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New impact categories in the amended standard EN15804 and their relevance for the construction sector

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Structure presentation

- Impact categories in the new amendment of EN15804
- Relevance of the additional impact categories for the construction sector
  - Qualitative assessment of relevance based on CEN/TR 17005:2016
  - Quantitave assessment of relevance based on Belgian cases (existing and new buildings)
- B-EPD - state of play

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New impact categories

Table 3 — Parameters describing environmental impacts

Impact Category	Parameter	Unit (expressed per functional unit or per declared unit)
Global Warming	Global warming potential, GWP;	kg CO_2 equiv
Ozone Depletion	Depletion potential of the stratospheric ozone layer, ODP;	kg CFC 11 equiv
Acidification for soil and water	Acidification potential of soil and water, AP;	kg SO_2 equiv
Eutrophication	Eutrophication potential, EP;	kg $(PO_4)^{3-}$ equiv
Photochemical ozone creation	Formation potential of tropospheric ozone,, POCP;	kg Ethene equiv
Depletion of abiotic resources-elements	Abiotic depletion potential (ADP-elements) for non fossil resources [a]	kg Sb equiv
Depletion of abiotic resources-fossil fuels	Abiotic depletion potential (ADP-fossil fuels) for fossil resources [a]	MJ, net calorific value

[a] The abiotic depletion potential is calculated and declared in two different indicators:

- ADP-elements: include all non renewable, abiotic material resources (i.e. excepting fossil resources);
- ADP -fossil fuels include all fossil resources.

Table 3 — Core environmental impact indicators

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
Climate change - total[a]	Global Warming Potential total (GWP-total)	kg CO_2 eq.
Climate change - fossil	Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq.
Climate change - biogenic	Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq.
Climate change - land use and land use change[b]	Global Warming Potential land use and land use change (GWP-luluc)	kg CO_2 eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H^+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg PO_4 eq.
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-marine)	kg N eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	mol N eq.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP);	kg NMVOC eq.
Depletion of abiotic resources - minerals and metals[c d]	Abiotic depletion potential (ADP-minerals&metals) for non-fossil resources	kg Sb eq.
Depletion of abiotic resources - fossil fuels[c]	Abiotic depletion potential (ADP-fossil) for fossil resources	MJ, net calorific value
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. deprived

[a] The total global warming potential (GWP) is the sum of (see 7.2.3.2)
— GWP-fossil
— GWP-biogenic
— GWP-luluc

[b] It is permitted to omit GWP-luluc as separate information if its contribution is < 5 % of GWP-total over the declared modules excluding module D.

[c] The abiotic depletion potential is calculated and declared in two different indicators:
— ADP-minerals&metals include all non-renewable, abiotic material resources (i.e. excepting fossil resources);
— ADP-fossil include all fossil resources and includes uranium.

[d] ultimate reserve model of the ADP-minerals&metals model

New impact categories

7.2.3.2 Additional environmental impact indicators

The following information on environmental impacts is expressed with the impact category indicators of LCIA using characterisation factors. These additional environmental impact indicators shall be calculated and included in the project report for each module declared and may be included in the EPD.

Table 4 shall be included in the EPD for the declared additional environmental indicators. If additional indicators are not declared, they shall be mentioned in the EPD, e.g. as an entry of "ND" to Table 4 or as text.

Table 4 — Additional environmental impact indicators

Impact category	**Indicator**	**Unit** (expressed per functional unit or per declared unit)
Particulate Matter emissions	Potential incidence of disease due to PM emissions	Disease incidence
Ionizing radiation, human health	Potential Human exposure efficiency relative to U235	kBq U235 eq.
Eco-toxicity (freshwater)	Potential Comparative Toxic Unit for ecosystems	CTUe
Human toxicity, cancer effects	Potential Comparative Toxic Unit for humans	CTUh
Human toxicity, non-cancer effects	Potential Comparative Toxic Unit for humans	CTUh
Land use related impacts/ Soil quality	Potential soil quality index	dimensionless

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New impact categories – relevance for the construction sector

- Water use

The issue of water and its management has become increasingly central to the global debate on sustainable development. This interest has been driven by ***growing water demand, increasing water scarcity in many areas and/or degradation of water quality****. Consuming water can affect human health (e.g. by reducing availability of irrigation water and hence food availability), ecosystems (by decreasing water availability for terrestrial/aquatic species) and future generations (by depleting non-renewable resources).* (CEN/TR 17005:2016, pp. 121)

Buildings contribute to water consumption through the following pathways:

- **Water embodied** in the construction products, the construction process and the use phase of the building
- **Operational water** requirements of the construction works, such as water required for washing, showering, cooking, garden watering, etc.

