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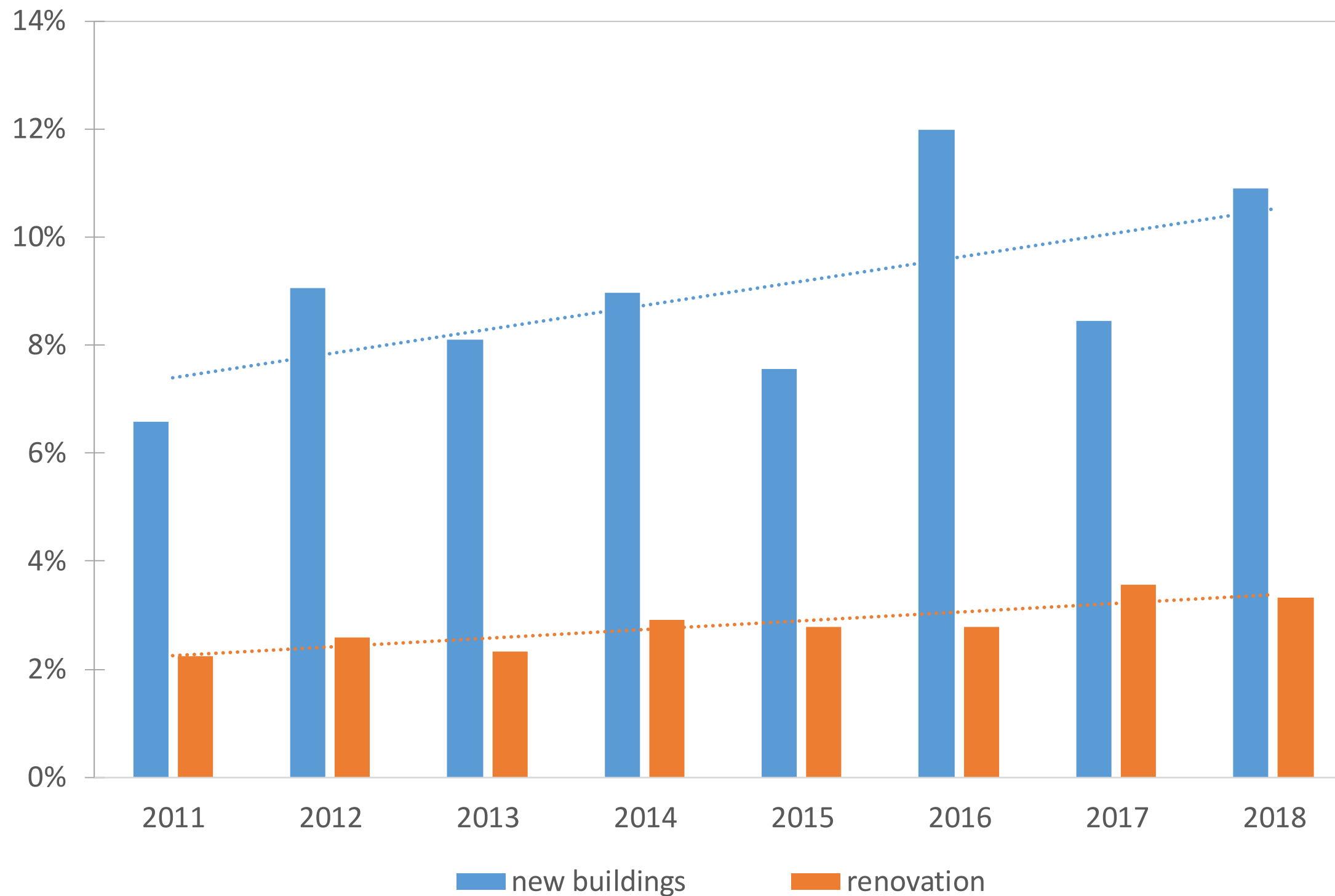
# ENVIRONMENTAL IMPACT OF TIMBER FRAME WALLS

