Greenhouse gas emission from construction process of multi-story wooden buildings

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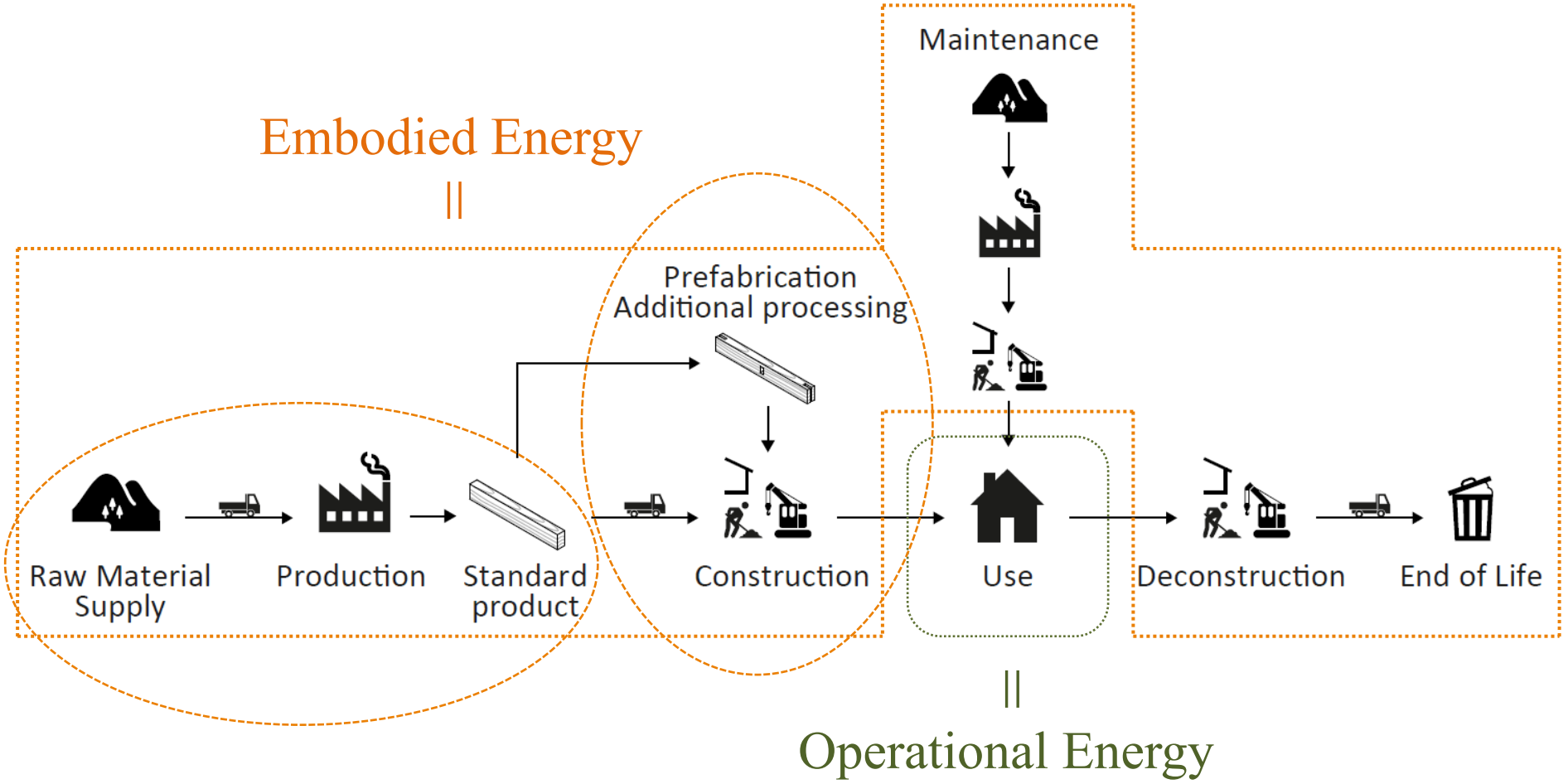
Building life cycle assessment



Construction stage in a building life cycle

Early studies

- In many cases, less than 10% of the total energy use in a building life cycle [4-10].
- Wooden building: 6-16% of the initial embodied energy, and 8-20% of the initial embodied greenhouse gas emission (GHG) [5].