New impact categories – relevance for the construction sector

- Particulate matter

Particulate matter (PM), also known as respiratory inorganics, is a term used to cover a range of ***finely divided solids or liquids suspended in the air that originate from a number of natural or man-made sources****.* (CEN/TR 17005:2016, pp. 58)

Buildings may contribute to PM through the following pathways:

- **Production of materials and the construction process** of buildings
- **Operational energy use** during the use phase
- **Demolition works, transport and waste processing** during the EOL phase

New impact categories – relevance for the construction sector

- Ionizing radiation

*Ionizing radiation includes **energetic particles that can detach electrons from atoms or molecules, thus ionizing them**. Ionizing radiation is generated through nuclear reactions, nuclear decay, by very high temperature, or via acceleration of charged particles in electromagnetic fields.*
(CEN/TR 17005:2016, pp. 79)

Buildings may contribute to ionizing radiation through the following pathways:

- Natural radon emissions from the **ground**
- **Nuclear** power for **electricity use** during the **use phase** of the building
- **Nuclear** power needed for **electricity used in manufacturing/transport/end-of-life** (EoL) of products (embodied impact)
- **Natural radionuclides in construction materials** (i.e. resulting in indoor/outdoor releases)

New impact categories – relevance for the construction sector

- Eco-toxicity

Addresses the toxic impacts on an ecosystem, which damage individual species and change the structure and function of the ecosystem. Ecotoxicity is ***a result of a variety of different toxicological mechanisms, caused by the release of substances*** *with a direct effect on the health of the ecosystem.* (CEN/TR 17005:2016, pp. 42)

Buildings may contribute to ecotoxicity through the following pathways:

- Before manufacturing of the construction **product/extraction of raw materials**
- During manufacturing of the **construction product**
- During **installation** in a building and during its **use phase**
- **Waste disposal and recycling**

New impact categories – relevance for the construction sector

- Human toxicity – cancer & non-cancer effects

*Accounts for the adverse health effects on human beings caused by the **intake of toxic substances** present in the environment. This can be **through inhalation of air, food/water ingestion or penetration through the skin**.* (CEN/TR 17005:2016, pp. 23)

Buildings may contribute to human toxicity through the following pathways:

- **Direct emissions of chemicals** from buildings during the **construction and use phase**, e.g. the leaching of components of impregnating agents (e.g. creosote or salts) from treated wood and metals (e.g. copper and lead) from metal outdoor building products
- Emissions of chemical substances related **to energy use** during the use phase of the building
- Chemical substances released due to **raw material extraction/manufacturing/transport/end-of-life** (EoL) of products (embodied impact)
- Exposure to chemical substances released to **indoor air during the use phase** of a building

New impact categories – relevance for the construction sector

- Land-use related impacts – soil quality

Land, whether through transformation and/or occupation, can be subject to a wide variety of interventions that ***affect the land/soil*** *(e.g. chemical input (fertilizers, biocides),* ***surface sealing, modification of vegetation, fragmentation, compaction, and drainage/irrigation****. Each of these interventions potentially causes environmental impacts related to the three areas of protection (human health, ecosystem quality and resources).* (CEN/TR 17005:2016, pp. 93)

Buildings may contribute to land use related impacts through the following pathways:

- **In situ land use:** the land transformed and occupied on the construction site to build the building, it is hence the physical footprint of the building; In this respect the land use impacts are directly associated with the building level only.
- **Embodied land use:** the land transformed and/or occupied for the production/transportation/EoL treatment of the construction materials and products which are used in the building. In this respect the land use impacts are associated with the product level.