Marijke Steeman, Eline Himpe, Matthias Vanroelen and Matthias De Roeck

# OVERVIEW

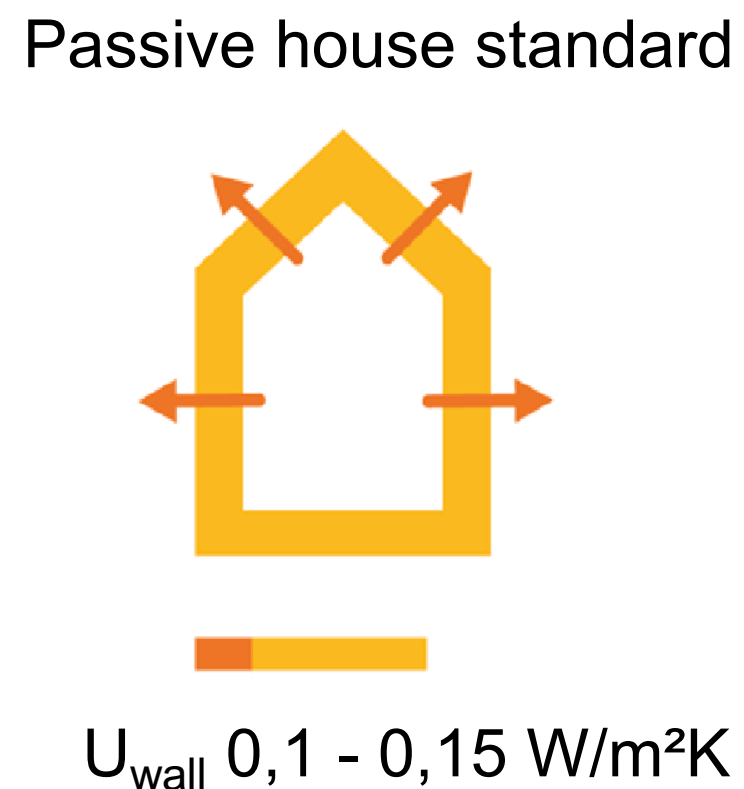
- Introduction and research aim
- Constituting materials
- Timber frame walls
- Influence of fasteners and tapes

# SHARE OF TIMBER FRAME INCREASES



# MATERIAL IMPACT

- Well-insulated, airtight construction
- More attention for sustainable construction
  - LCA-tool for building professionals launched in 2018

