# EARLY DESIGN STAGE BUILDING LCA USING THE LCABYG TOOL:

## COMPARING CASES FOR EARLY STAGE AND DETAILED LCA APPROACHES

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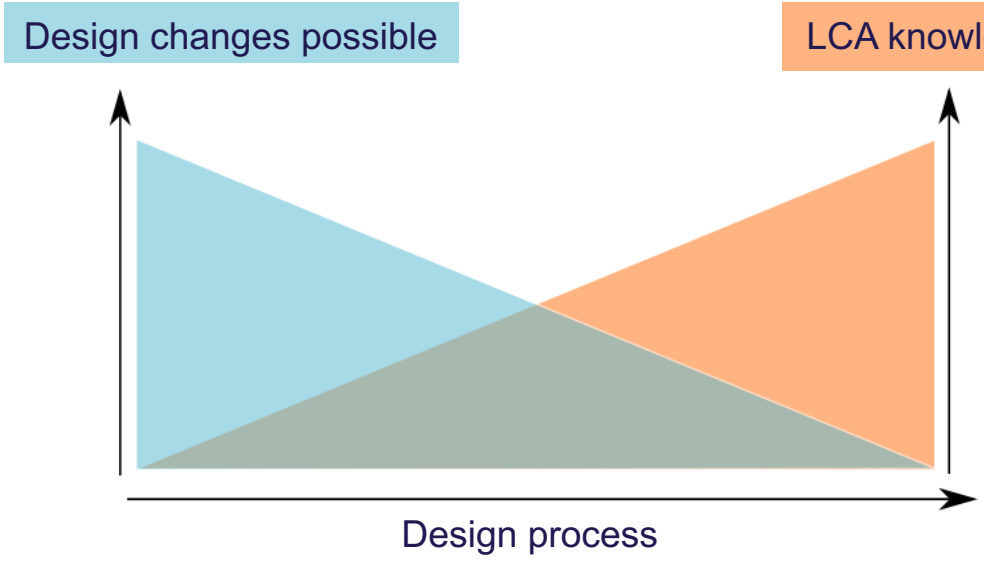
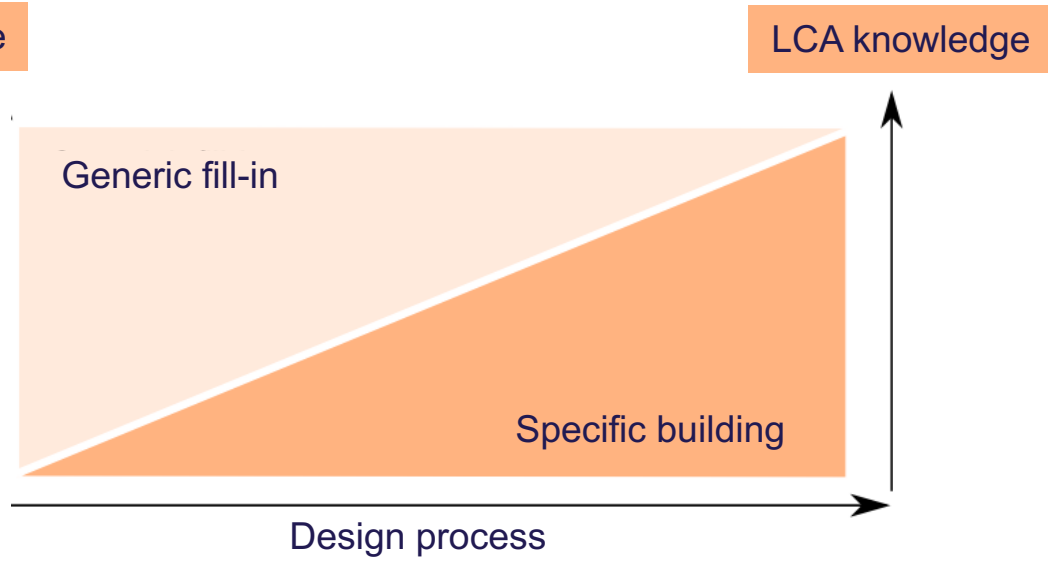
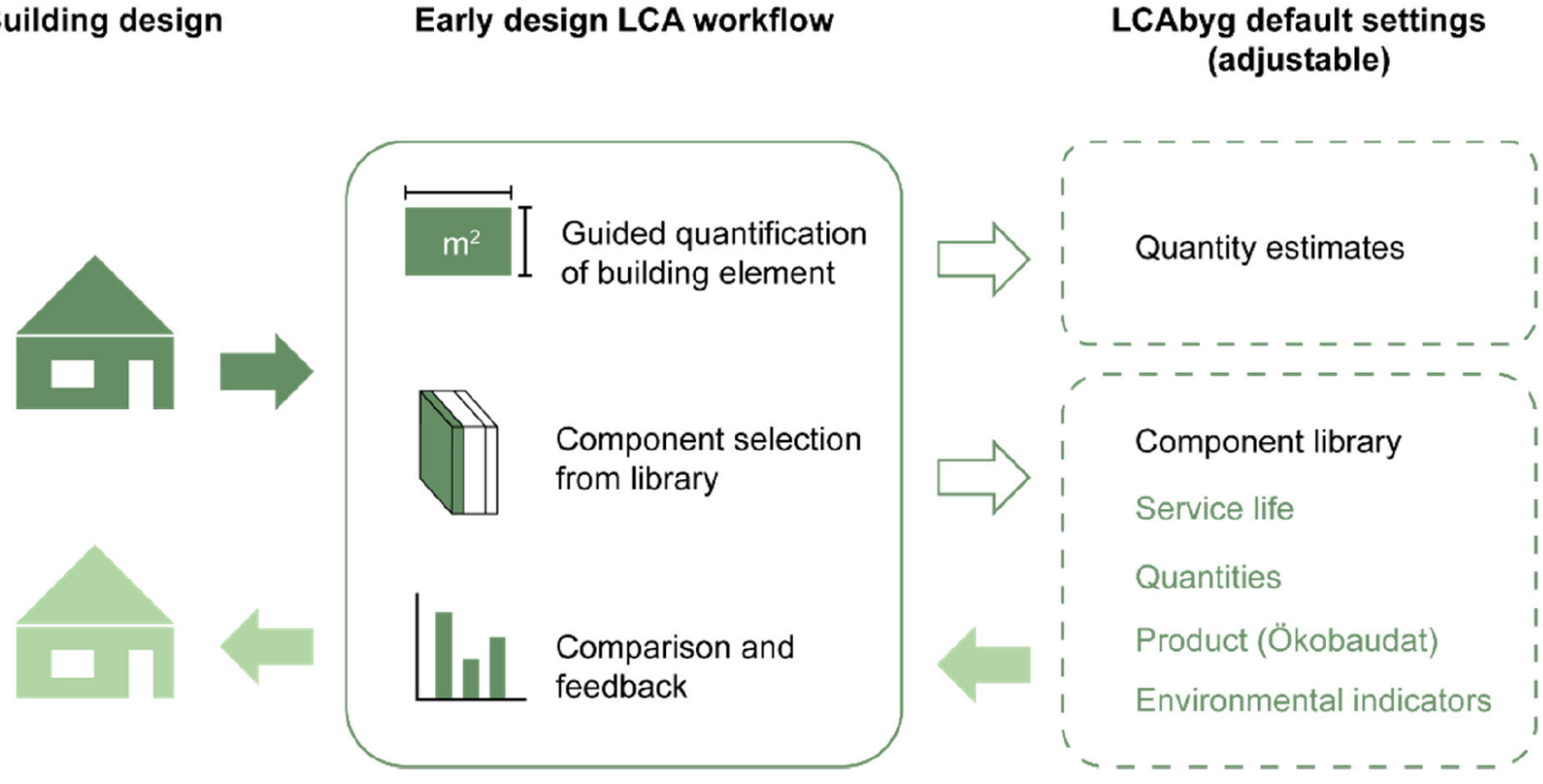
# Early design LCA for buildings