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New impact categories – relevance for the construction sector

- Assessment of buildings, considering both the ‘old’ and ‘new’ impact categories
- Impact assessment method: Belgian MMG method => some deviations from the amendment (indicated in red for the new impact categories)

CEN indicator In line with EN 15804:2012+A1		CEN+ indicator In line with PEF/ILCD recommendations	
Global warming	kg CO_2 eq.	Human toxicity - cancer effects	CTUh
Ozone depletion	kg CFC-11 eq.	Human toxicity - non-cancer effects	CTUh
Acidification of soil and water	kg SO_2 eq.	Particulate matter	kg PM2.5 eq
Eutrophication	kg $(PO4)_3$- eq.	Ionising radiation - human health	kg U235 eq
Photochemical ozone creation	kg ethene eq.	Ecotoxicity - freshwater	CTUe
Depletion of abiotic resources - elements	kg Sb* eq.	Water scarcity	m^3 water eq
Depletion of abiotic resources - fossil fuels	MJ, net calorific value	Land occupation - soil organic matter	kg C deficit
		Land occupation - biodiversity	m^2 yr
		Land transformation - soil organic matter	kg C deficit
		Land transformation - biodiversity	m^2

New impact categories – relevance for the construction sector

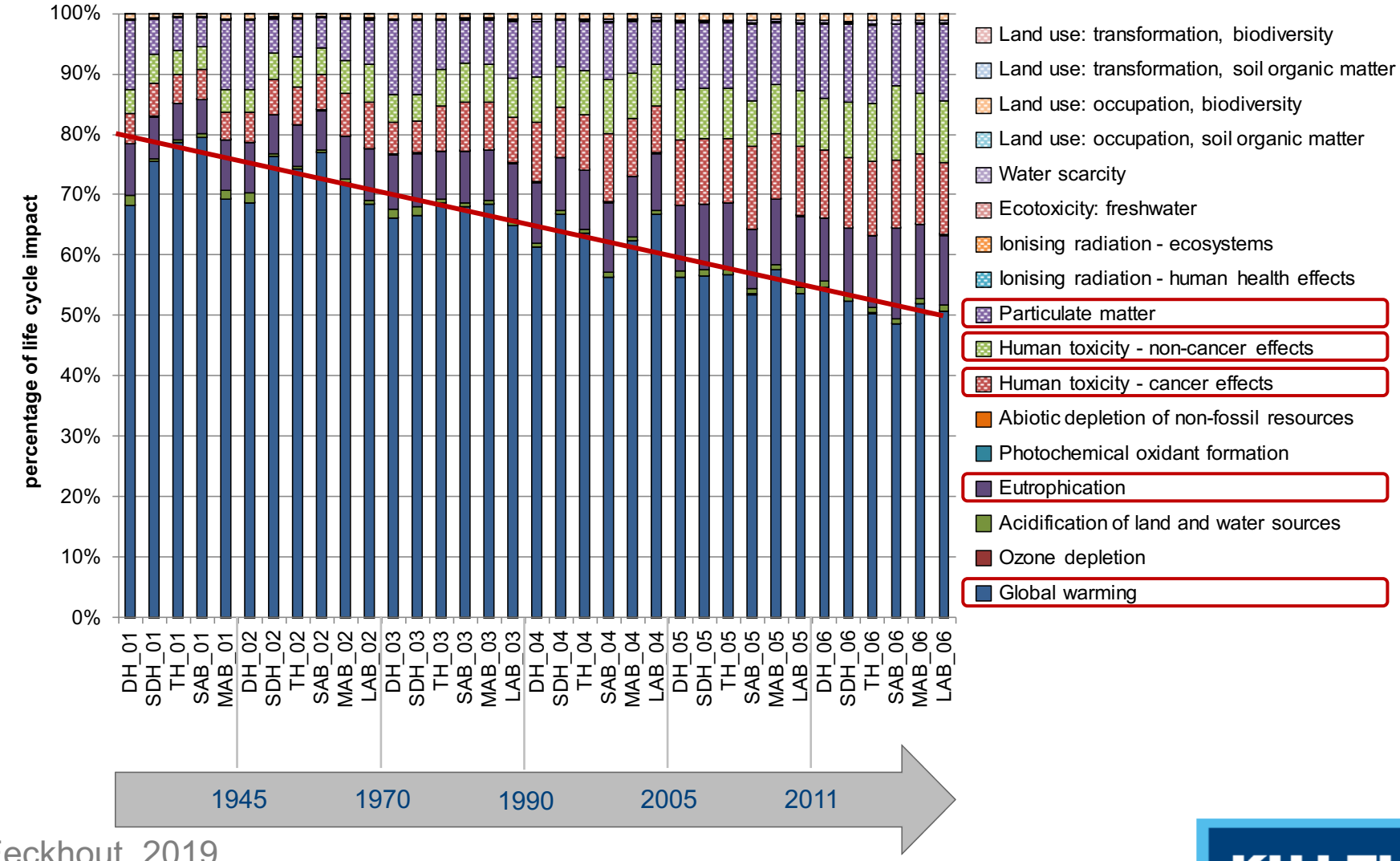
- Cases existing buildings in Belgium

Period / building type	Pre 1945	1945-1970	1971-1990	1991-2005	2006-2011	From 2012
Detached house	DH_01	DH_02	DH_03	DH_04	DH_05	DH_06
Semi-detached house	SDH_01	SDH_02	SDH_03	SDH_04	SDH_05	SDH_06
Terraced house	TH_01	TH_02	TH_03	TH_04	TH_05	TH_06
Small apartment building	SAB_01	SAB_02	SAB_03	SAB_04	SAB_05	SAB_06
Medium apartment building	MAB_01	MAB_02	MAB_04	MAB_04	MAB_05	MAB_06
Large apartment building	n.a.	LAB_02	LAB_03	LAB_04	LAB_05	LAB_06

Source: master thesis Fien Eeckhout, 2019

New impact categories – relevance for the construction sector

- Life cycle impacts of existing buildings in Belgium



Source: master thesis Fien Eeckhout, 2019

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New impact categories – relevance for the construction sector