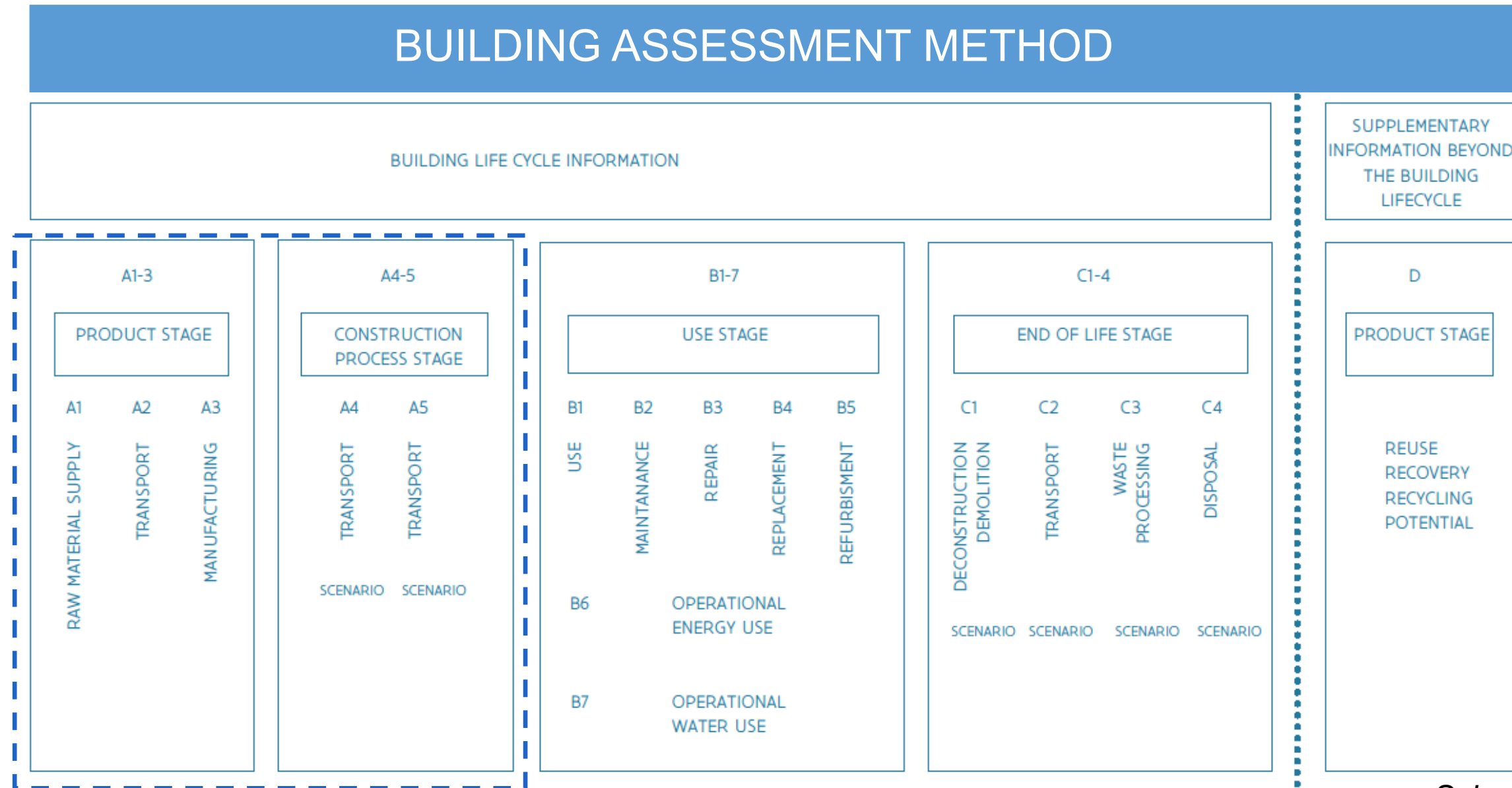


■ Impact of operational energy  
■ Impact of construction materials

# RESEARCH AIM

- Gain insight in environmental impact of timber frame walls
- Focus on building materials and construction typically used in Belgium
- Secondary materials taken into account e.g. measures for airtightness, fixings

# RESEARCH METHOD



*Scheme retrieved from OVAM*

Simapro version 8.4.0.0, Ecoinvent v. 3. 3 database  
ReCiPe 2008 end point (h) method