# LCAbyg tool – Early design functions in version 4.0 Beta



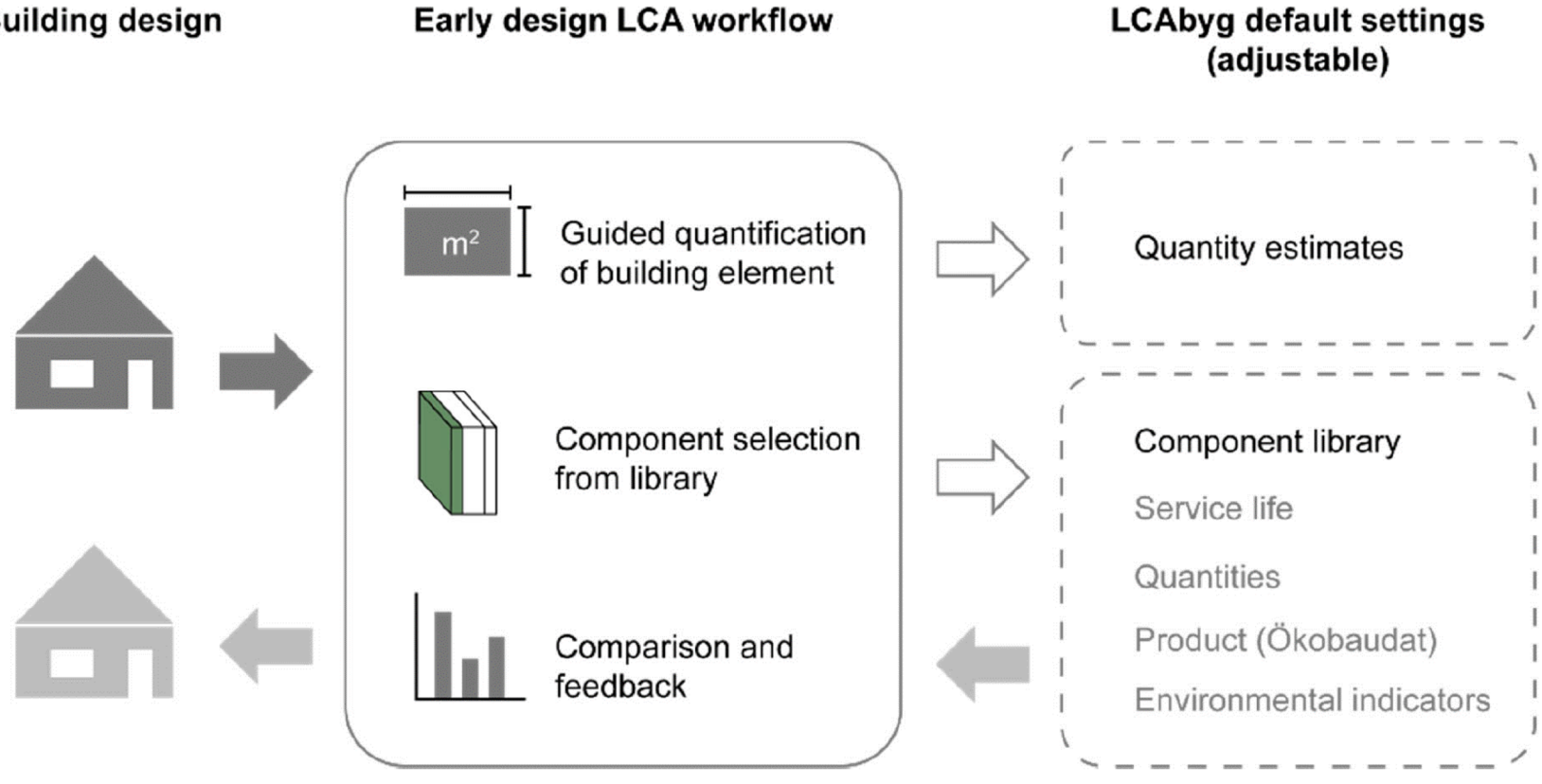
# Tasks: Evaluating early design approach

- How precise is the early design tool?

- Does the design tool give a higher impact than the typical LCA (as expected)?

Early design tool is conservative in material estimation and selected impact data and complete in building inventory
→ The tool's results should therefore be higher than the typical LCA

