

# The Belgian benchmark system for buildings

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# Content

1. Introduction
2. Benchmark methodology
3. Bottom-up approach
4. Future developments

# Content

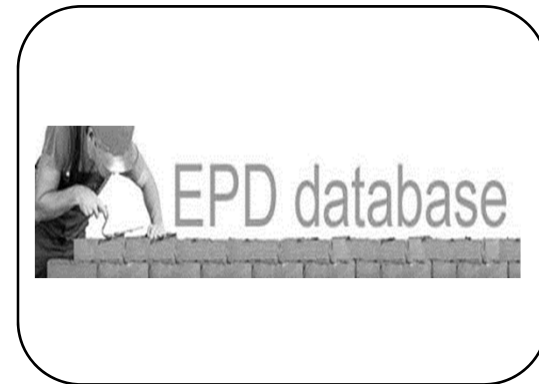
1. **Introduction**
2. Benchmark methodology
3. Bottom-up approach
4. Future developments

# Life Cycle Assessment in the Belgian building practice

## LCA METHOD



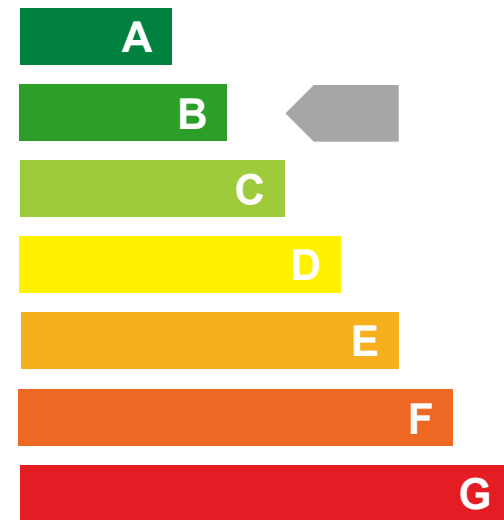
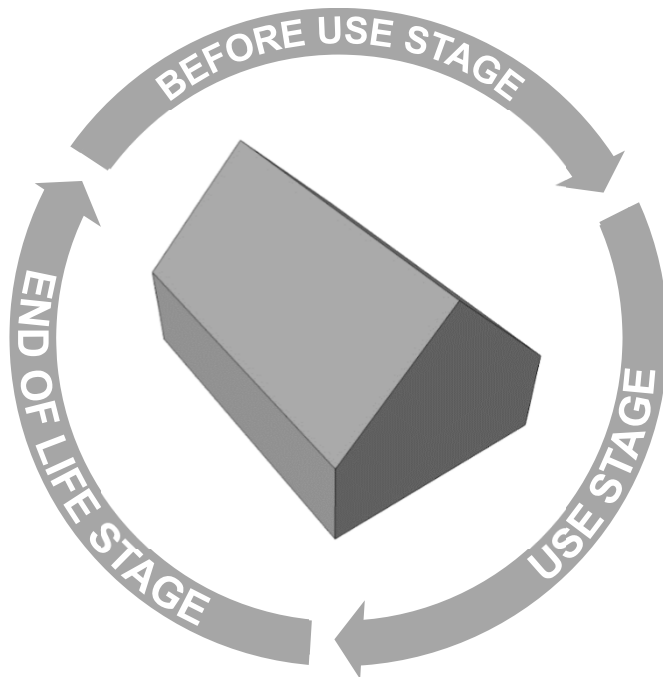
## EPD DATABASE



## WEB-BASED TOOL

# Development of environmental benchmarks for buildings

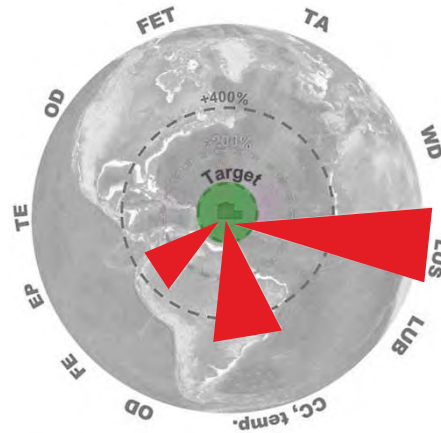
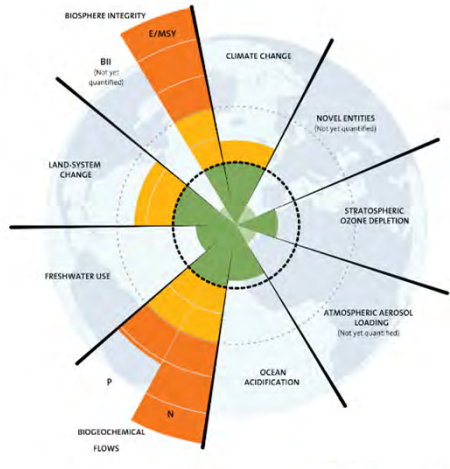
- **Policy applications:** definition of environmental targets
- **Private / commercial applications:** market positioning



# Content

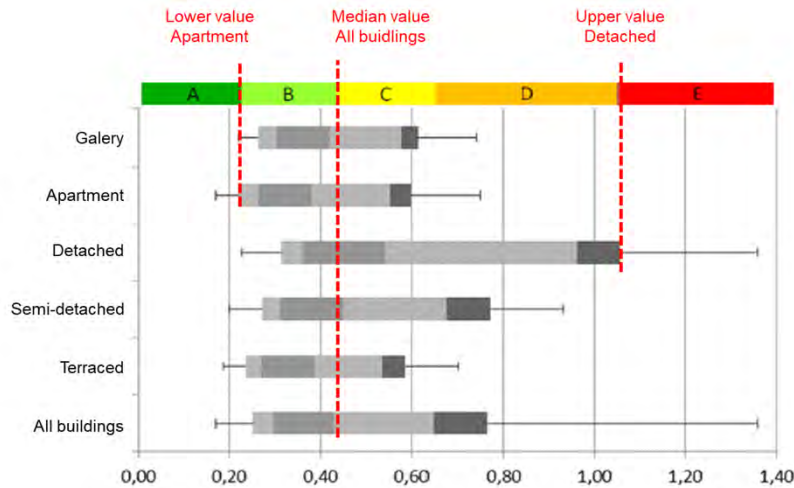
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# Combined top-down and bottom-up approach