# RESEARCH METHOD

Select typical building materials



Environmental impact of constituting materials



Timber frame wall design



Environmental impact of timber frame walls



# CONSTITUTING MATERIALS

## Structural materials

I-joist



SLS



LVL



## Insulation

Cellulose flakes



Glass wool



Rock wool



## Exterior sheathing board

Wood fibre board



Medium density fibreboard



## Interior sheathing board

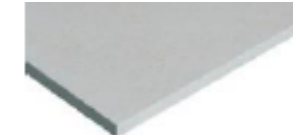
OSB3



Multiplex+PE



Gypsum FB+PE



Chipboard+PE



## Interior finishing materials

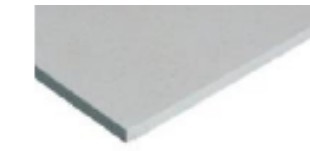
Medium density FB



Gypsum board



Gypsum FB



## External finishing materials

Airgap

Fiberglass



Battens



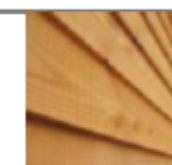
Masonry



External plaster



Wooden cladding



# CONSTITUTING MATERIALS & THEIR IMPACTS

## Structural materials

I-joist

SLS

LVL



## Insulation

Cellulose flakes

Glass wool

Rock wool



## Exterior sheathing board

Wood fibre board

Medium density fibreboard



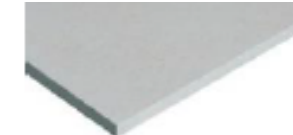
## Interior sheathing board

OSB3

Multiplex+PE

Gypsum FB+PE

Chipboard+PE

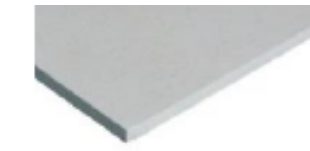


## Interior finishing materials

Medium density FB

Gypsum board

Gypsum FB



## External finishing materials

Airgap

Fiberglass

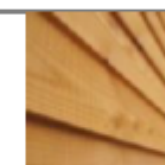
Battens



Masonry

External plaster

Wooden cladding



Life span

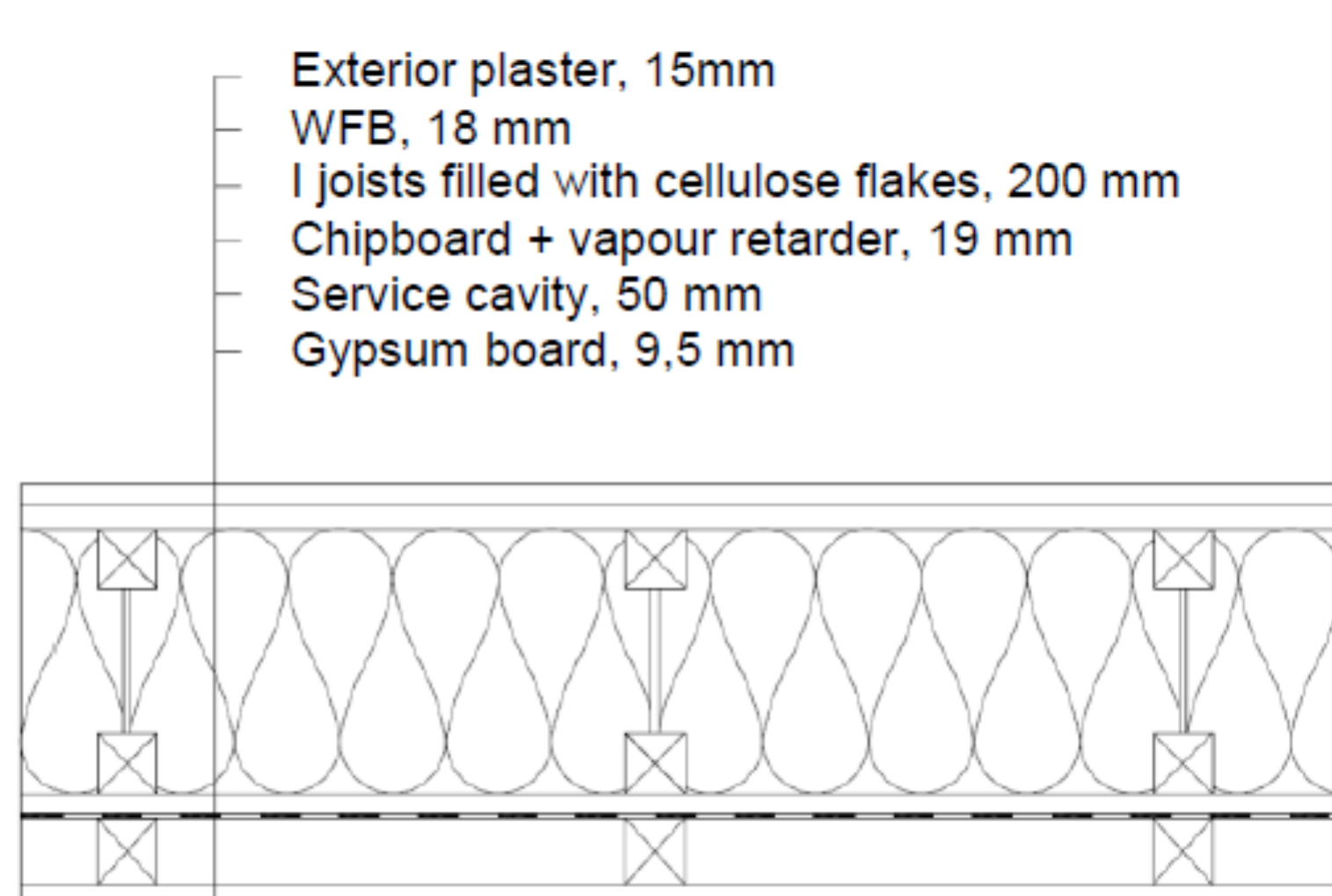
60 years

50 years

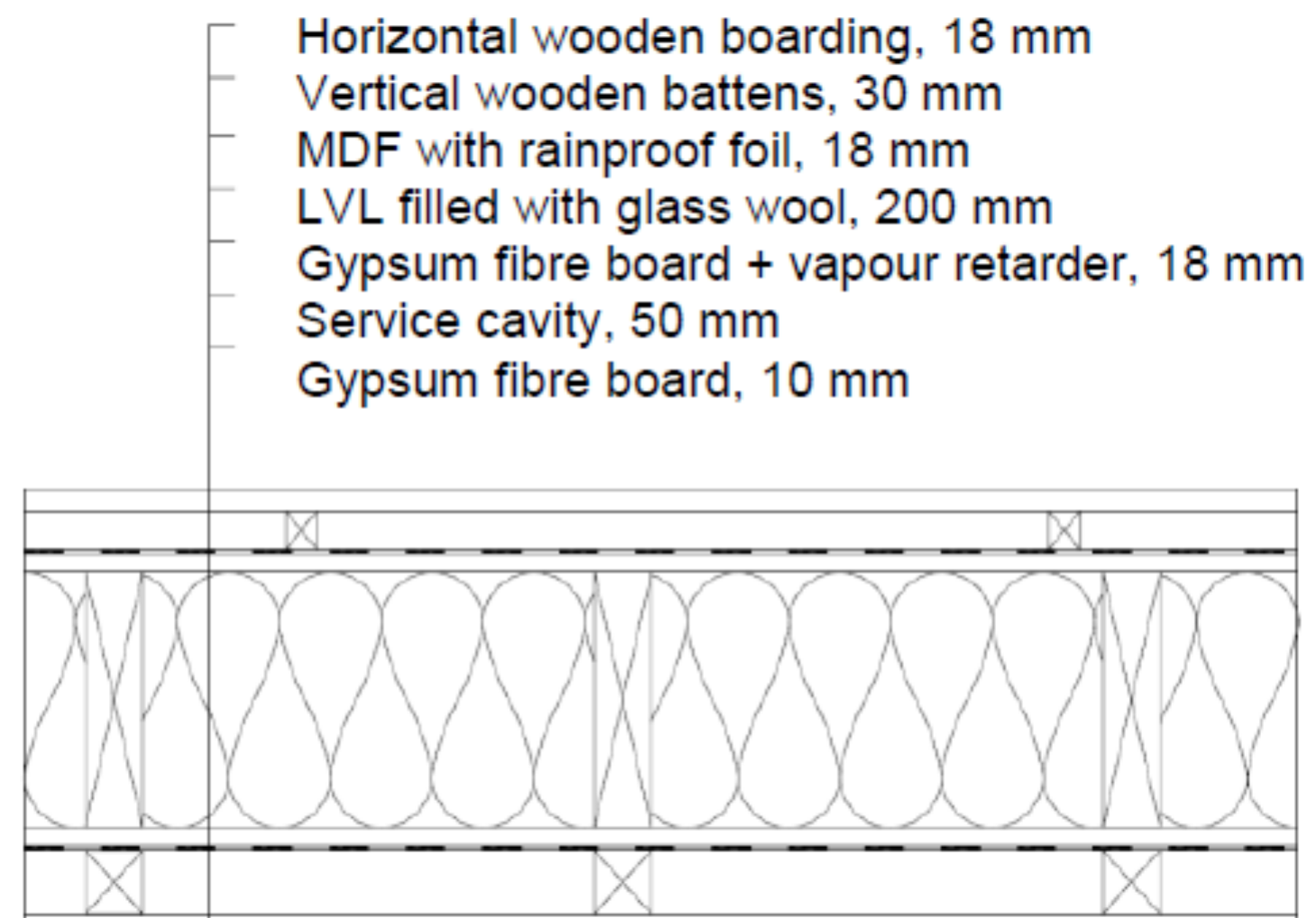
masonry 80 yr  
plaster 15 yr  
cladding 30 yr