# Tasks: Evaluating early design approach



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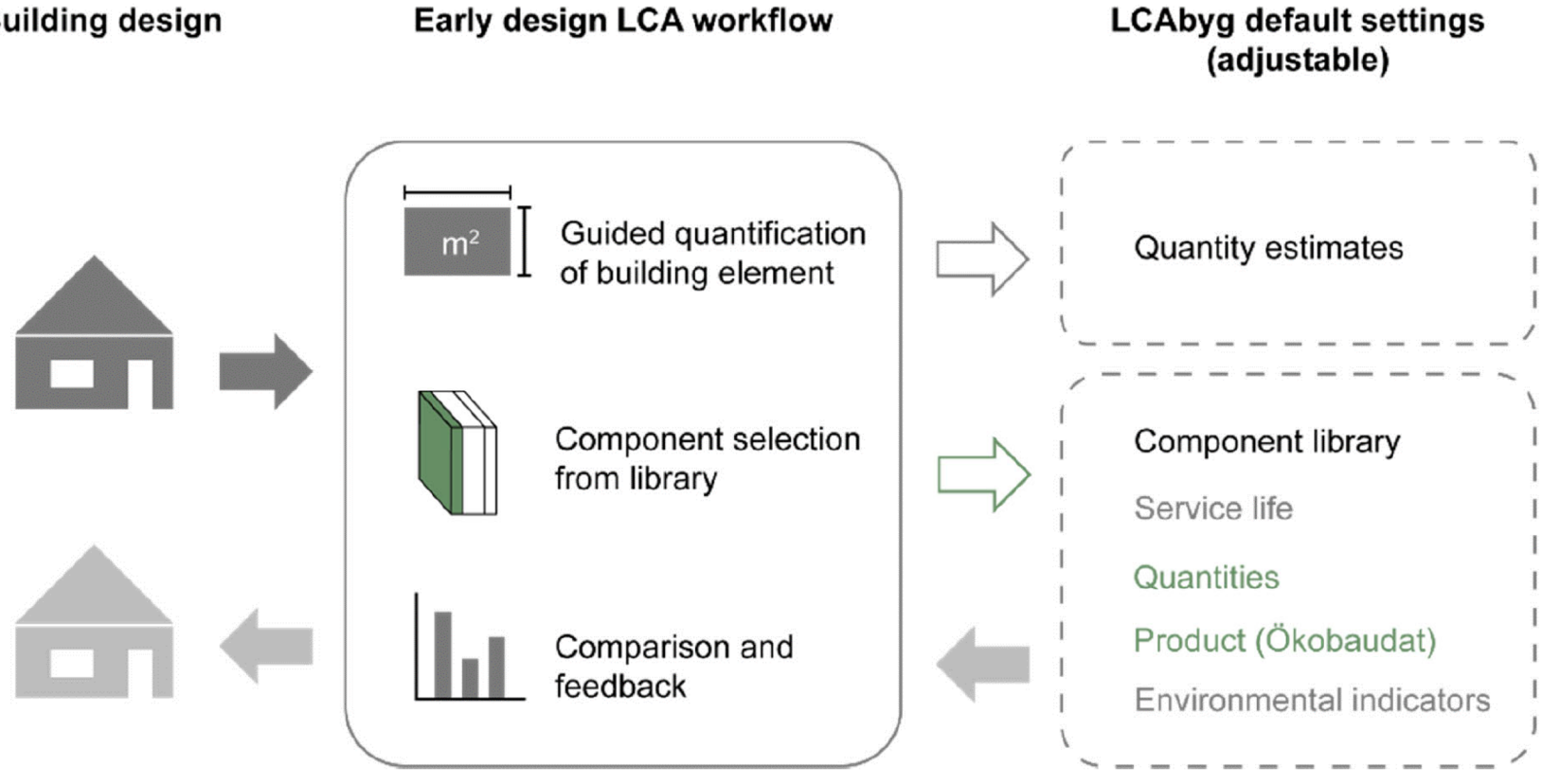


# Method

- Using LCA from existing cases
- Using tool for early design approach on the same cases

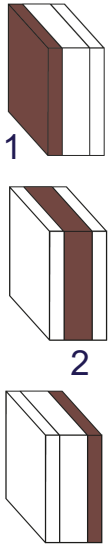
→ comparing results on GWP

# Case buildings

- LCA from building certification
- Different construction types

| | Building type | Characteristic |
|---|---|---|
| **Case A** | Residential,Terraced house | *Low energy building* |
| **Case B** | Residential, Multi-family building | *Wood structure, cellulose insulation* |
| **Case C** | Residential, Terraced house | *Conctrete strcture, brick facade* |

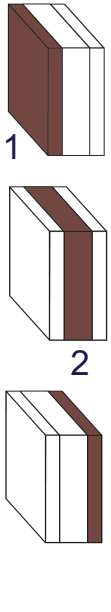
# Scenarios




| | BL (Base Line) | | ED1 (Early design 1) | | ED2 (Early design 2) | |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - |
| | - | - | - | - | - | - |
| 2 | 260 mm | Cellulose fibre | 300 mm | Mineral wool | *260* mm | Cellulose fibre |
| | 40 mm | CLT | 100 mm | CLT | *40* mm | CLT |
| 3 | - | - | 0.38 kg | Wood protection | - | - |
| | 30 mm | Pine wood | 30 mm | Pine wood | 30 mm | Pine wood |
| | - | - | 150 g | Screws, nails, fittings in galvanized steel | 150 g | Screws, nails, fittings in galvanized steel |
| | 150 g | Aluminum profile | 2 mm | Wood lists | 2 mm | Wood lists |
| | 1 pcs | Plaster board, wind barrier | 1 pcs | Plaster board, wind barrier | 1 pcs | Plaster board, wind barrier |

# Scenarios

Specific inventory  Component library  Adjusted component library

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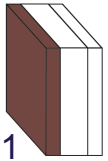
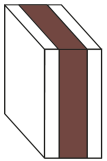
# Scenarios

Completeness

Completeness
+ Accuracy



1



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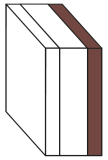