## Top-down approach

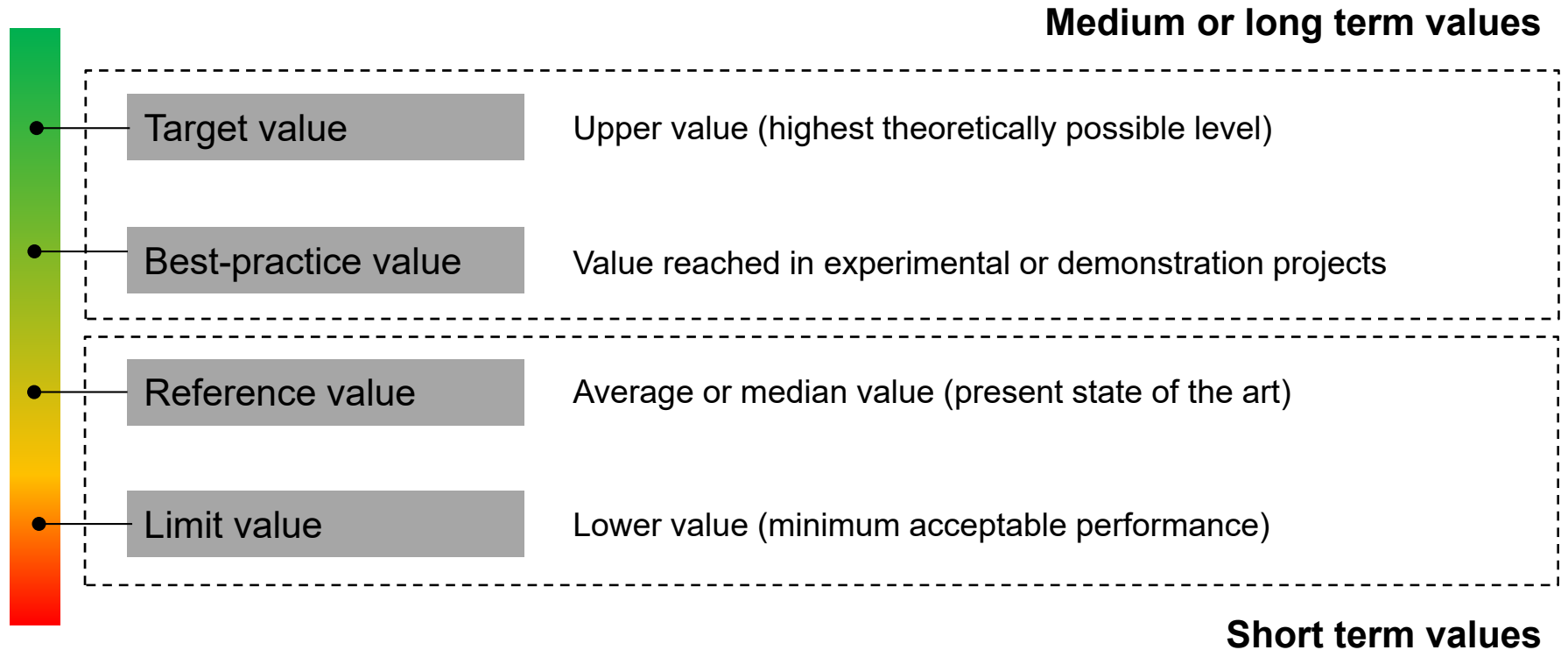
Target values from environmental goals



## Bottom-up approach

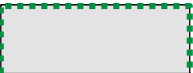
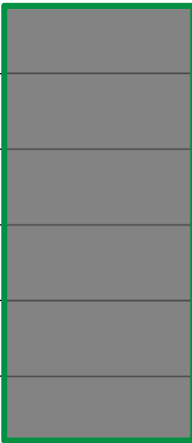
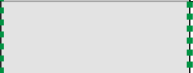
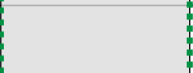
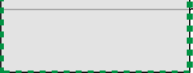


Limit, reference and best-practice values from building stock analysis



# Performance levels for short and long term






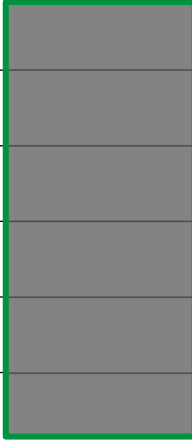




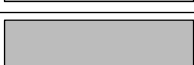
# Flexible benchmark scope – life cycle stages



| Life cycle stages |                            | Type 1  | Type 2   |
|-------------------|----------------------------|---|--|
| A 1-3             | Product stage              |  |  |
| A 4-5             | Construction process stage |  |  |
| B 1-5             | Use stage                  |  |  |
| C 1-4             | End-of-life stage          |  |  |
| B6                | Operational energy use     |  |  |
| B7                | Operational water use      |  |  |

 Main benchmark  
 Indicative values

 Embodied   
  Operational   
  Whole life cycle

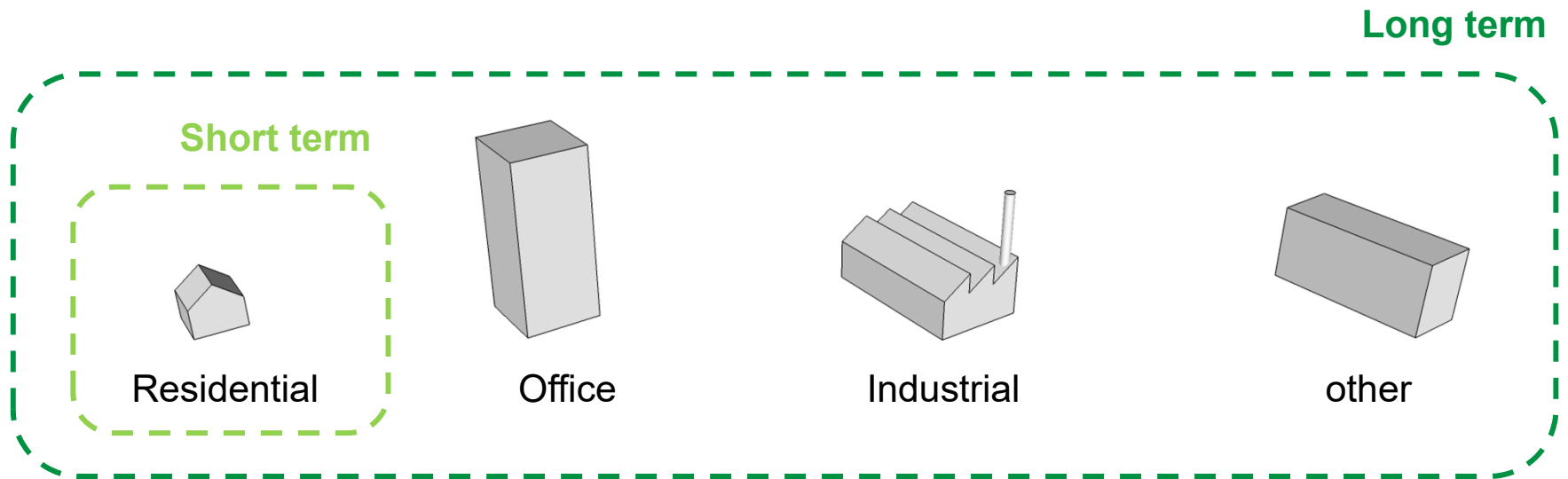
# Flexible benchmark scope – environmental indicators

| Impact indicators            | Type 1  | Type 2   |
|------------------------------|---|--|
| Global warming               |  |  |
| Ozone depletion              |  |  |
| Acidification                |  |  |
| Eutrophication               |  |  |
| Photochemical ozone creation |  |  |
| ...other indicator           |  |  |