Recent studies

- Operation phase of a building is still dominant, but the construction stage is the next most important area [22]
- Several studies indicates the importance of the construction stage [11-14]

* Reference number corresponds to the reference list in the full paper.

Objective of this study

To investigate GHG emission from the construction stage based on the detailed data collection and assessment

Case study buildings

5 story, 488m2
Sawn timber panel frame
Germany

3 story, 548m2
Cross laminated timber frame
Finland

5 story, 1398m2
Cross laminated timber frame
Italy

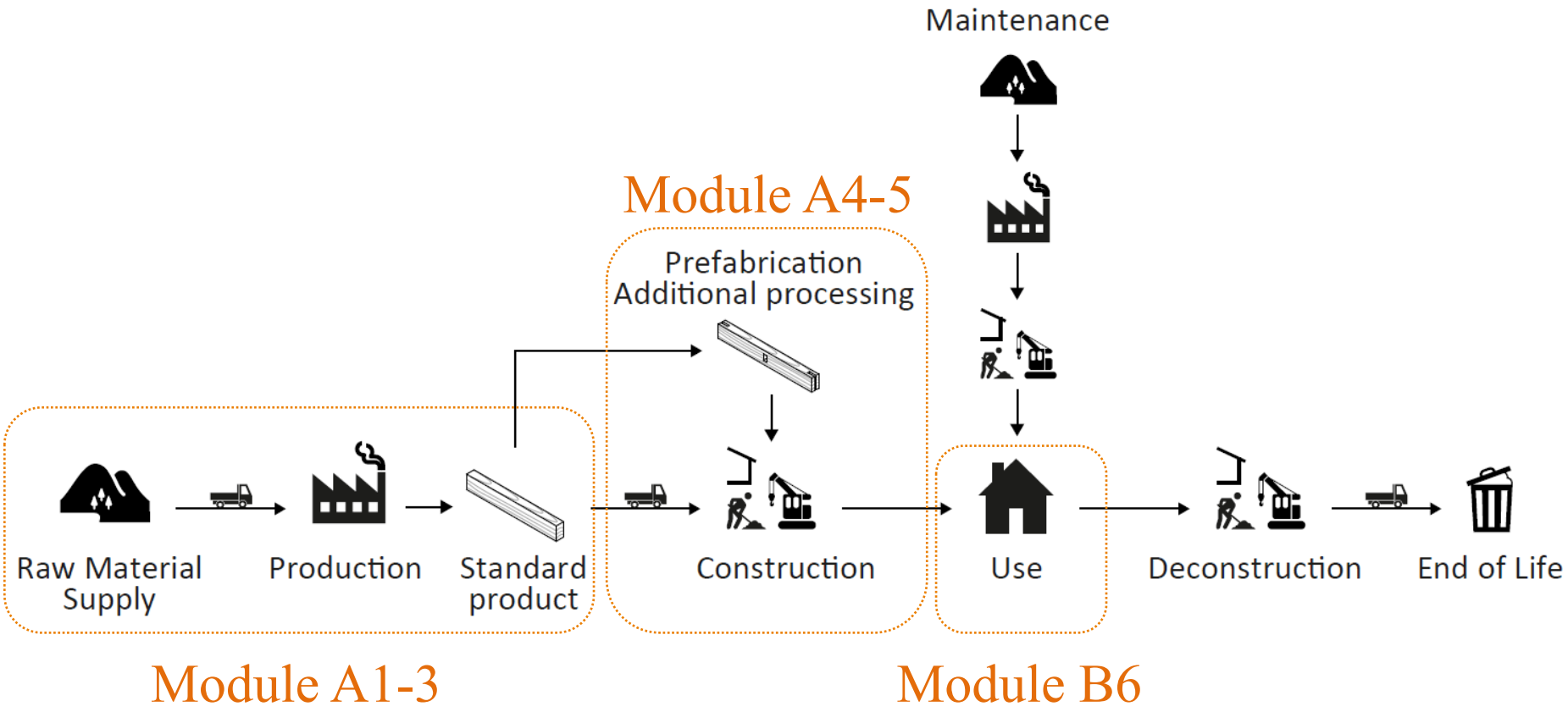
Assessment conditions

LCA data: **ecoinvent ver.2.2**

Assessment category: **Greenhouse gas emission**

Functional unit: **m2 of living floor area**

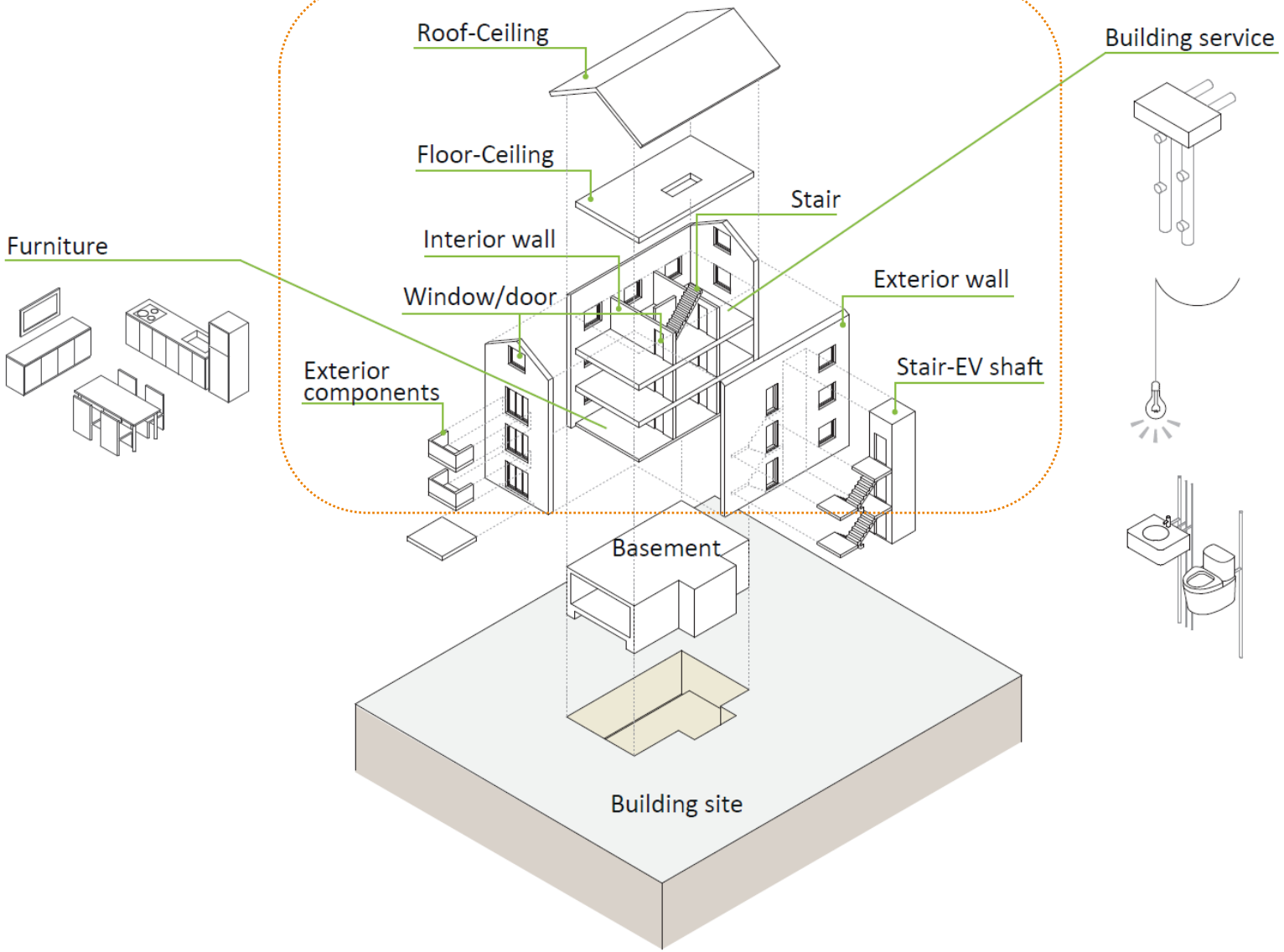
Covered life cycle modules



Reference: EN15978

Included building parts

*Only wooden building elements



Data collection

Module A1-3 (Product stage)

Mass of each component was calculated from working drawings and cross-checked with material order list.