3

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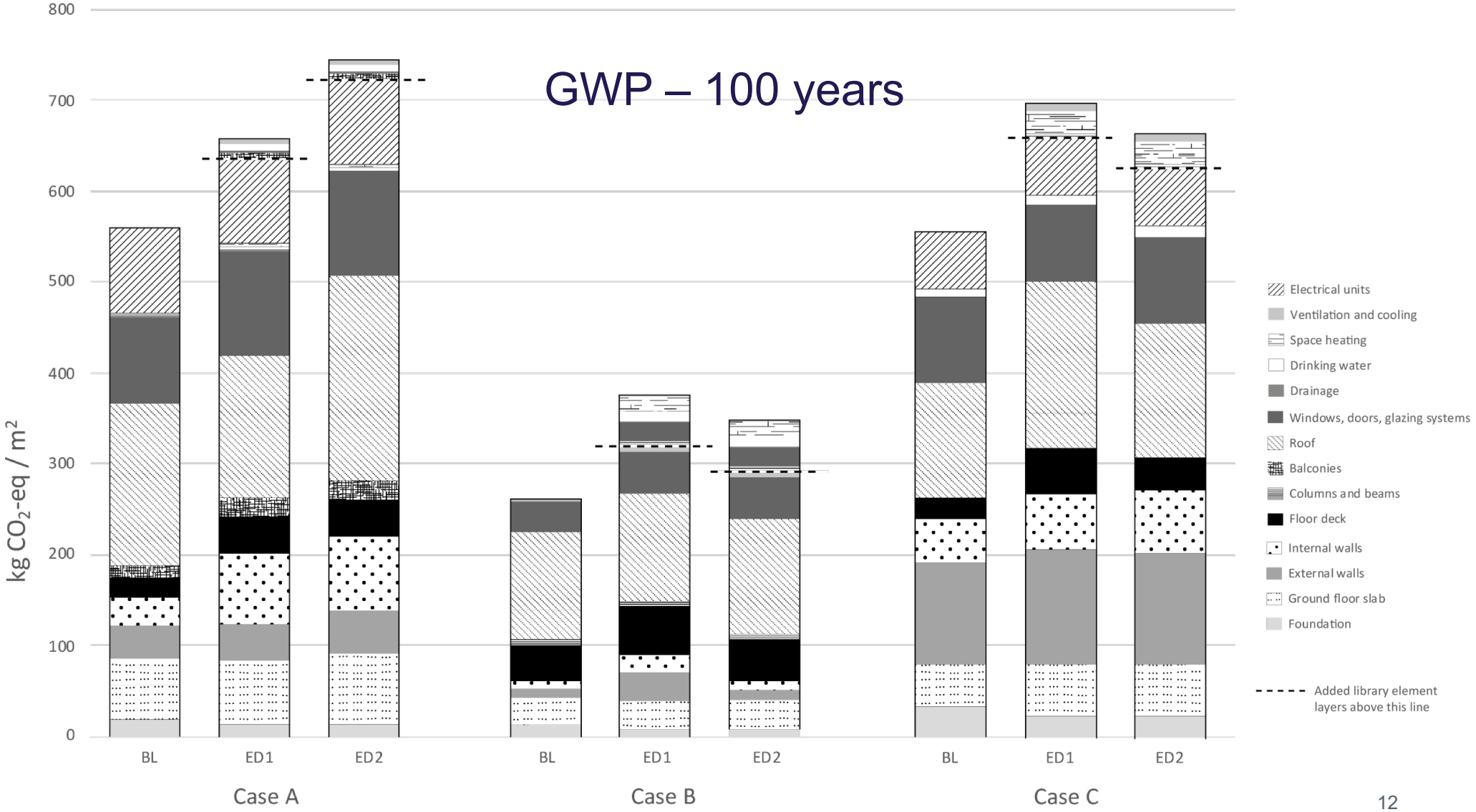