 Main benchmark  
 Indicative values

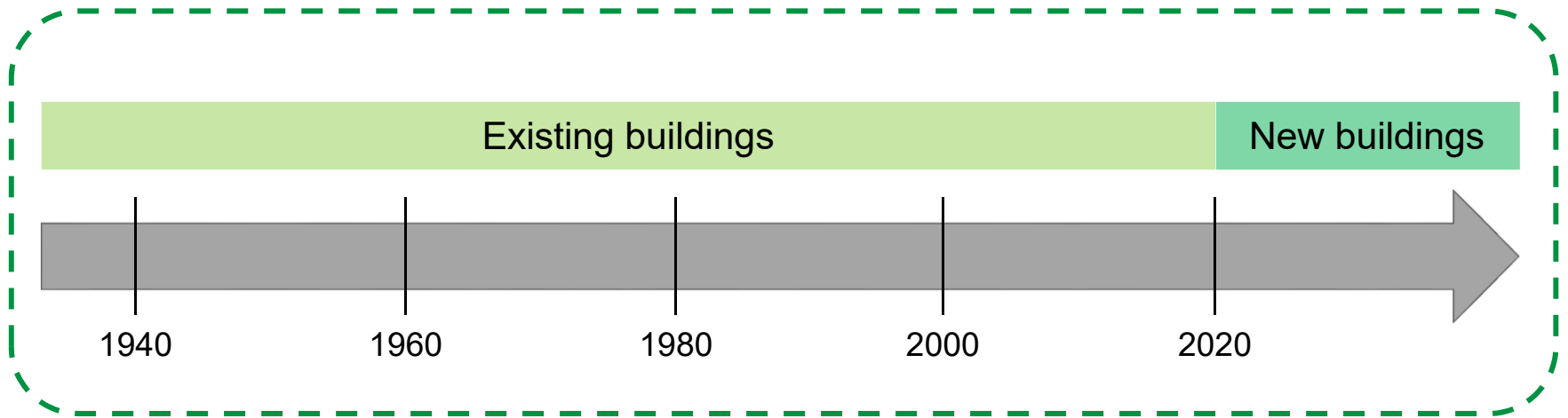
 Individual indicators   
  Aggregated indicator

# Benchmark applications – building typologies

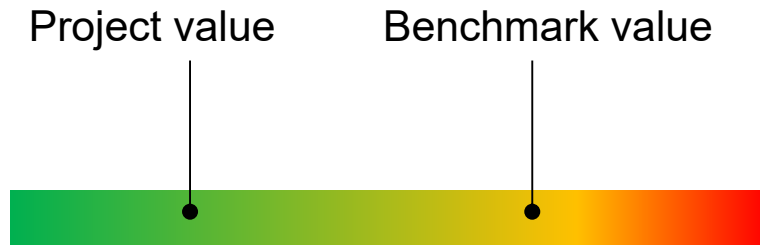


# Benchmark applications – new construction and refurbishment

Applicable to the whole building stock

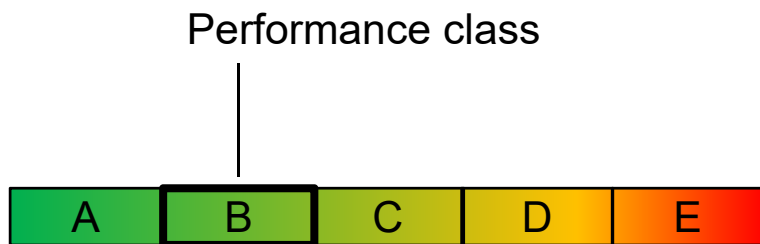


# Transparent and user-friendly communication



**Communication based on benchmark values**

More transparent



**Communication based on performance classes**

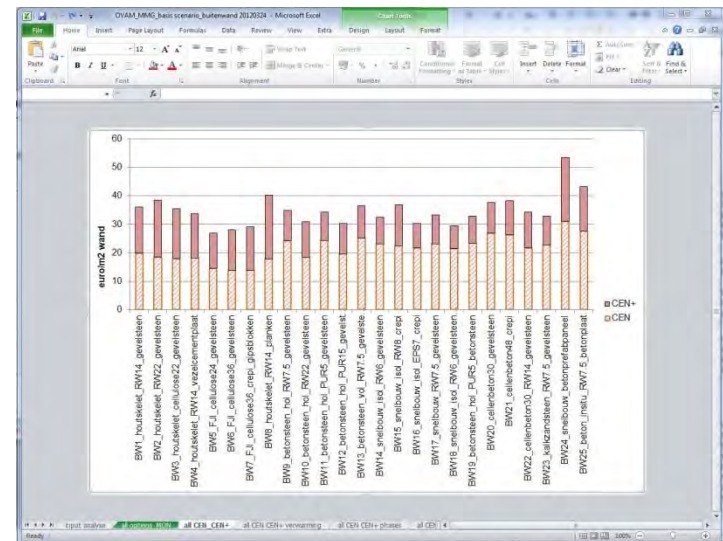
More user-friendly

# Content

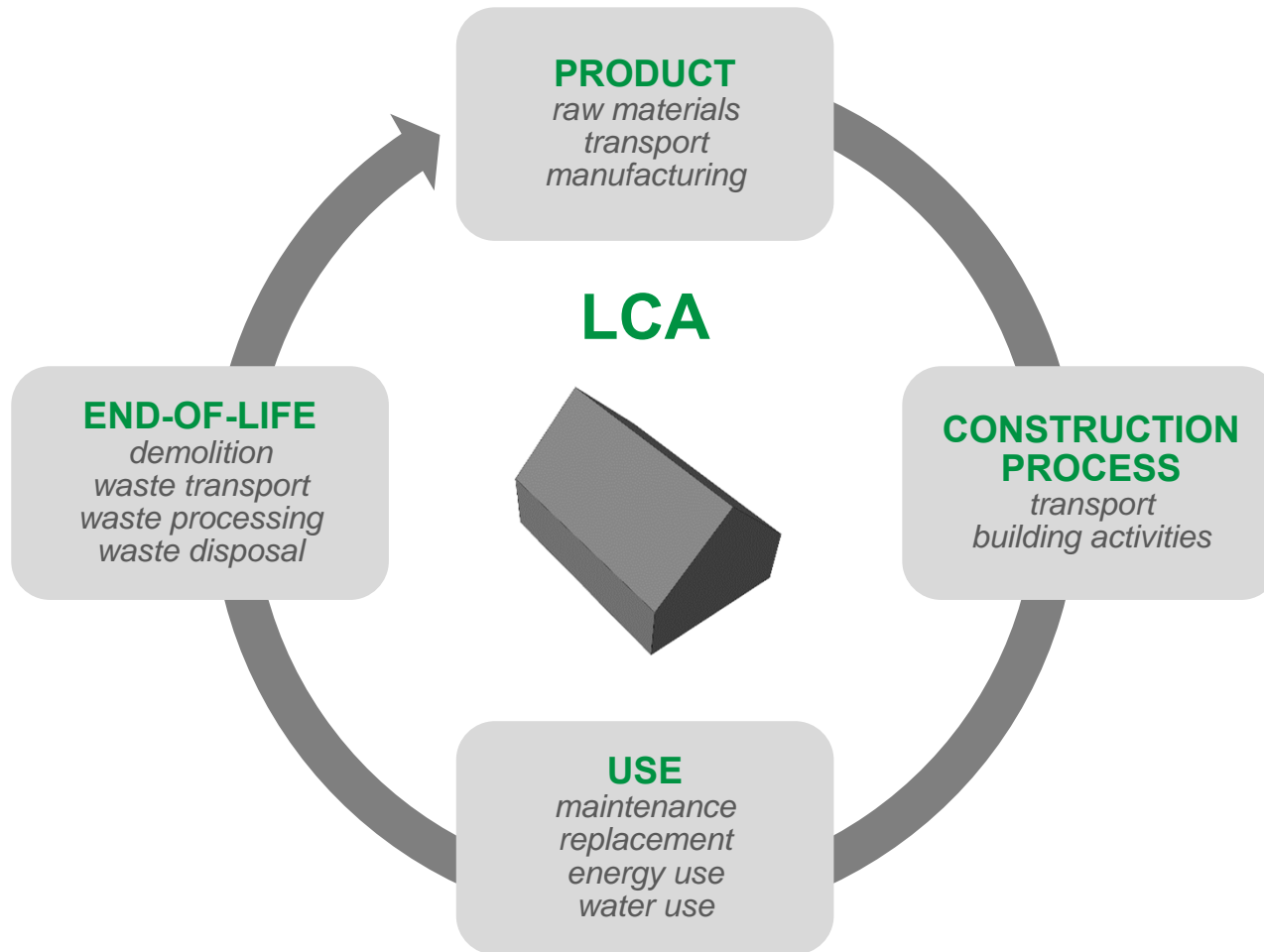
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# Environmental profile of building elements (MMG)