Material choice with **highest** / **lowest** environmental impact

# TIMBER FRAME WALL DESIGN



Construction with lowest impact



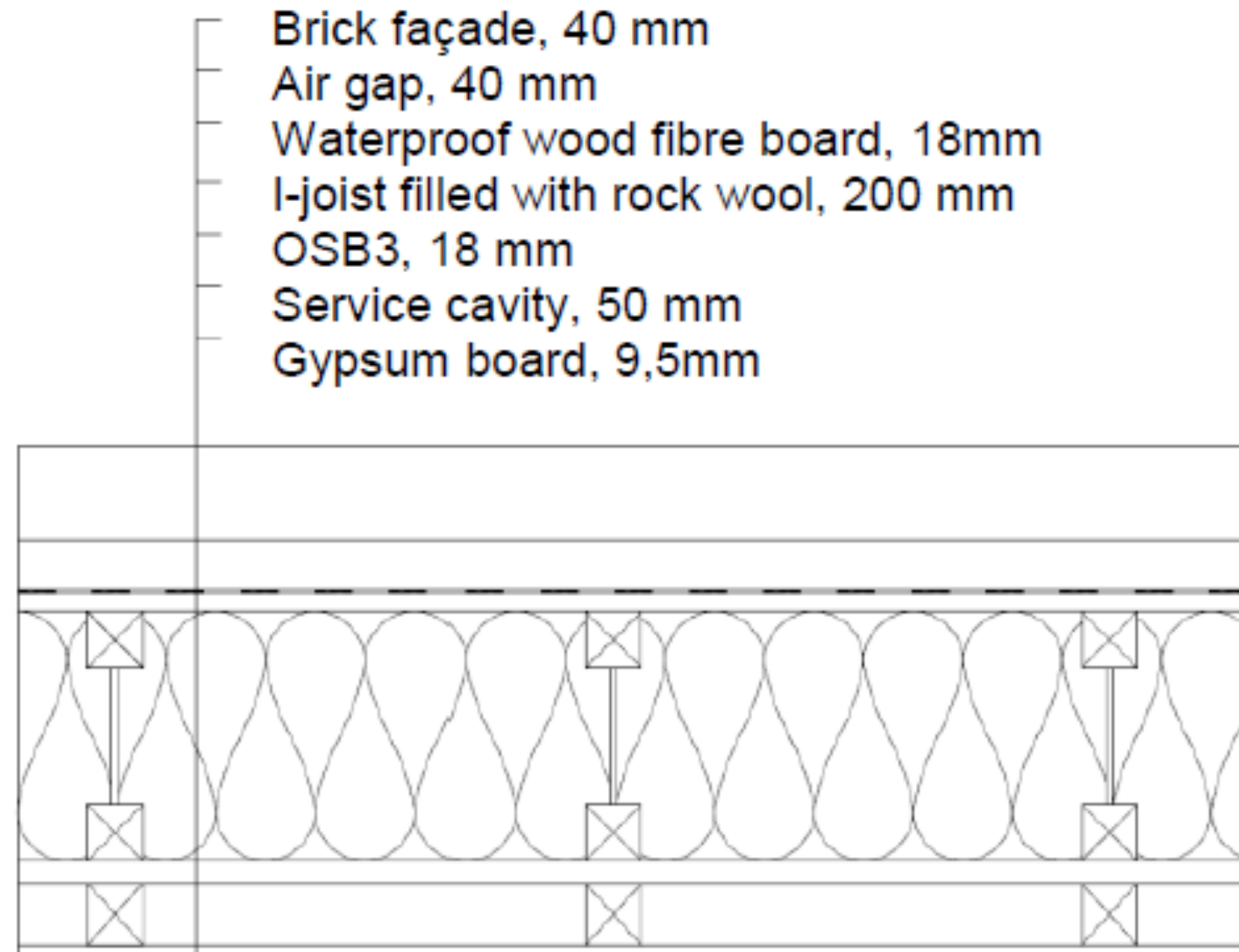
Construction with highest impact

U-value 0,22 W/m<sup>2</sup>K

F.U. 1m<sup>2</sup> wall

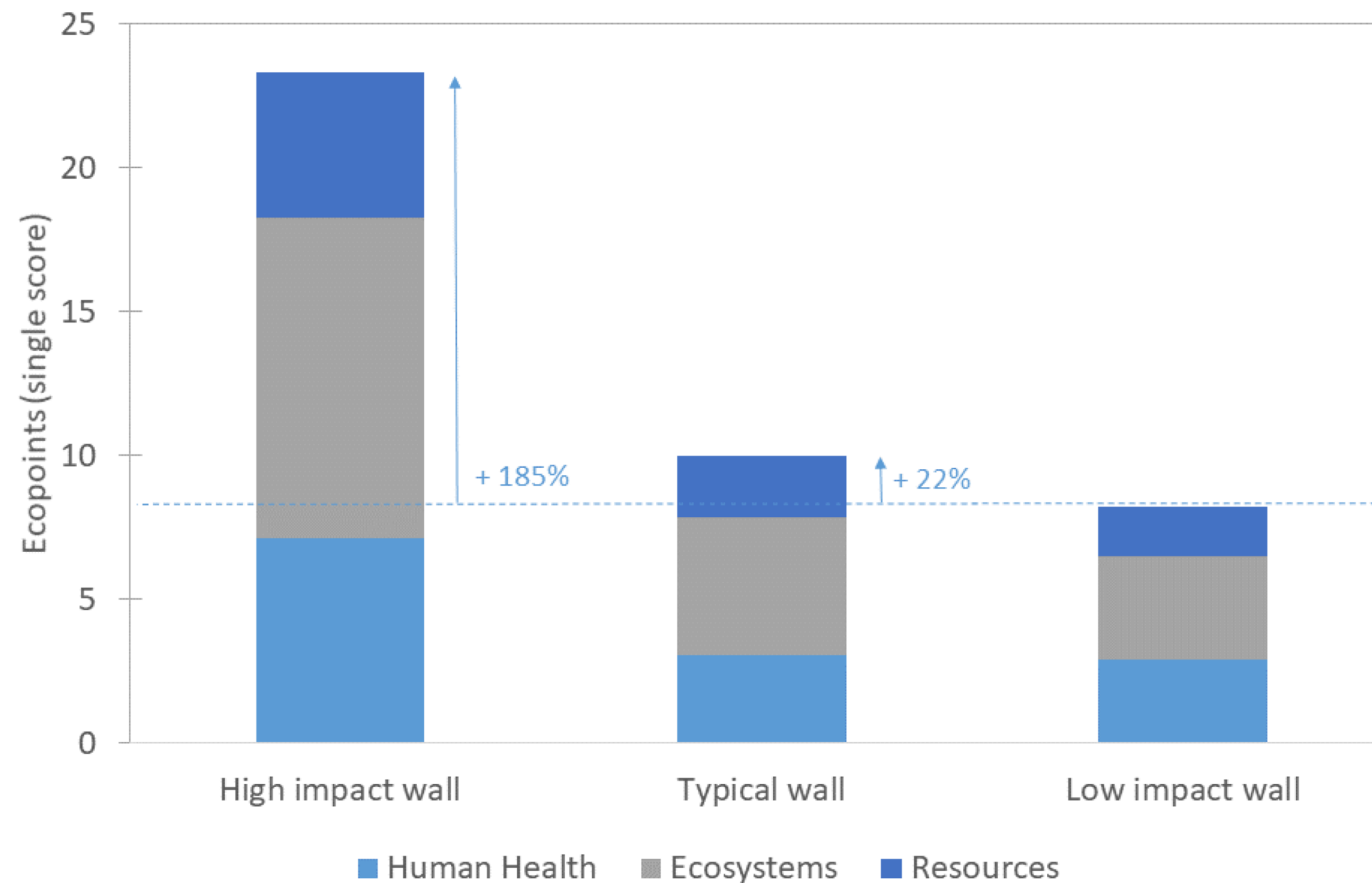
# TYPICAL TIMBER FRAME CONSTRUCTION

U-value 0,22 W/m<sup>2</sup>K  
F.U. 1m<sup>2</sup> of wall



# RESULTS ON COMPONENT LEVEL

- Highest impact ~ 3 times lowest impact
- Typical timber frame construction has quite good performance



# IMPACT OF SECONDARY MATERIALS

Timber frame wall 3 m x 2,44m

8 vertical I-joists (h-to-h 40 cm)

Airtight tapes

- Seam OSB3 boards (8 x 2,44m)
- Top + bottom wall (2 x 3m)