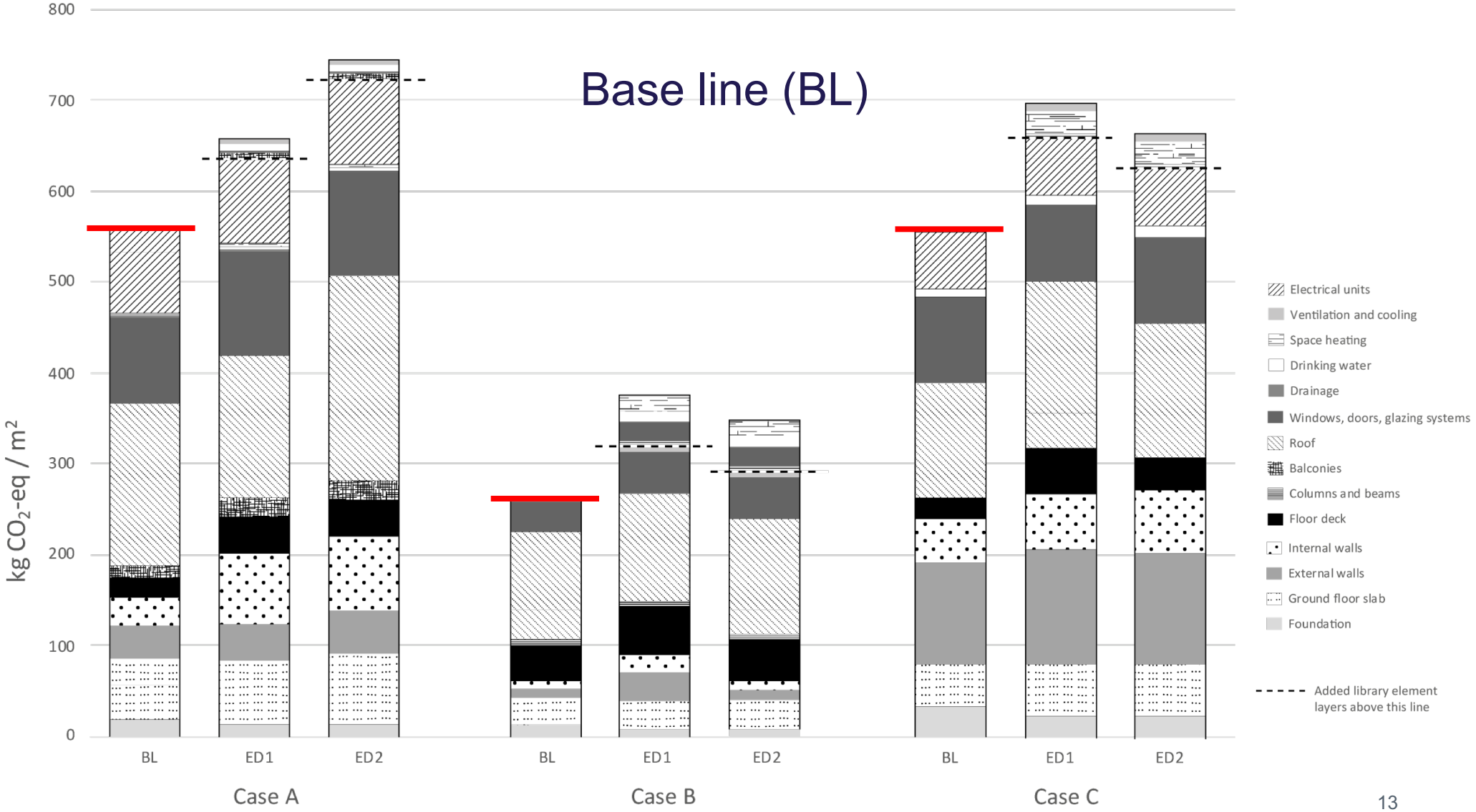
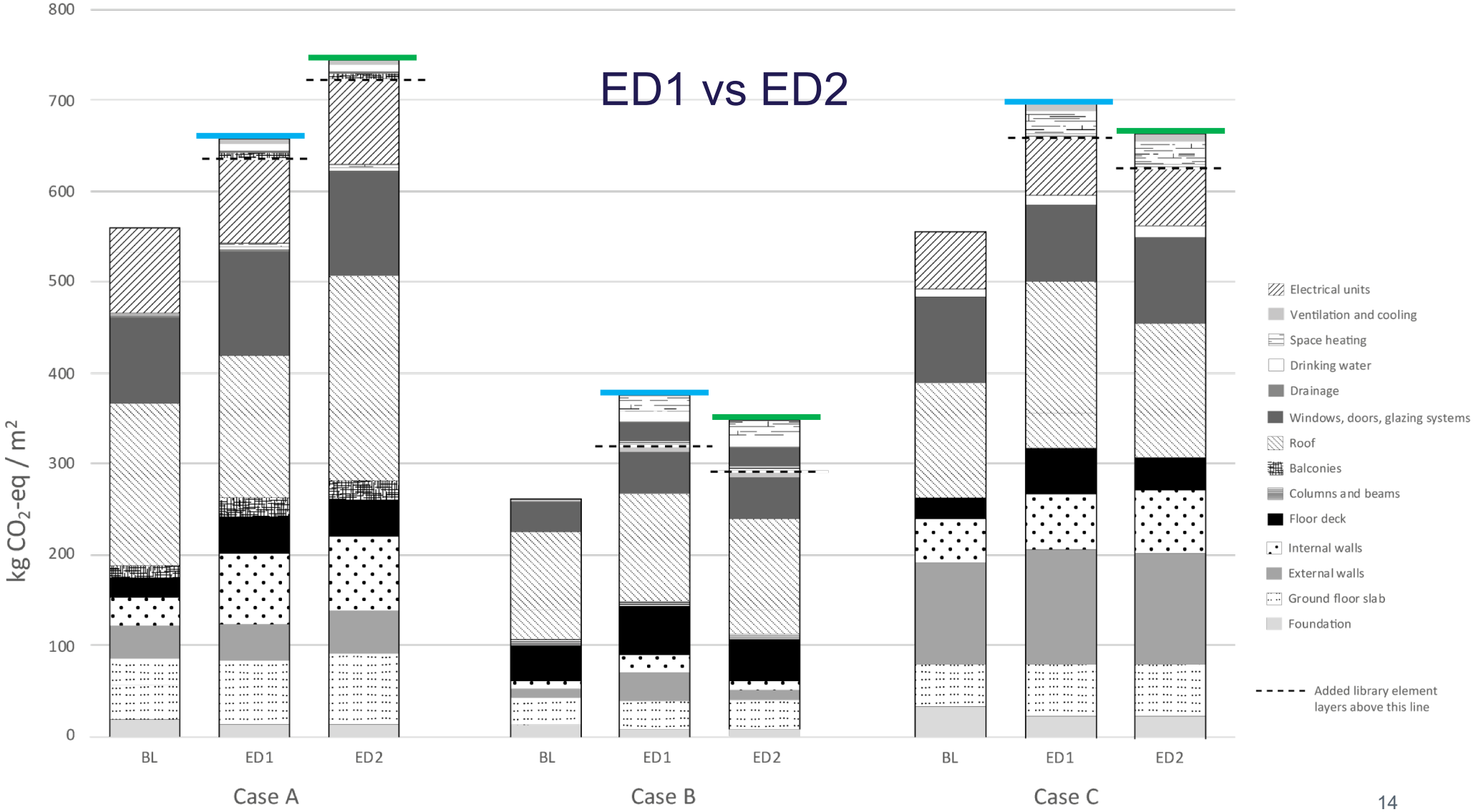
# GWP – 100 years