Module A4-5 (Construction stage)

All information was collected by interviewing with the constructors and monitoring of construction work.

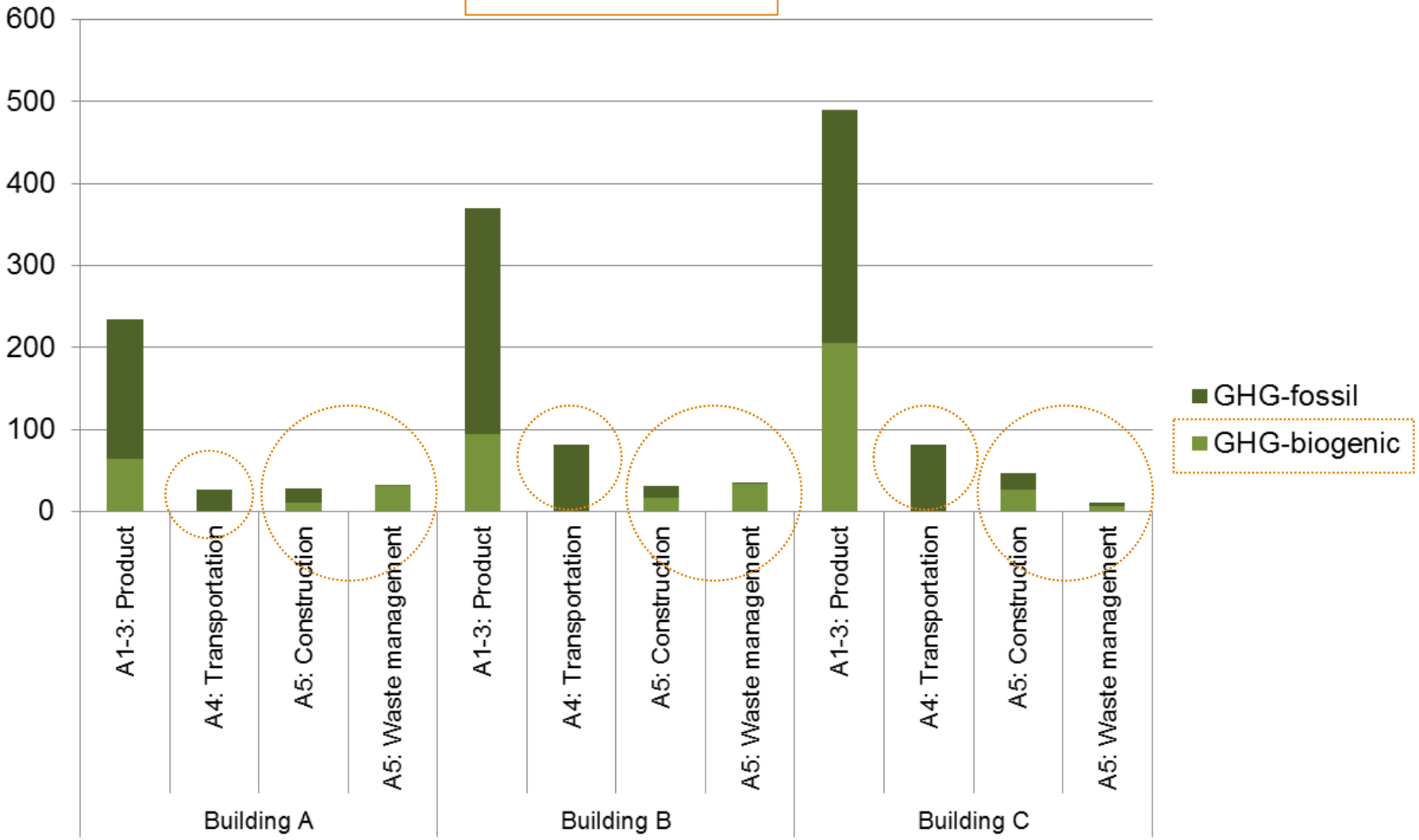
Module B6 (Operational energy use)

Operative energy was based on the estimated electricity and heating/ cooling energy demand of the buildings.

