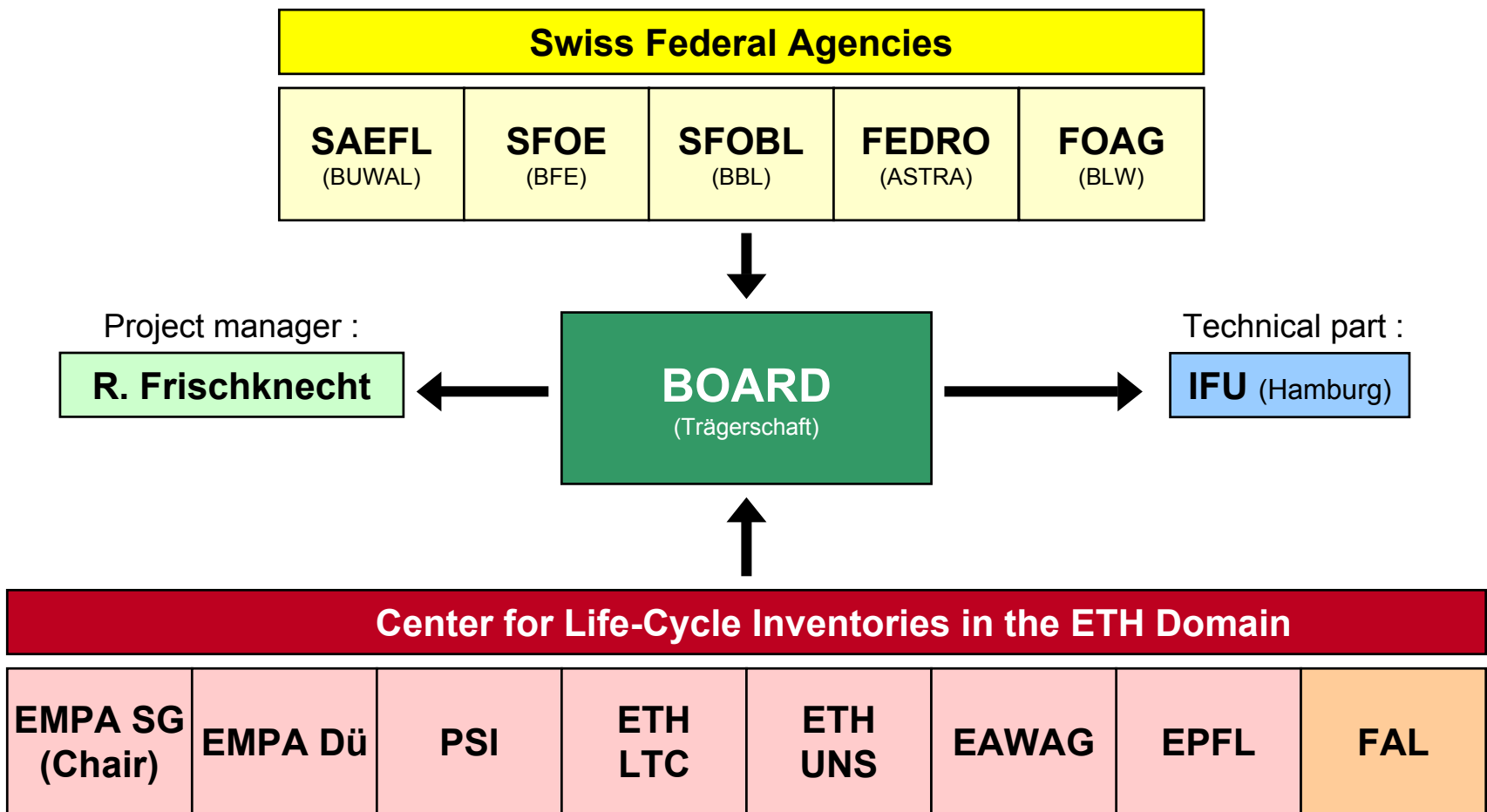


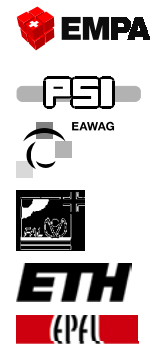
Quality checks and availability

- Internal review
- Use of currently applied LCIA methods for error tracking
- No external review (except by users)
- ECOINVENT membership:
unlimited access to entire database