- **Harmonized methodology** to assess the environmental impact of building elements
  - Adapted to the Belgian context
  - In line with current European LCA standards and guidelines
- **Environmental profile database**
- **Expert calculation model**




# Life Cycle Assessment






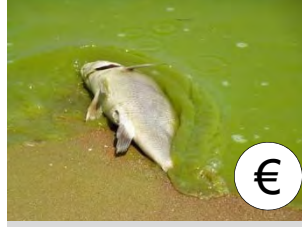




# Environmental impact indicators

## CEN indicators

|  |  |
|--|--|
| <br>Global warming                | <br>Ozone depletion         |
| <br>Acidification                 | <br>Eutrophication          |
| <br>Photochemical ozone creation | <br>Depletion of resources |

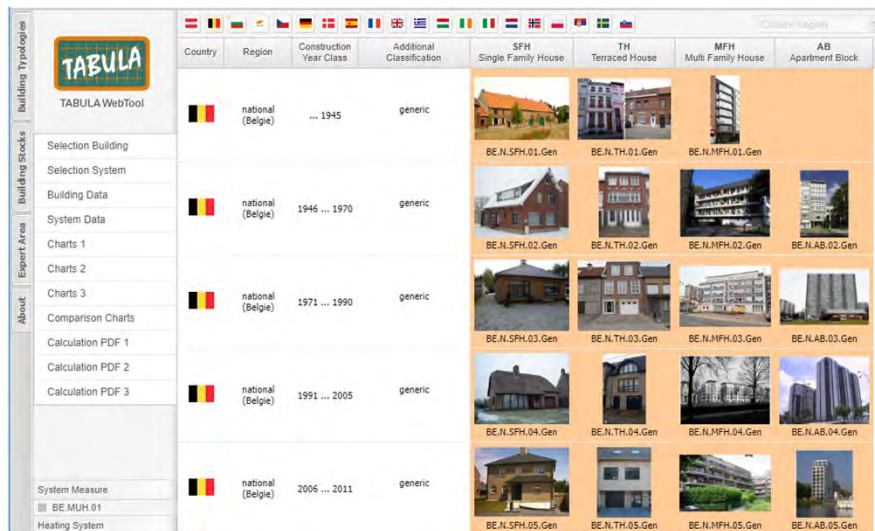
## CEN + indicators







|  |   |
|--|---|
| <br>Human toxicity  | <br>Particulate matter |
| <br>Radiation       | <br>Ecotoxicity        |
| <br>Water scarcity | <br>Land use          |

Individual indicators      x      Monetary values       $\longrightarrow$       Aggregated score      €

# Tabula / Episcopo

- Database of **representative building typologies** in Europe
- Buildings subdivided per **size** and **construction year** classes
- **Fictive buildings** based on average geometrical data from Energy Advice Procedure (EAP)
- Assessment of **energy refurbishment measures**
- No data on **internal geometry** and **composition of internal elements**



|        | Existing state   | Usual Refurbishment   | Advanced Refurbishment  |
|--------|--|---|---|
| Roof 1 | surface area<br>215.0m <sup>2</sup><br>type of construction / refurbishment measure<br>flat roof, no insulation (concrete structure) | 215.0 m <sup>2</sup><br>add extra insulation of 12 cm with lambda 0,035-0,045<br>0    | 215.0m <sup>2</sup><br>add extra insulation of 26 cm with lambda 0,035-0,045<br>0     |
|        | picture<br>                                       |   |   |
|        | U-value<br>3.50 W/(m <sup>2</sup> K)   | 0.30 W/(m <sup>2</sup> K)   | 0.15 W/(m <sup>2</sup> K)   |
| Wall 1 | surface area<br>292.5m <sup>2</sup><br>type of construction / refurbishment measure<br>massive brickwork                             | 292.5 m <sup>2</sup><br>add extra insulation of 8 cm with lambda 0,025-0,035<br>0     | 292.5m <sup>2</sup><br>add extra insulation of 14 cm with lambda 0,025-0,035<br>0     |
|        | picture<br>                                     |  |  |
|        | U-value<br>2.20 W/(m <sup>2</sup> K)   | 0.30 W/(m <sup>2</sup> K)   | 0.18 W/(m <sup>2</sup> K)   |
|        | surface area<br>215.0m <sup>2</sup><br>type of construction / refurbishment measure<br>natural or ceramic stone floor                | 215.0 m <sup>2</sup><br>add extra insulation of 8 cm with lambda 0,025-0,035<br>0     | 215.0m <sup>2</sup><br>add extra insulation of 12 cm with lambda 0,025-0,035<br>0     |

