Reducing construction phase greenhouse gas emissions of detached houses through material supply chain management

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In this presentation

Why construction phase GHG emissions matter

How these emissions can be lowered with material supply chain management

To what level we can reach without significant cost impacts
- a case example
Outline

• GHG emission source shares globally
• Importance of GHG emissions of building sector
• GHG peak emissions from construction
• Case study research method and the reference building
• Case study reference building – technical details
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• Material changes
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GHG emission source shares globally

49 GtCO$_2$ in total

*IPCC – Climate Change 2014: Mitigation of Climate Change*
Importance of GHG emission of building sector

IPCC – Climate Change 2014: Mitigation of Climate Change
GHG peak emissions from construction

Floor space 70,000 m² -> ~ 1.5 t CO₂/m² of peak emissions

Case study research method and the reference building

Method: Process LCA
Databases: European reference life cycle database + SimaPro

Actual average national electricity emissions
Case study reference building – technical details

- 149 cross square meters
- Building year 2016 – 2017
- Wooden frame detached house
- Heat recovery integrated into ventilation
- Electricity based floor heating as a second heating system
- Heated net area 130 m²
- Energy value 167,6 kWh/m²/a (C-class)
- Purchased annual energy 98,59 kWh/m²/a (electricity)
GHG emissions of the reference building

27 000 t CO₂ / 149 m²
~181 CO₂ / m²

R. Sygula, Oliver Beyer, 2016, Life cycle assessment of a wooden frame low energy detached house in Finland
Material changes

• Rock & Glass wool into Cellulose insulation → emissions from insulation drops from 10126 kgCO₂ to 382 kgCO₂

• Steel used in roof structure changed into recycled steel → decreased emissions by 737 tCO₂

• Emission saving potential for concrete nearly 2 tCO₂, but drying time requirements of 90 days -> no go
GHG emissions from updated reference building

16 500 t CO₂ / 149 m²

→

~91 CO₂ /m²

50% of original emissions
Comparison between buildings

![Graph showing comparison between buildings](image-url)

- Reference house
- Reference house with modifications
Reduction potential to GHG emissions – Globally

- If only 25% of building sector GHG emissions could be reduced, it would represent the same amount of GHG emissions as Canada is producing annually, which is 11th of the most GHG emitting countries in the world.
Summary

- Construction phase peak GHG emissions are crucial from the climate change targets perspective
- Through material selection it is relatively easy to decrease these emissions
- The simple process LCA study for a reference building indicated decrease of 50% of emissions with simple material selection
- Scaling such activities up would generate remarkable emission decrease implications