# Base line (BL)


800
700
600
500
400
300
200
100
0
kg CO2-eq / m2
BL
ED1
ED2
Case A
Case B
Case C
Electrical units
Ventilation and cooling
Space heating
Drinking water
Drainage
Windows, doors, glazing systems
Roof
Balconies
Columns and beams
Floor deck
Internal walls
External walls
Ground floor slab
Foundation
Added library element layers above this line

# ED1 vs ED2


800
700
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kg CO2-eq / m2
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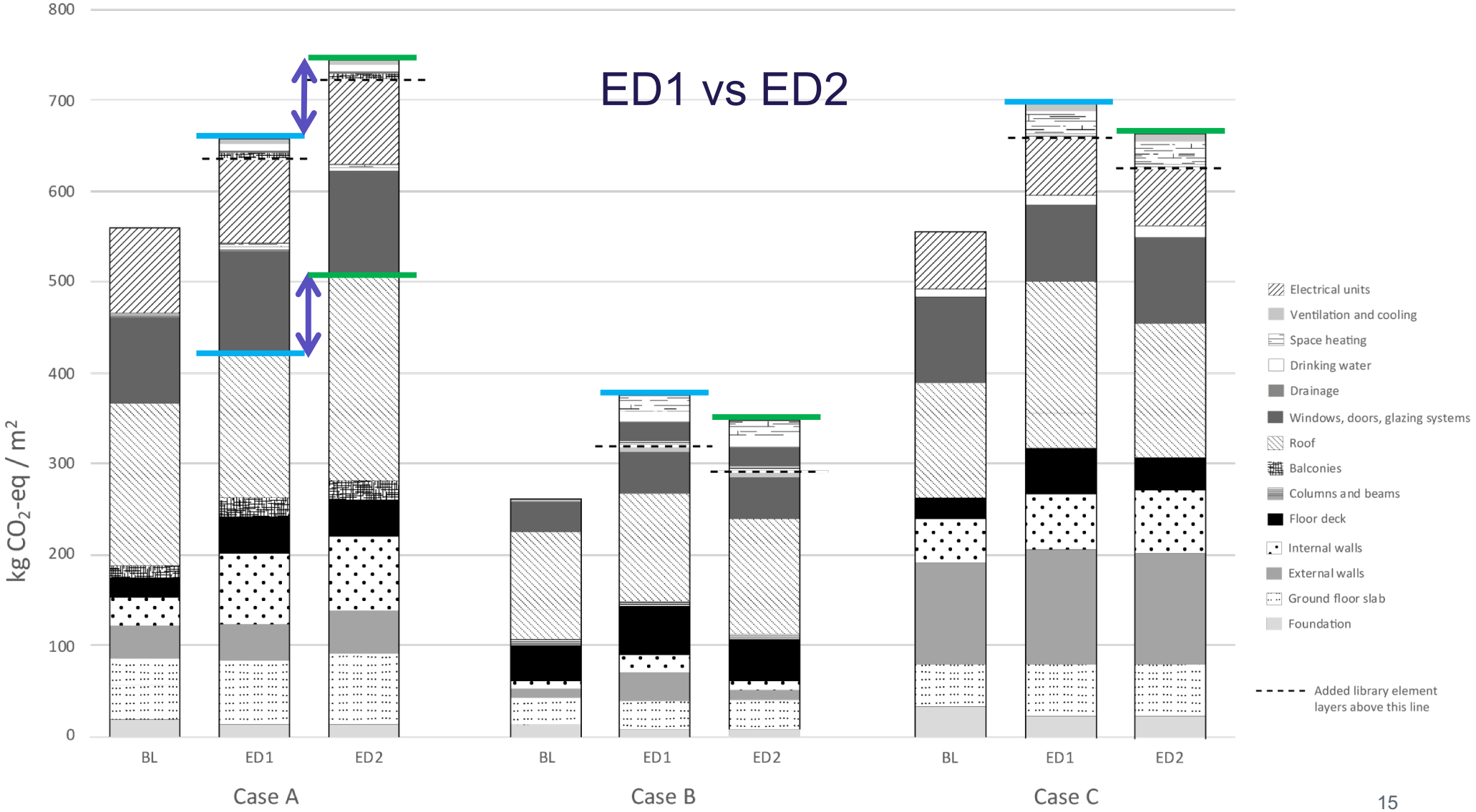
ED1 vs ED2
kg CO2-eq / m2
800
700
600
500
400
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100
0
BL
ED1
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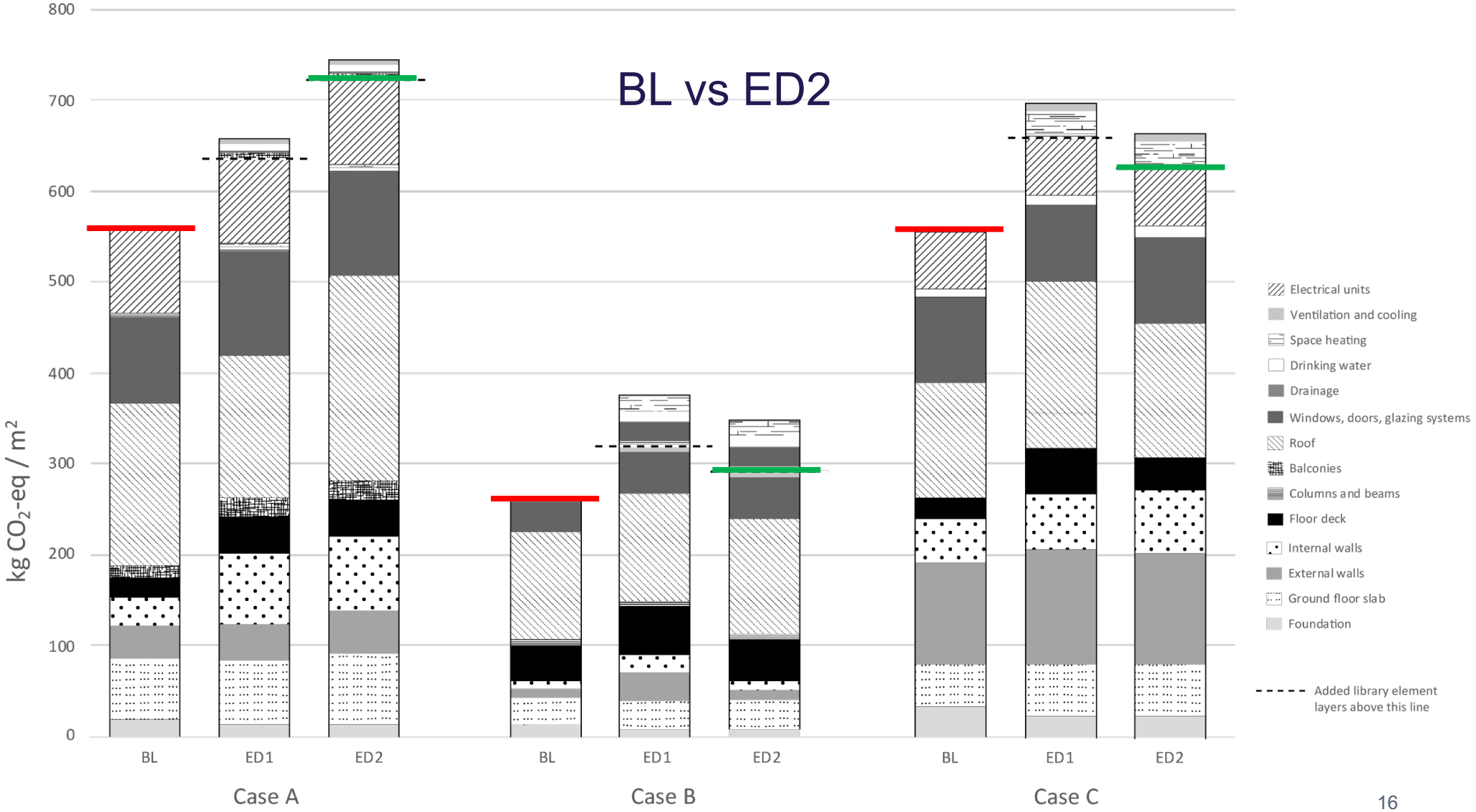
# BL vs ED2


800
700
600
500
400
300
200
100
0
kg CO2-eq / m2
BL
ED1
ED2
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Yes, but..

- How precise is the early design tool?

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Yes, but..