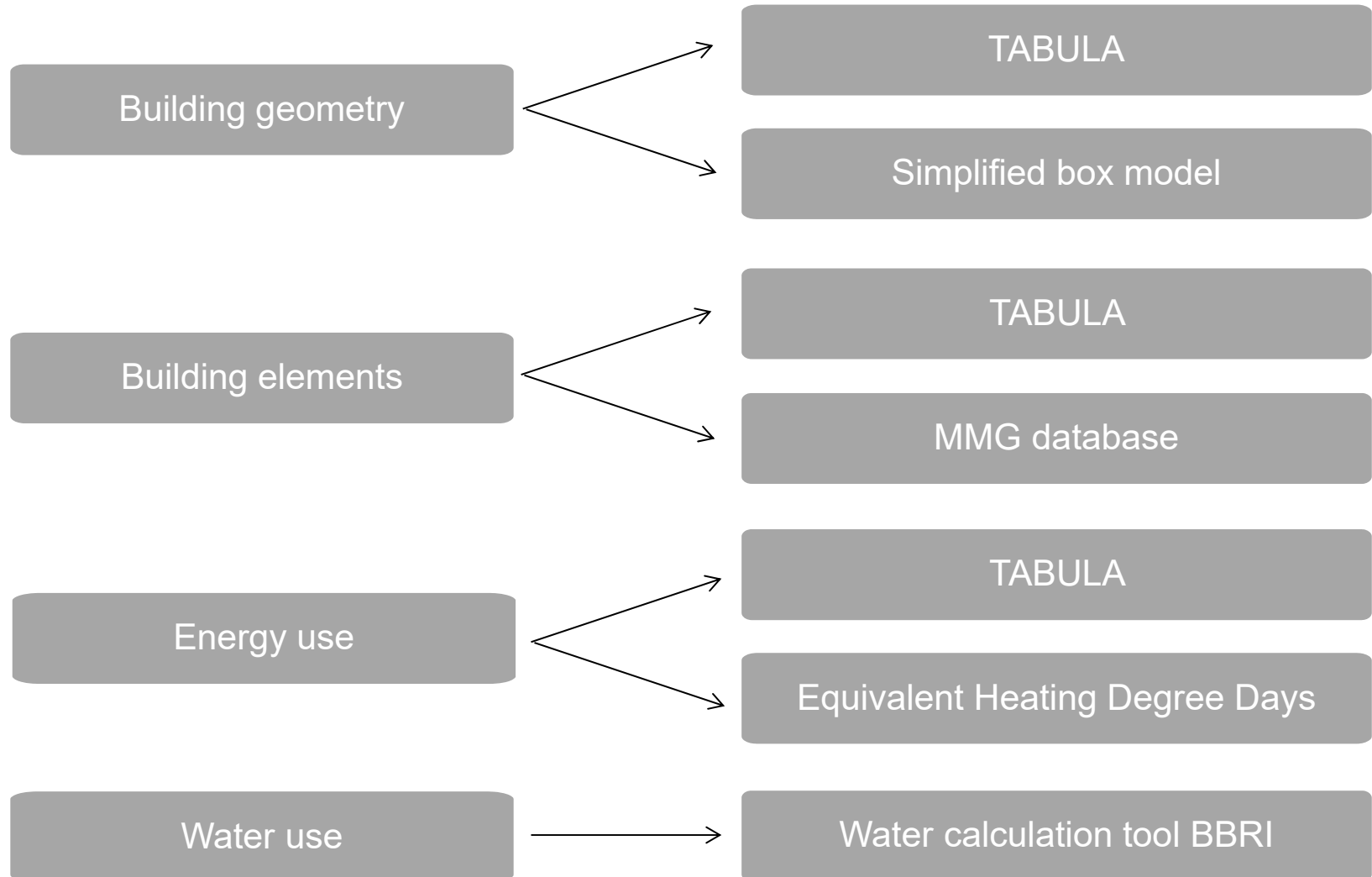
## Case studies existing building stock

| building type \ Period    | 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    |

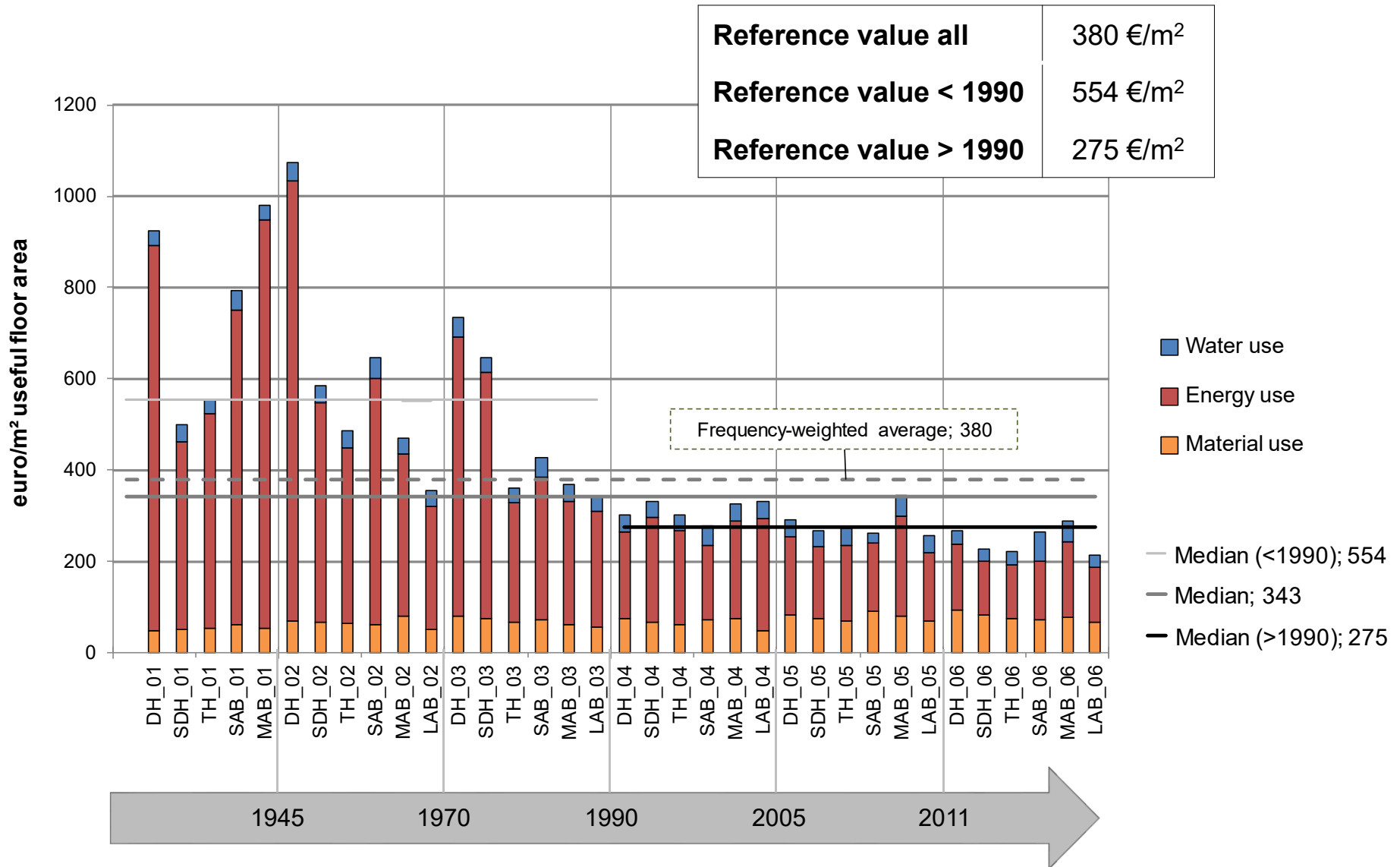
## Case studies new buildings

| Energy performance and construction type | EPB standard<br>Massive construction | EPB standard<br>Timber construction | Passive standard<br>Massive construction |
|--|--------------------------------------|-------------------------------------|--|
| Building type                            |                                      |                                     |  |
| 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                      |