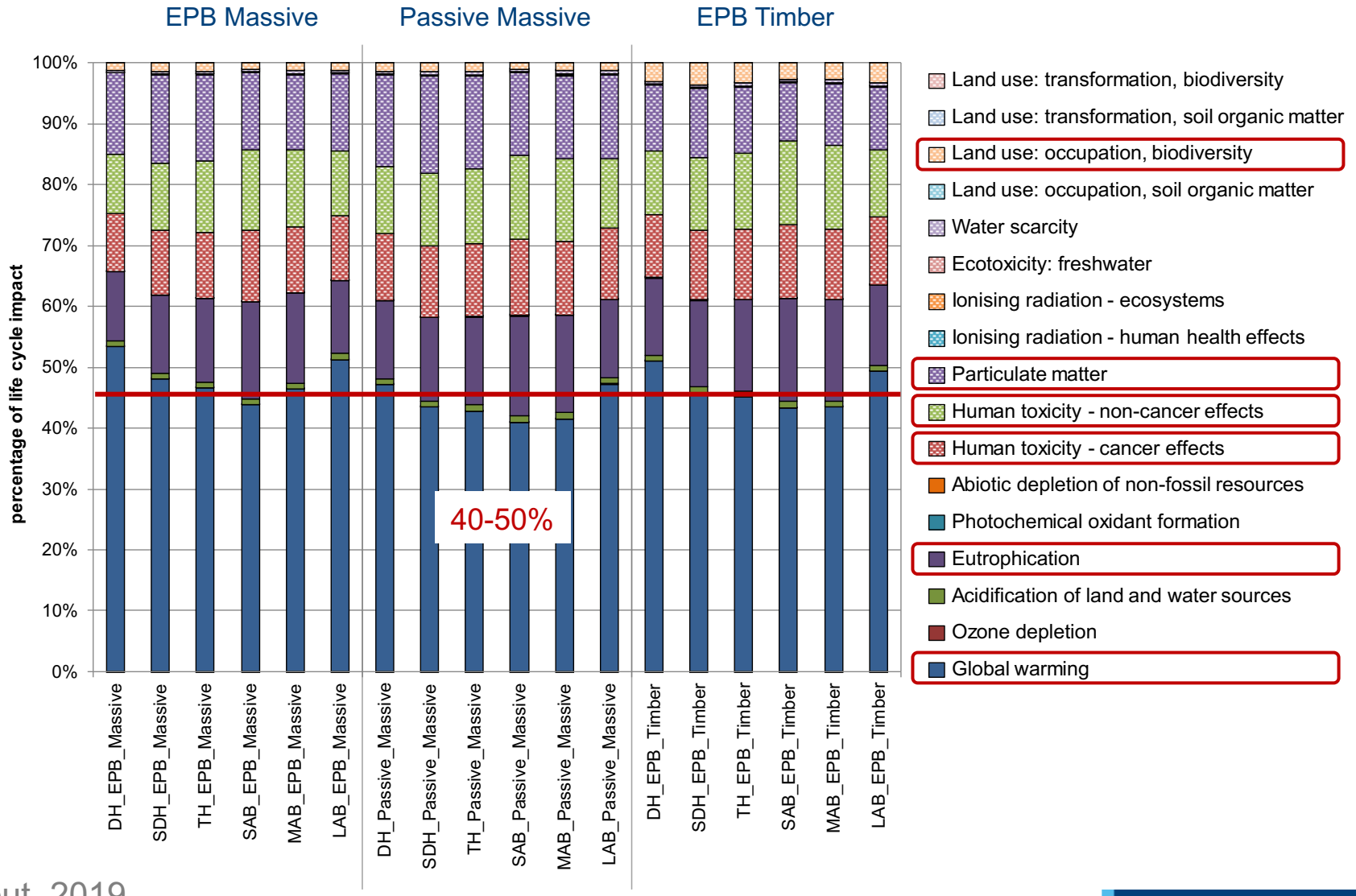
- Cases new buildings in Belgium

Energy performance and construction type / Building type	EPB standard Massive construction	EPB standard Timber construction	Passive standard Massive construction
Detached house	DH_EPB_Massive	DH_EPB_Timber	DH_Passive_Massive
Semi-detached house	SDH_EPB_Massive	SDH_EPB_Timber	SDH_Passive_Massive
Terraced house	TH_EPB_Massive	TH_EPB_Timber	TH_Passive_Massive
Small apartment building	SAB_EPB_Massive	SAB_EPB_Timber	SAB_Passive_Massive
Medium apartment building	MAB_EPB_Massive	MAB_EPB_Timber	MAB_Passive_Massive
Large apartment building	LAB_EPB_Massive	LAB_EPB_Timber	LAB_Passive_Massive