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Within 12%

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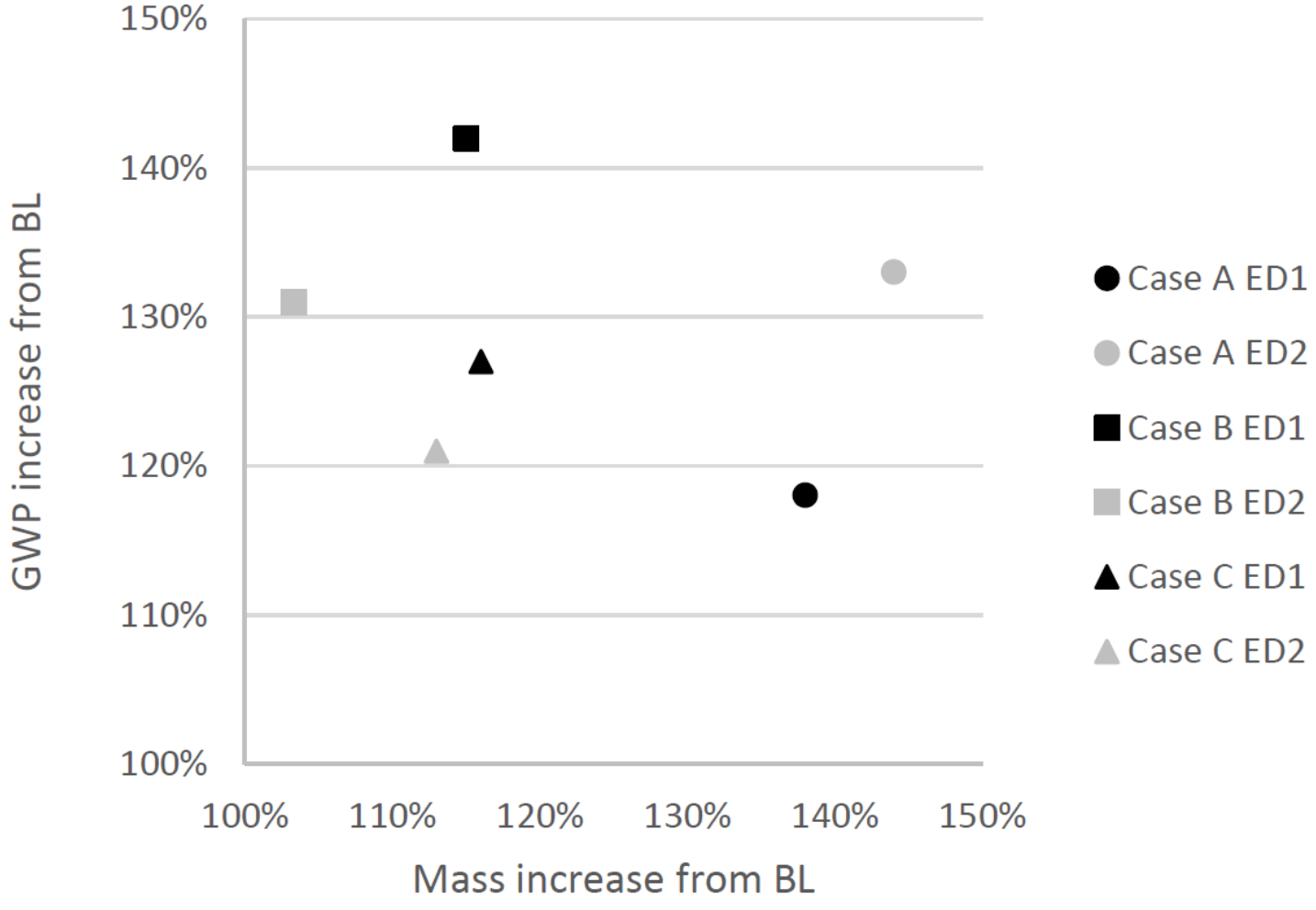
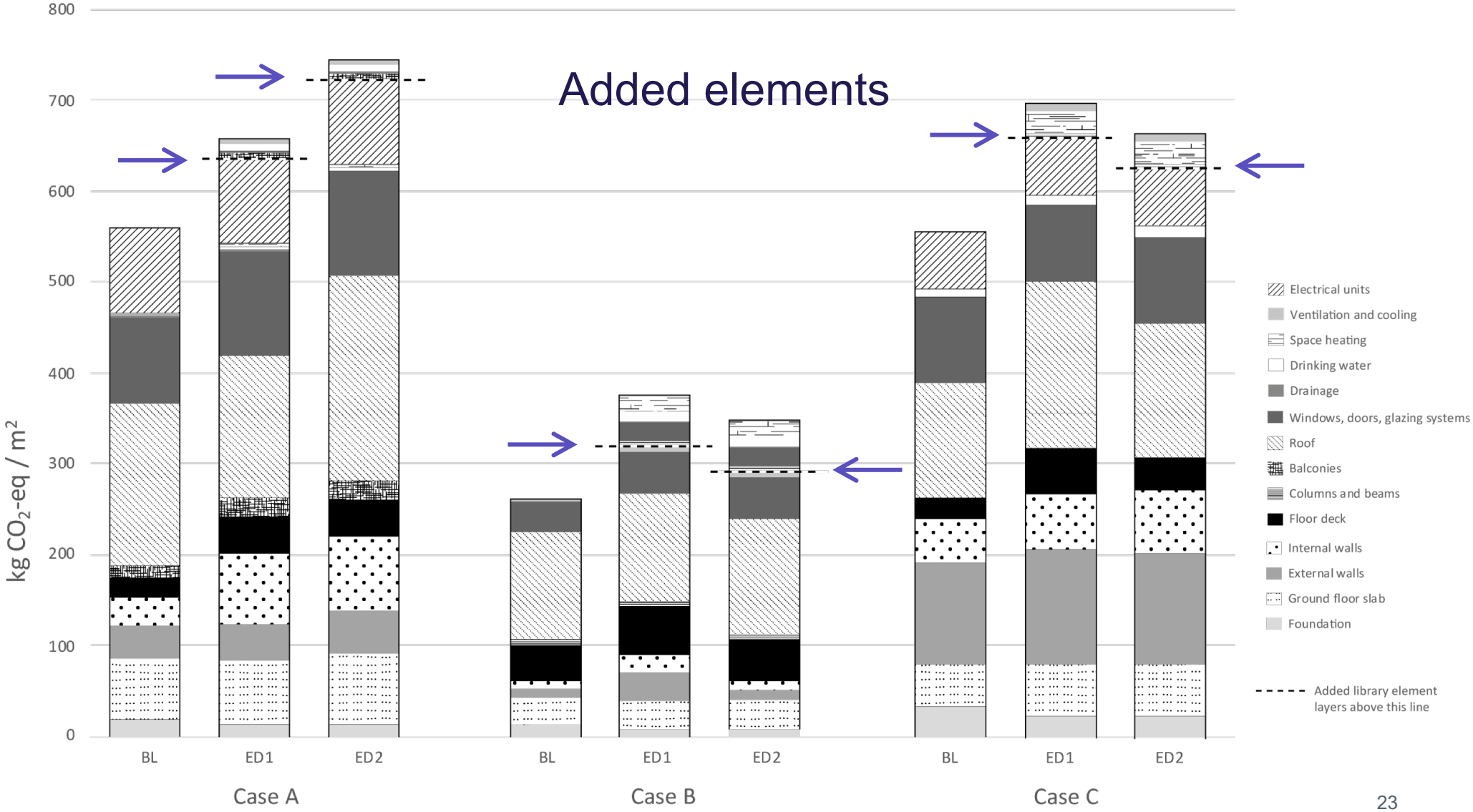
# Mass and GWP correlation