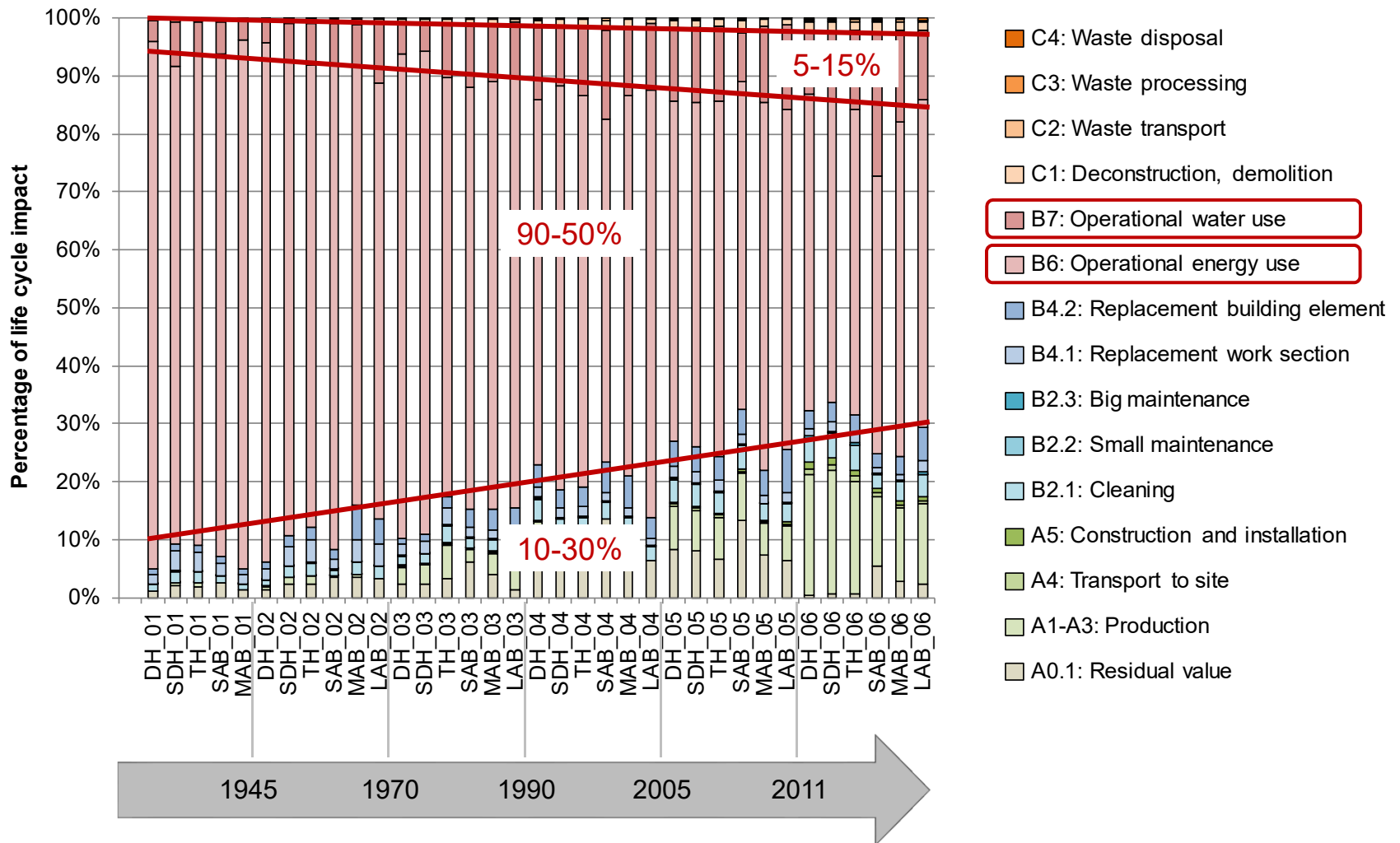
# Input data collection



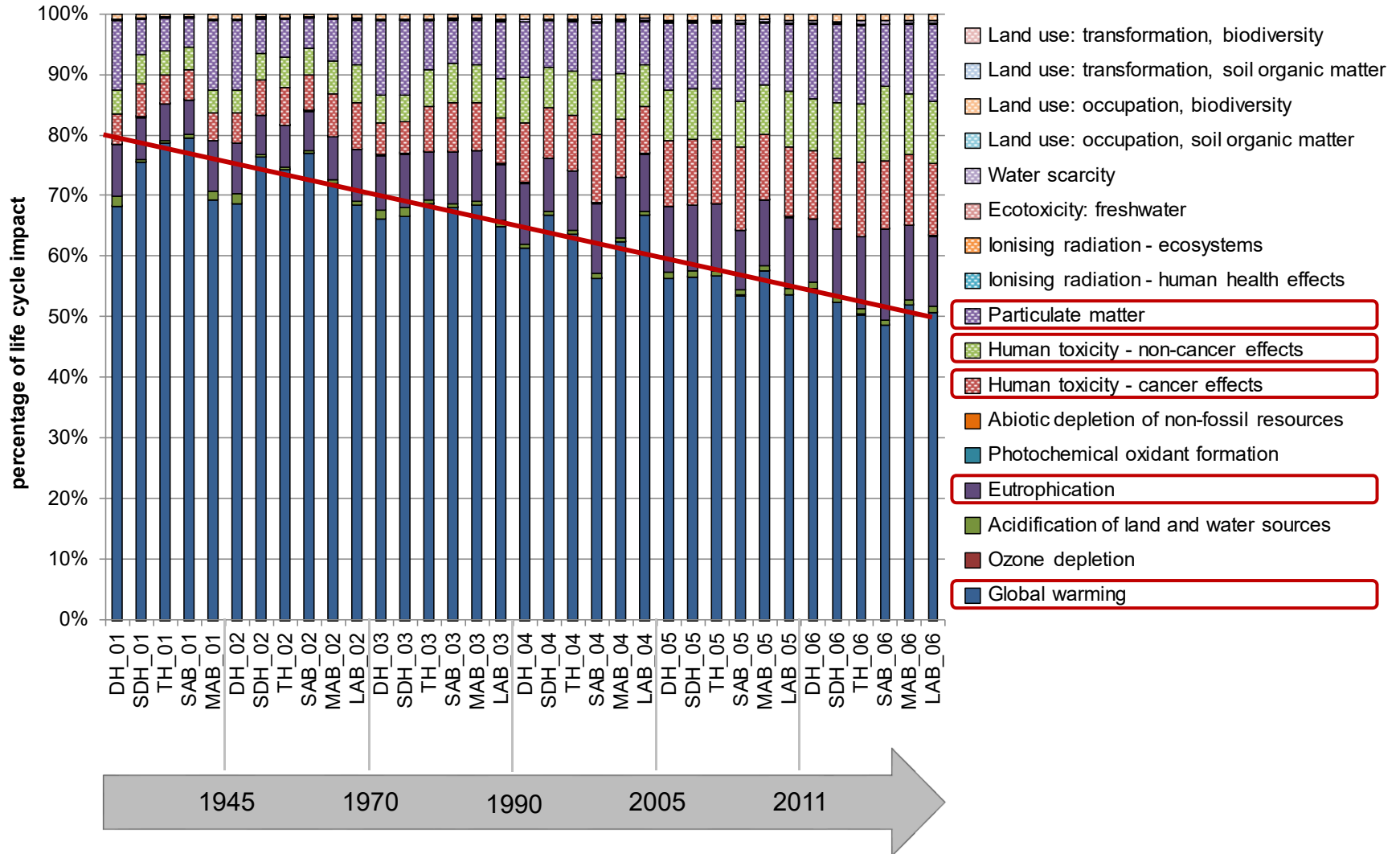
# Results existing buildings



# Results existing buildings – life cycle