Source: master thesis Fien Eeckhout, 2019

New impact categories – relevance for the construction sector

- Life cycle impacts of new buildings in Belgium

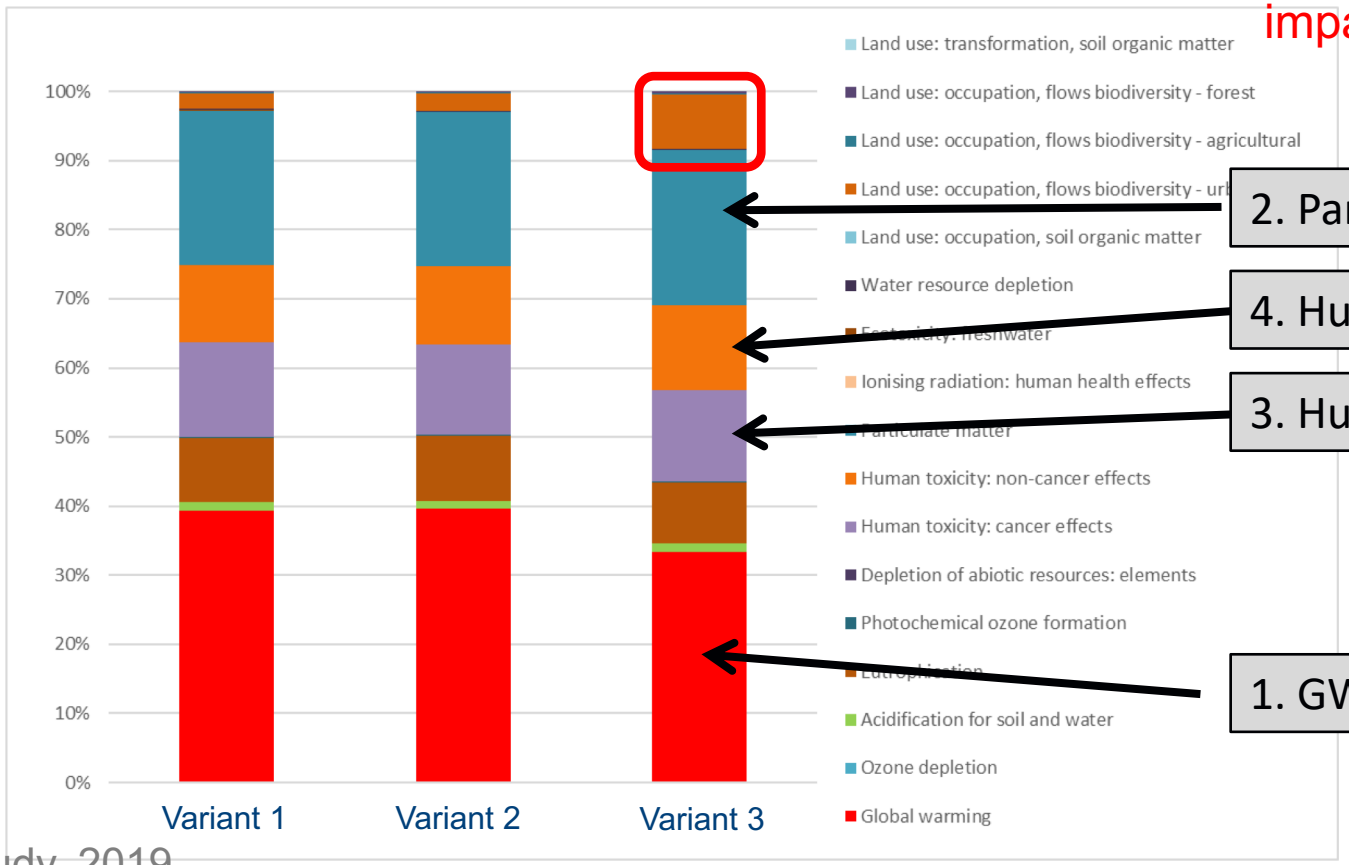


Source: master thesis Fien Eeckhout, 2019

New impact categories – relevance for the construction sector

- Life cycle impacts of a terraced house, three material variants, in line with Energy Performance Requirements for new buildings

Note: variant 3 would have the lowest impact if land use was not accounted for



2. Particulate matter

4. Human tox – non cancer

3. Human tox - cancer

1. GWP

Source: Febelcem study, 2019

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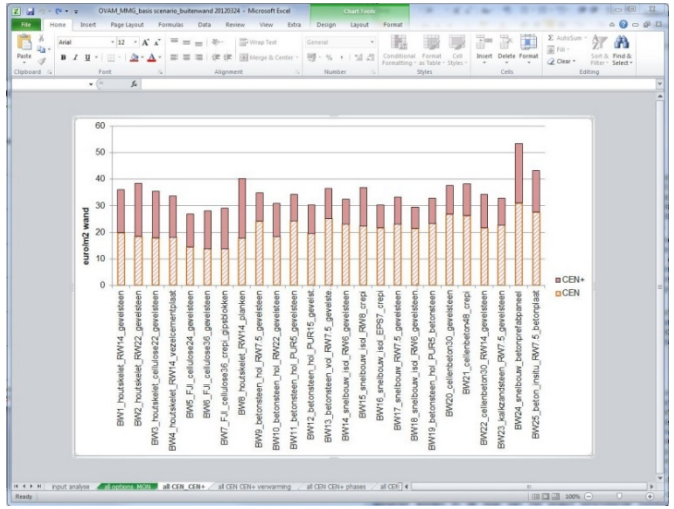
State of play BE

- **Assessment Method** “Environmental profile of building elements”(MMG)
  - Belgian context
  - Based on European standard (EN 15804) and ILCD recommendations
- **Static database with environmental data** (115 element variants)
- **Expert calculation tool**
- **User-friendly online tool for designers: totem**
- **LCI data: Royal decree + Belgian database**



totem
CREATE | EVALUATE | INNOVATE
EN FR

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State of play BE – EPDs

LCI data – National database

- Goal: integration of EPDs in TOTEM
- Current B-EPDs: conform EN15804+A1 and NBN/DTD B08-001, not yet in line with EN15804+A2 => no clear yet when and how transition will take place