+ *0,17 kg tape*



# IMPACT OF SECONDARY MATERIALS

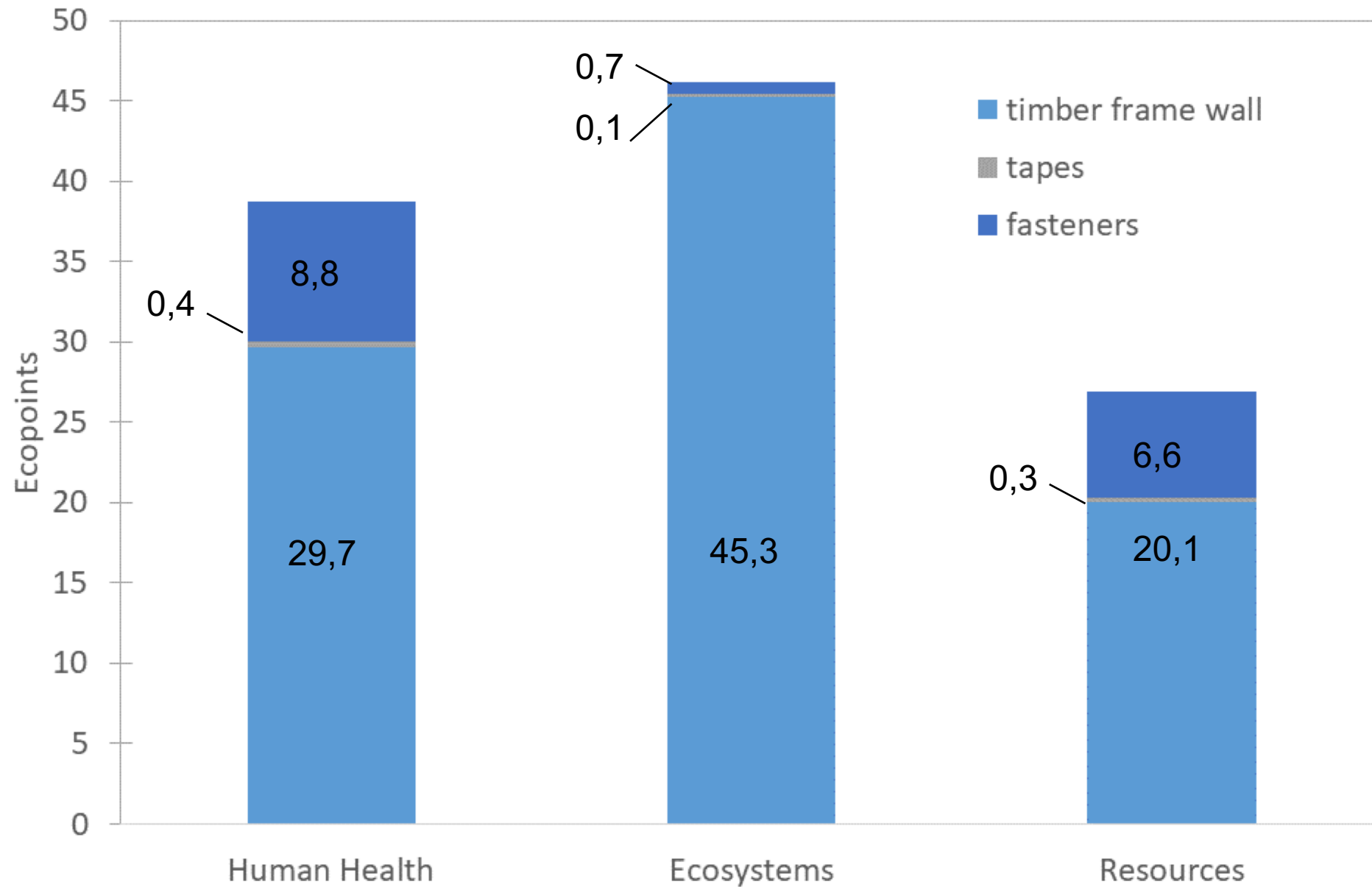
Timber frame wall 3 m x 2,44m

8 vertical I-joists (h-to-h 40 cm)

- Cavity anchors 4 per m<sup>2</sup> facade
  - Staples to fasten WFB
  - Staples to fasten OSB
  - Screws to fasten gypsum board
  - Screws for horizontal beams
  - Threaded rod
- + 6,4 kg stainless steel



# IMPACT OF SECONDARY MATERIALS



- Total impact + 17,75%
- 16,94% results from fasteners
- 0,81% results from tapes
- Largest impact on HH and resources



# CONCLUSIONS

- Environmental impact of typical timber frame construction is quite good compared to the range of materials that can be used
- Fasteners make up almost 20% of total impact
  
- Next steps
  - Alternative materials e.g. plastic cavity anchors
  - Bio-based (insulation) materials
  - Impact of prefabrication

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