modules



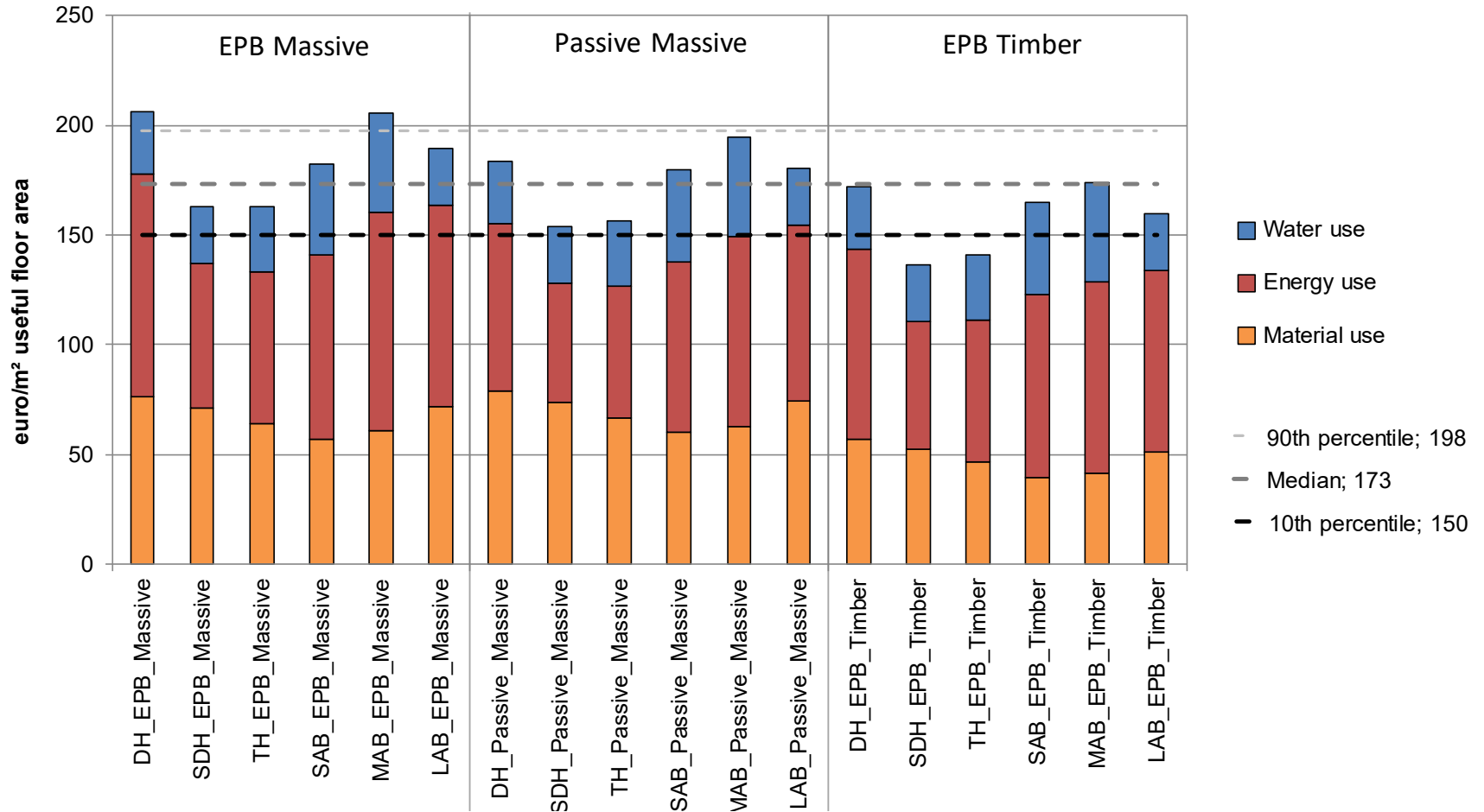
# Results existing buildings – impact indicators



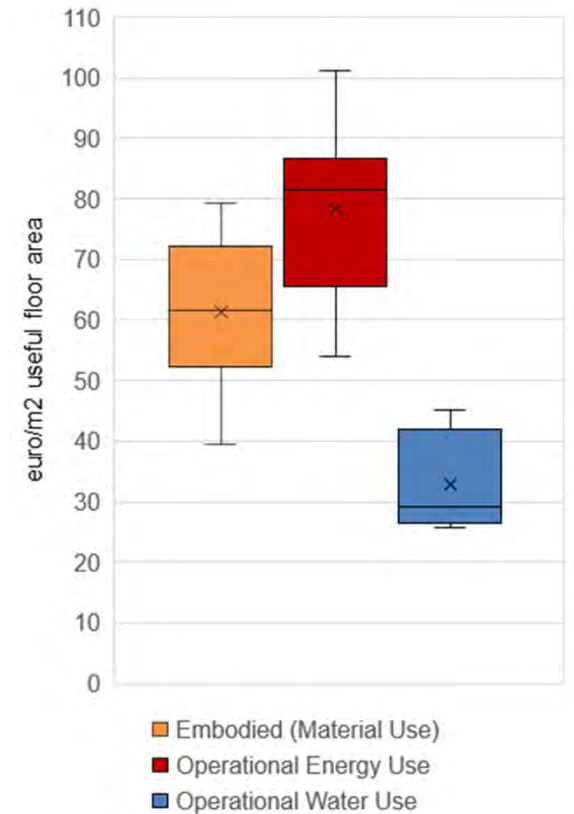
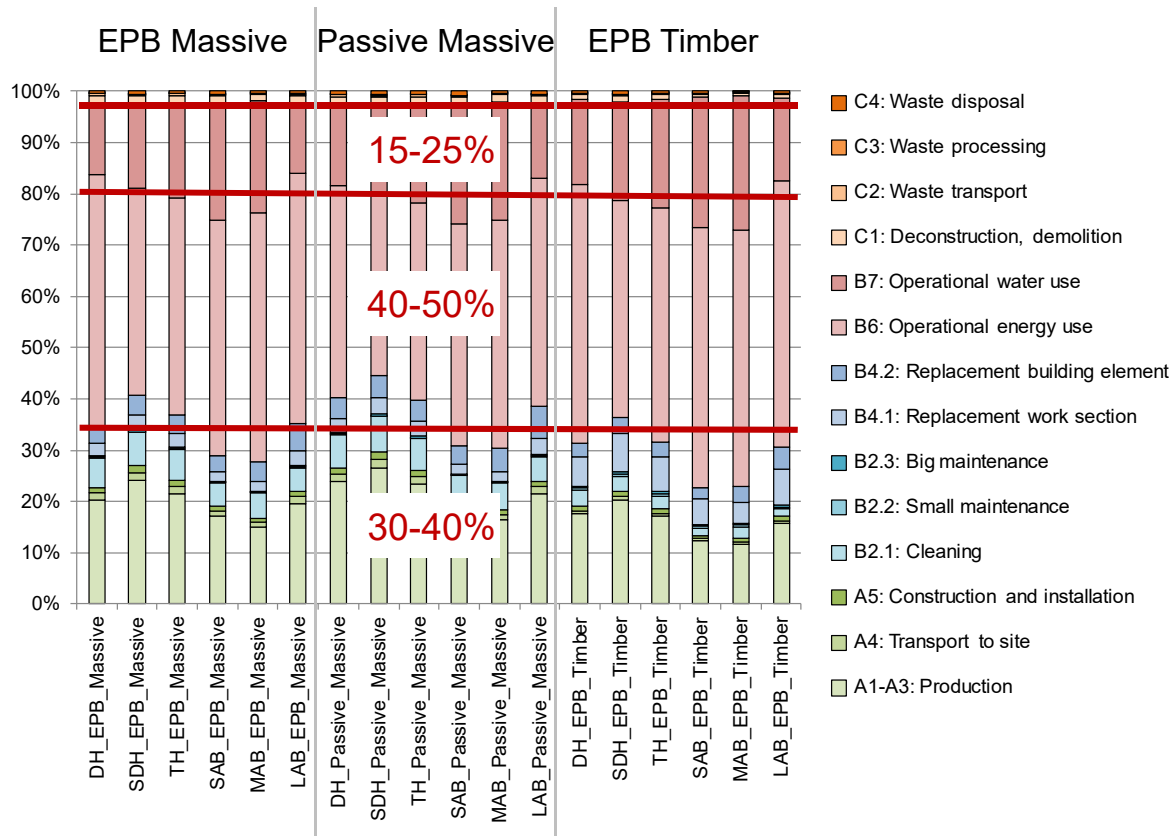