www.b-epd.be

References

- CEN/TR 17005:2016, Sustainability of construction works — Additional environmental impact categories and indicators — Background information and possibilities
- Fien Eeckhout, Masterthesis Development of environmental benchmarks for residential buildings, KU Leuven, June 2019
- Allacker K., Study on the environmental impact of concrete and cement based products applied in buildings – evaluation with totem, Study for FEBELCEM, April 2019
- Totem: https://www.totem-building.be
- B-EPD database: https://www.health.belgium.be/en/database-environmental-product-declarations-epd

Questions?

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State of play BE – EPDs

LCI data – Royal Decree July 2014

22 MEI 2014. — Koninklijk besluit tot vaststelling van de minimumeisen voor het aanbrengen van milieuboodschappen op bouwproducten en voor het registreren van milieuproductverklaringen in de federale databank

De milieuproductverklaring is in overeenstemming met artikel 7, de norm NBN EN 15804 en de bepalingen in bijlage 1.

Bijlage 2. — Bepalingsmethodes
voor de bijkomende indicatoren verplicht vanaf 1 januari 2017

Bepalingsmethodes en eenheden
zoals vastgelegd
in de norm NBN EN 15804.
Bij ontstentenis
zijn de bepalingen van
de *Product Environmental Footprint*
van DG Environment van toepassing.

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