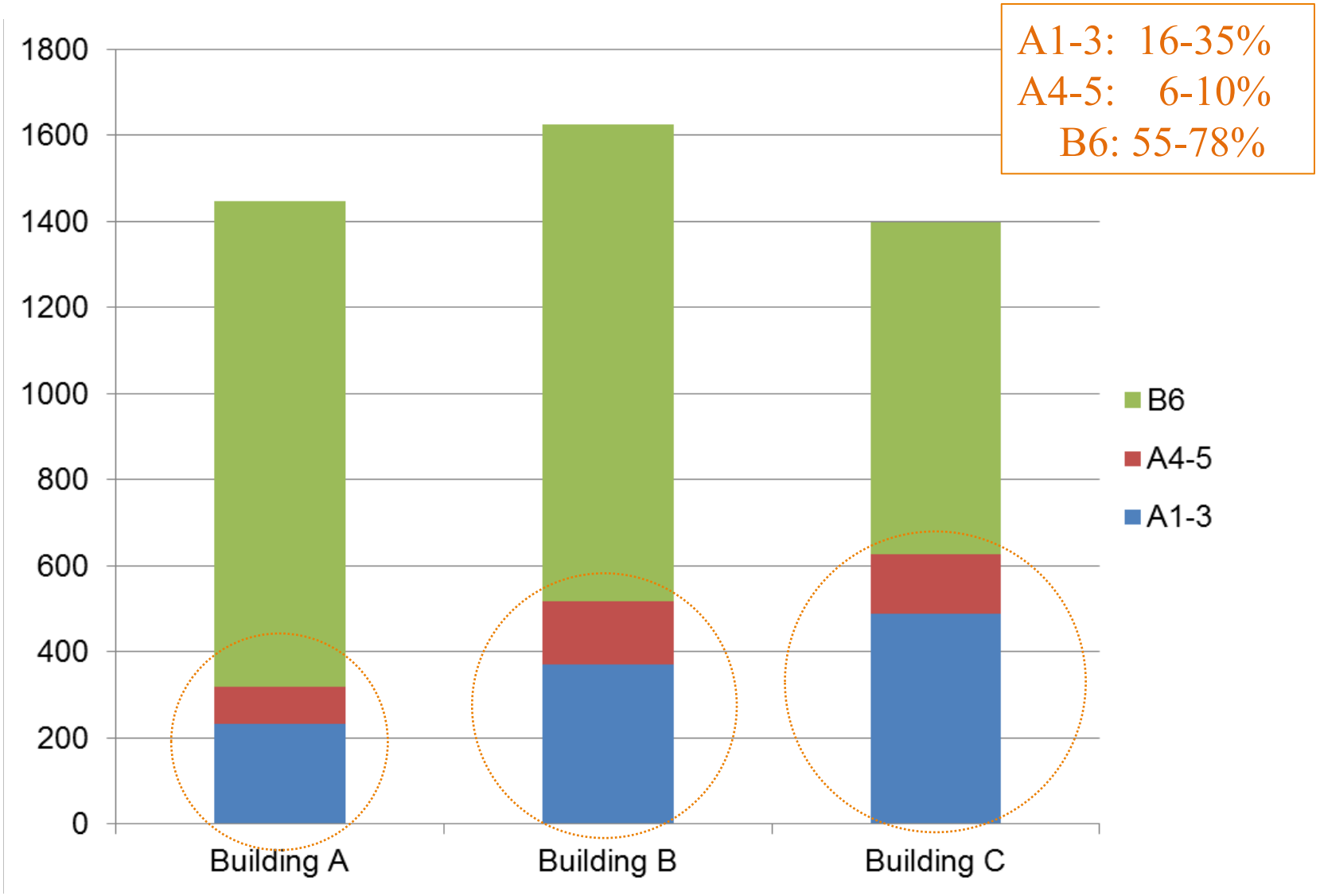
Results and Discussion

GHG emission for the Module A (kgCO2-eq./m2)

A1-3: 70-80%
A4-5: 20-30%



GHG emission for the Module A and B6 (kgCO2-eq./m2)



Conclusion

- The construction stage has relevant impact in a building life cycle.
- Especially transportation process is significant to mitigate GHG emission from the stage.
- Optimization of the construction stage needs to be considered.

- Further study is required to set practical and reliable assessment method.

Thank you for your attention!