# Results new buildings

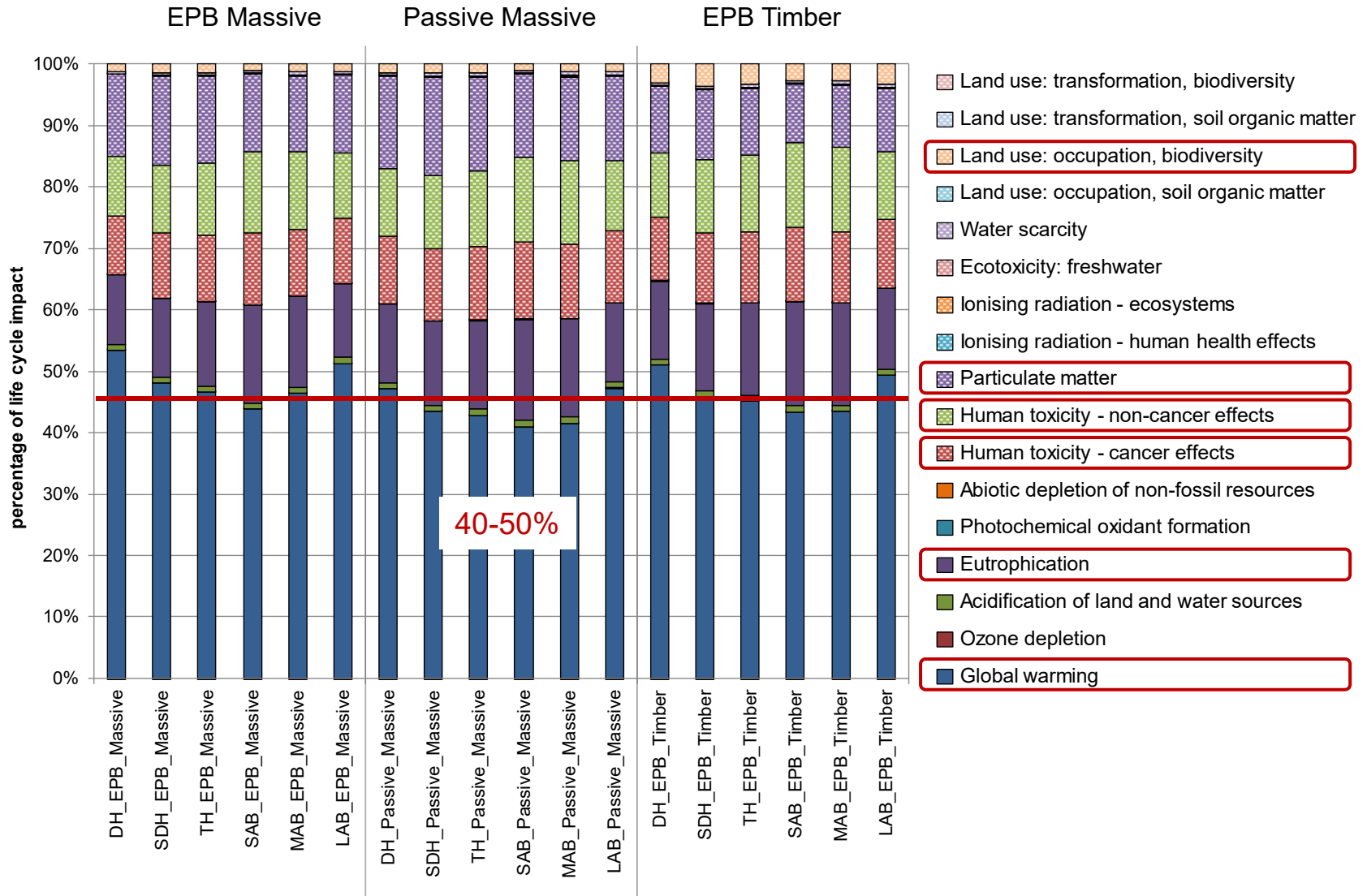
|                            |                      |
|----------------------------|----------------------|
| <b>Best practice value</b> | 150 €/m <sup>2</sup> |
| <b>Reference value</b>     | 173 €/m <sup>2</sup> |
| <b>Limit value</b>         | 198 €/m <sup>2</sup> |



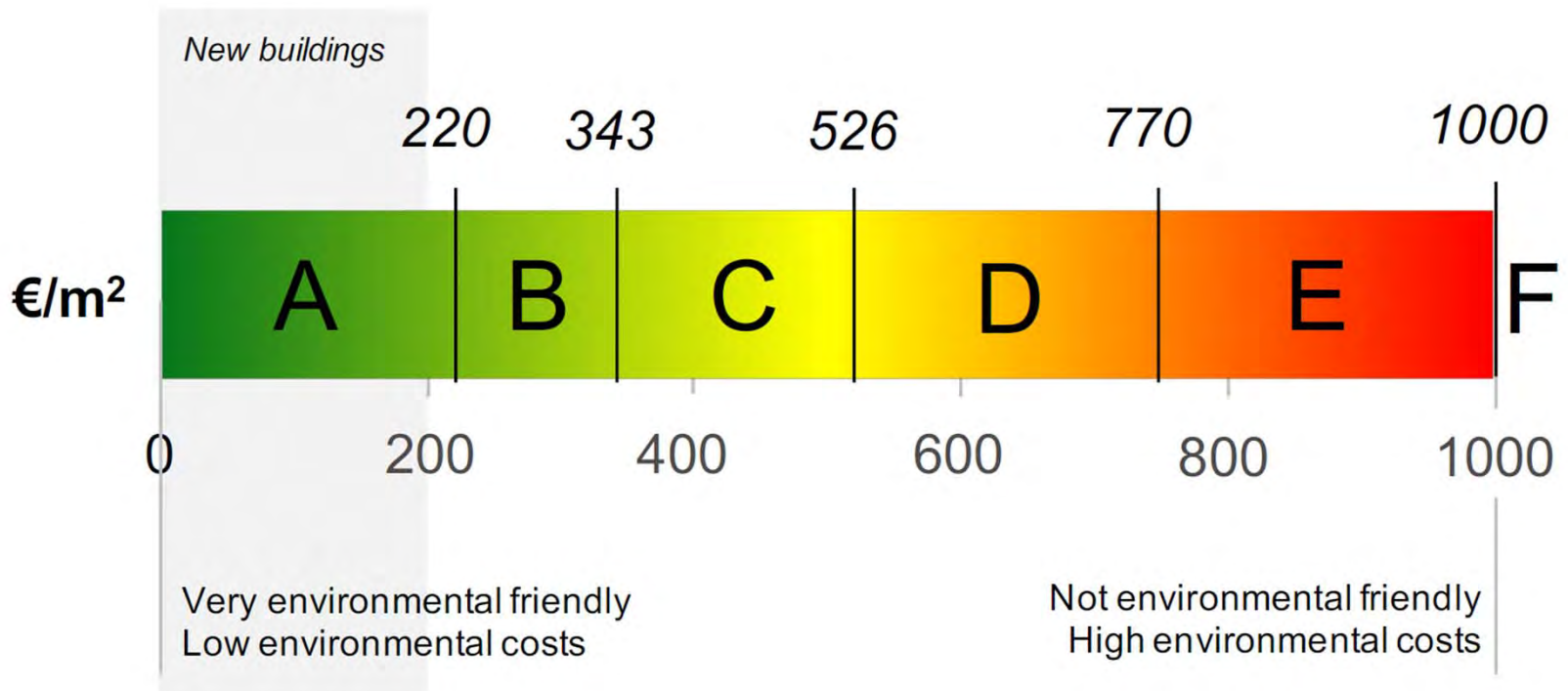
# Results new buildings – life cycle modules



# Results new buildings – impact indicators



# Performance classes



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# Future developments

- Refinement of **bottom-up approach**
  - Additional case studies
  - Extension to refurbishment projects
  - Big data of existing building stock
- Modelling based on **top-down approach**
  - Selection of environmental goals and policy targets
  - Translation of targets to the building sector
- **Stepwise implementation** in building practice
  - Short term: decision support
  - Medium term: legal requirements

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