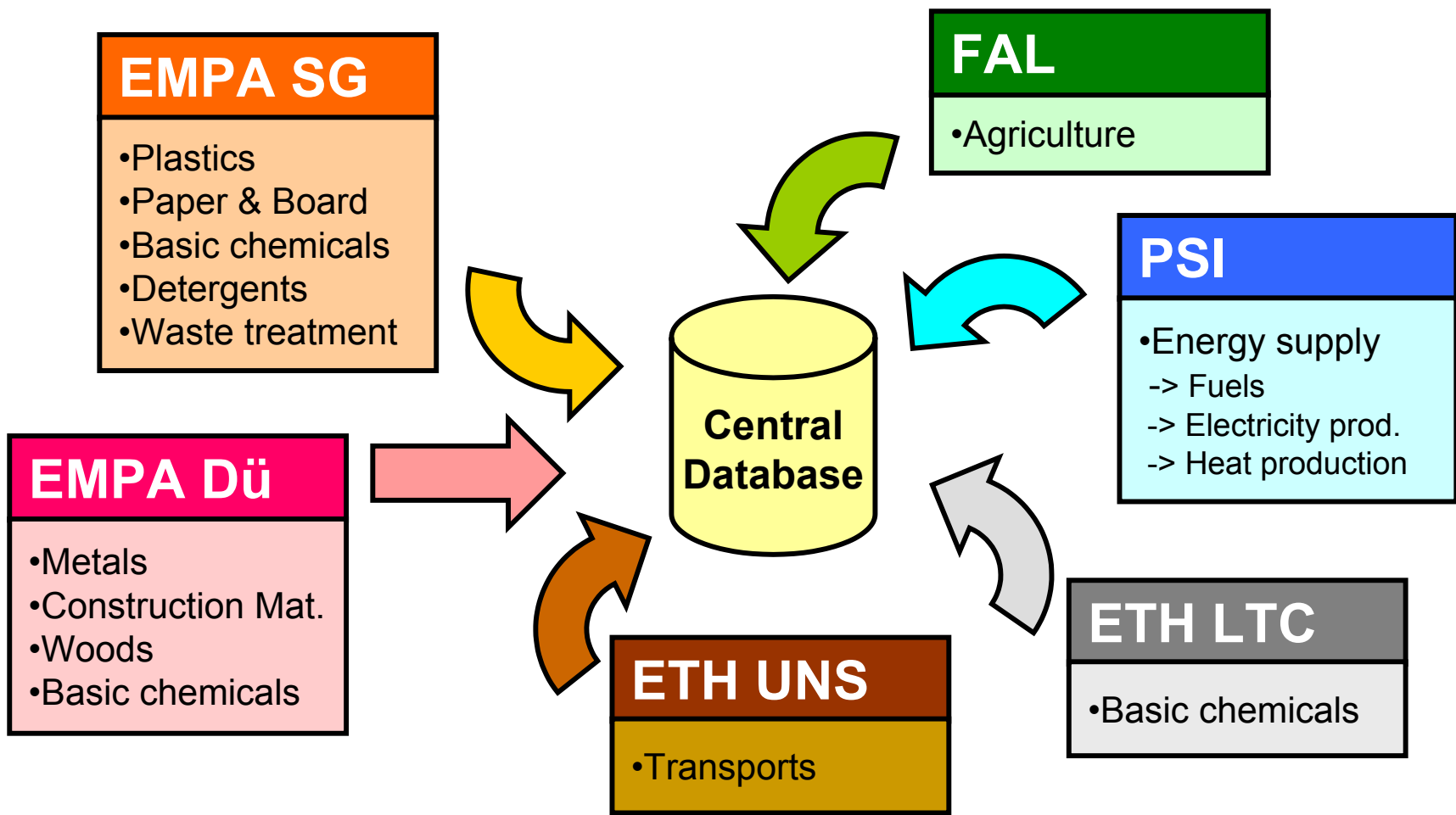


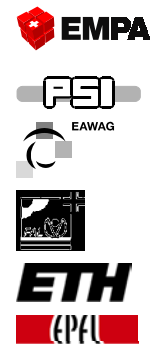
Project team





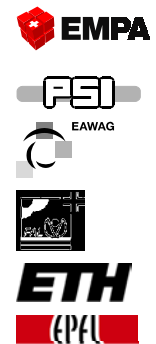
Database content



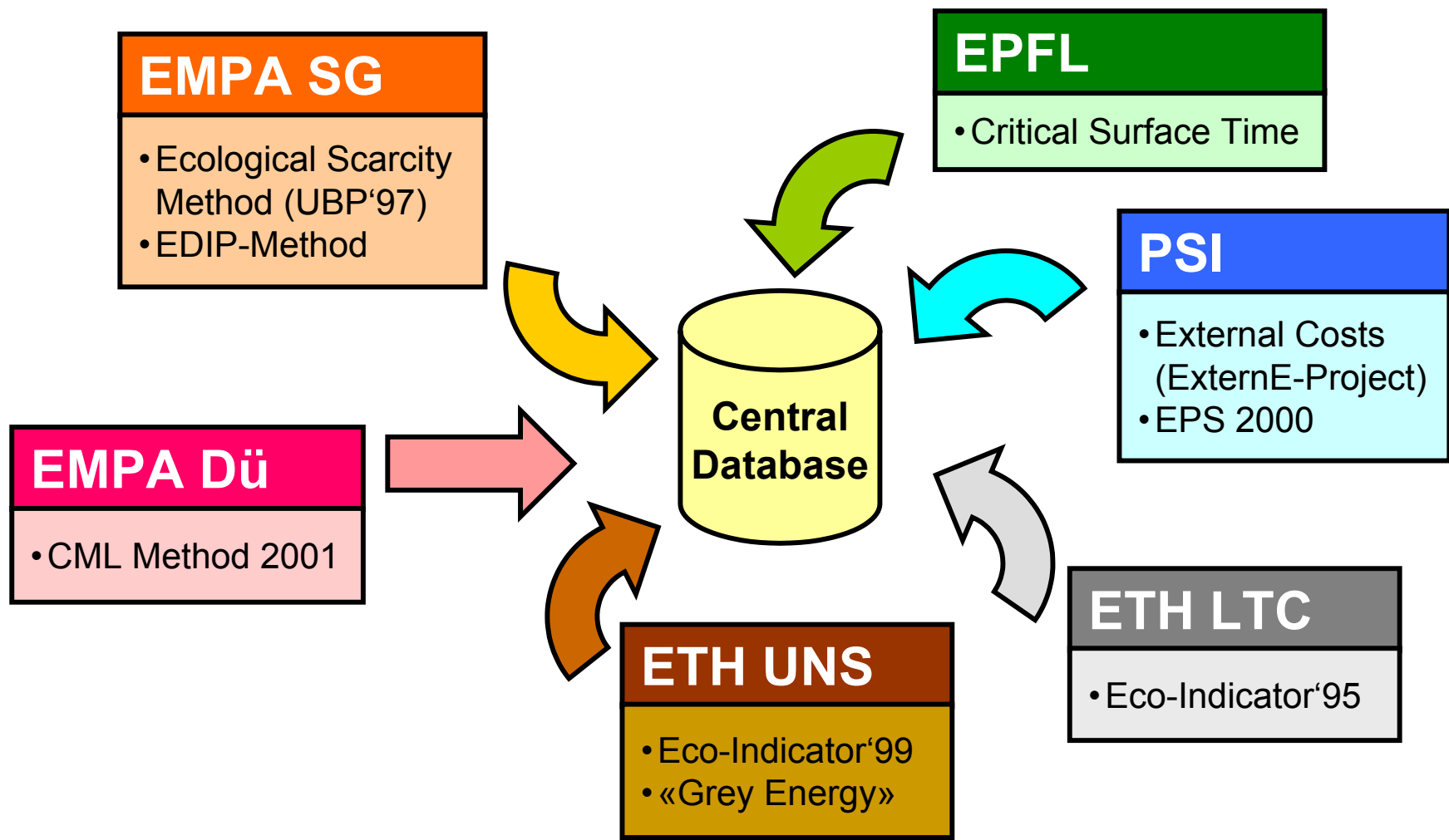


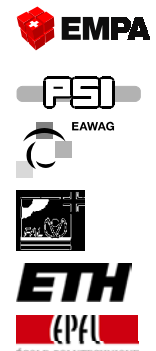
Database content II

Energy	oil natural gas lignite hard coal wood energy nuclear power hydro power wind power photovoltaic solar collector electricity heat pumps district heating cooling	construction materials insulation materials construction processes metals wooden materials chemicals paintings washing agents plastics glass paper & cardboard	Materials	
		biomass agricultural production agricultural means of production		Agriculture
	transport systems	food industry private consumption		
	waste management water supply	others		



Database content III





Database architecture