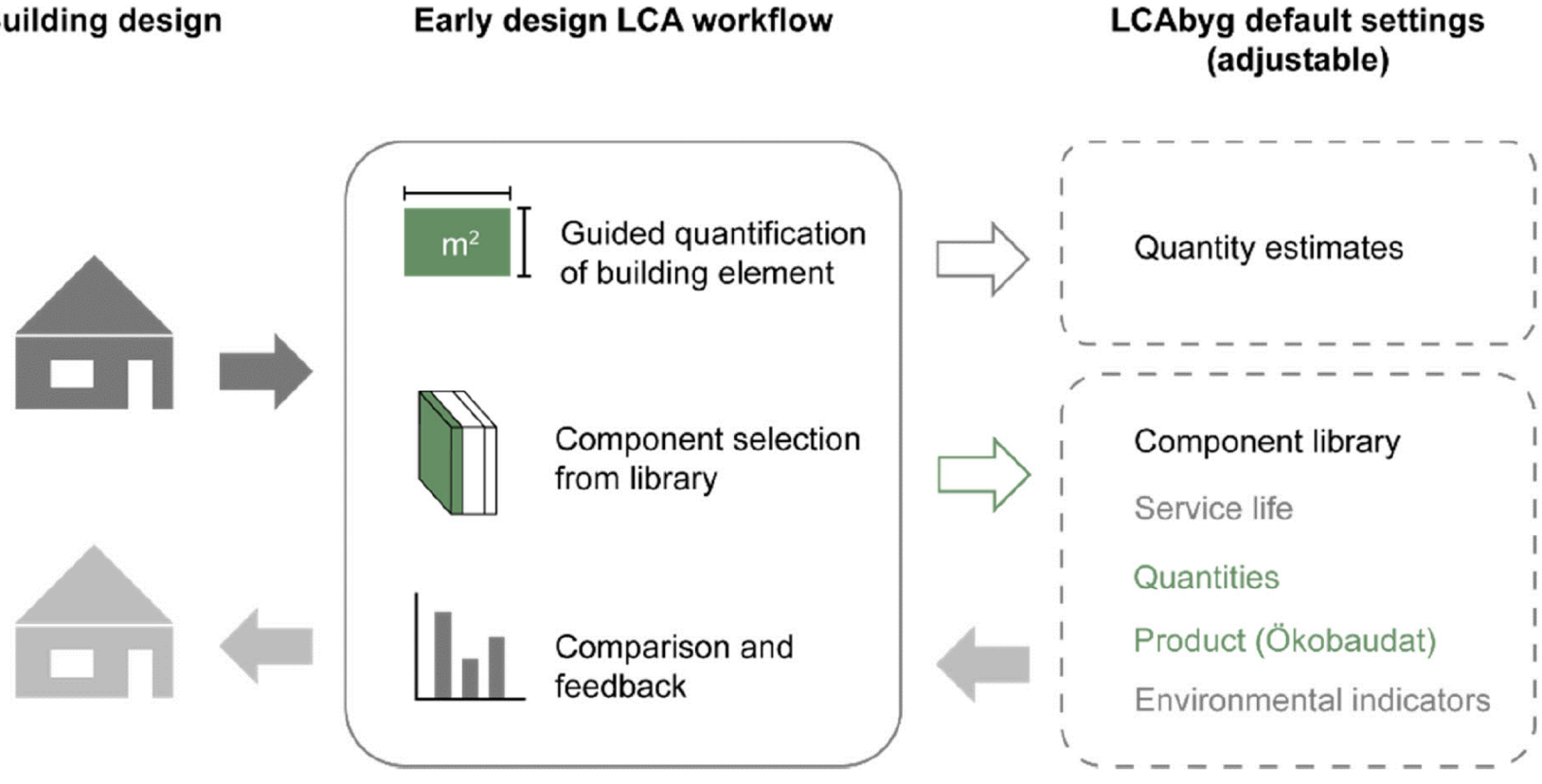
# Inventory scheme

| Building element | Element layers | Case A | | Case B | | Case C | |
|---|---|---|---|---|---|---|---|
| | | BL | ED2 | BL | ED2 | BL | ED2 |
| Foundations | Foundations | x | | x | | (x) | |
| Ground floor slab | Flooring | x | | x | | x | |
| | Load-bearing system | x | m | x | q | x | q |
| | Insulation and underlay | (x) | q | (x) | | x | q |
| External walls | Inside finishing | (x) | | n/a | | x | |
| | Load-bearing and insulating system | x | q, m | x | q, m | x | q |
| | Façade system | x | | x | m | x | |
| Internal walls | Finishing | x | | x | | x | |
| | Load-bearing | x | q, m | x | q, m | x | q |
| | Finishing | x | | n/a | | x | |
| Floor deck | Flooring | x | | x | | x | |
| | Load-bearing and insulating system | x | q | x | q | x | q, m |
| | Ceiling | (x) | | x | | x | |
| Columns and beams | Columns and beams | n/a | | x | | n/a | |
| | Finishing | n/a | | - | | n/a | |
| Balconies | Platform | x | q | n/a | | n/a | |
| | Mounting | - | | n/a | | n/a | |
| | Balustrates and handrails | x | | n/a | | n/a | |
| Roof | Roof cladding | x | | x | | x | |
| | Load-bearing and insulating system | x | q, m | x | q, m | x | q, m |
| | Ceiling | x | | x | | x | |
| Windows, doors, glazing systems | Profiles | x | | x | | x | q |
| | Panes | x | | x | | x | |
| | Doors | x | | - | | x | |
| Drainage | Soil pipe | - | | - | | - | |
| | Down comer | x | | - | | - | |
| Drinking water | Hot water tank | - | | - | | x | |
| | Piping | x | | - | | - | |
| Space heating | Supply | x | | - | | - | |
| | Piping | n/a | | - | | - | |
| | Radiator / floor heating | x | | x | | - | |
| Ventilation and cooling | Supply | - | | x | | - | |
| | Ductwork | x | | - | | - | |
| Electrical units | PV-panels | x | | n/a | | x | |

# Added elements



# LCAbyg tool – Early design functions in version 4.0 Beta



# Scenarios

Certification

Component selection from library

Quantities

Product (Ökobaudat)

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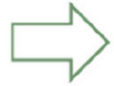
# Scenarios

| Baseline (BL) | Early Design 1 (ED1) | Early Design 2 (ED2) |
|---|---|---|
| Certification |  Component selection from library |   Quantities Product (Ökobaudat) |
| Specific inventory | Component library | Adjusted component library |