



Aalto University

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

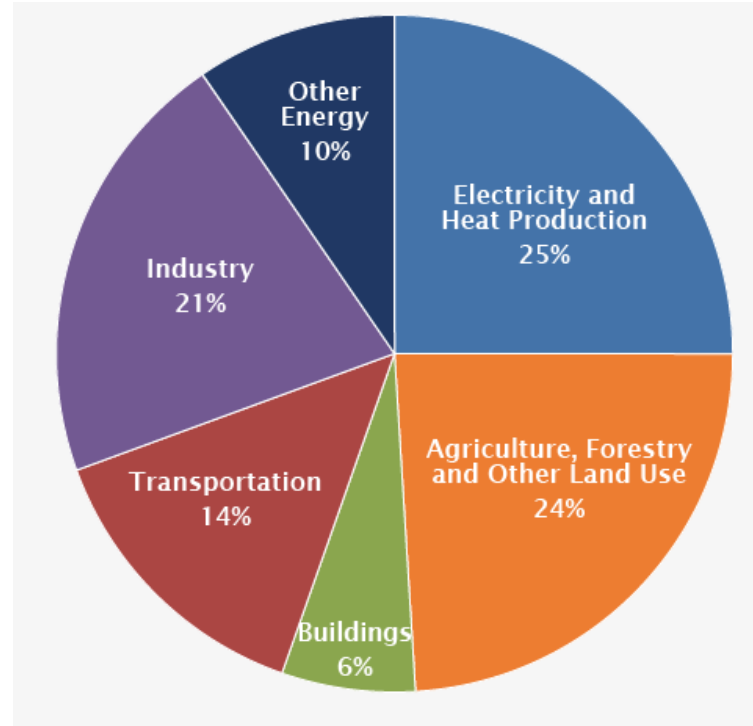
**To what level we can reach without significant cost impacts
- a case example**

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
- GHG emissions of the reference building
- Material changes
- GHG emissions from updated reference building
- Comparison between buildings
- Reduction potential to GHG emissions – Globally
- Summary

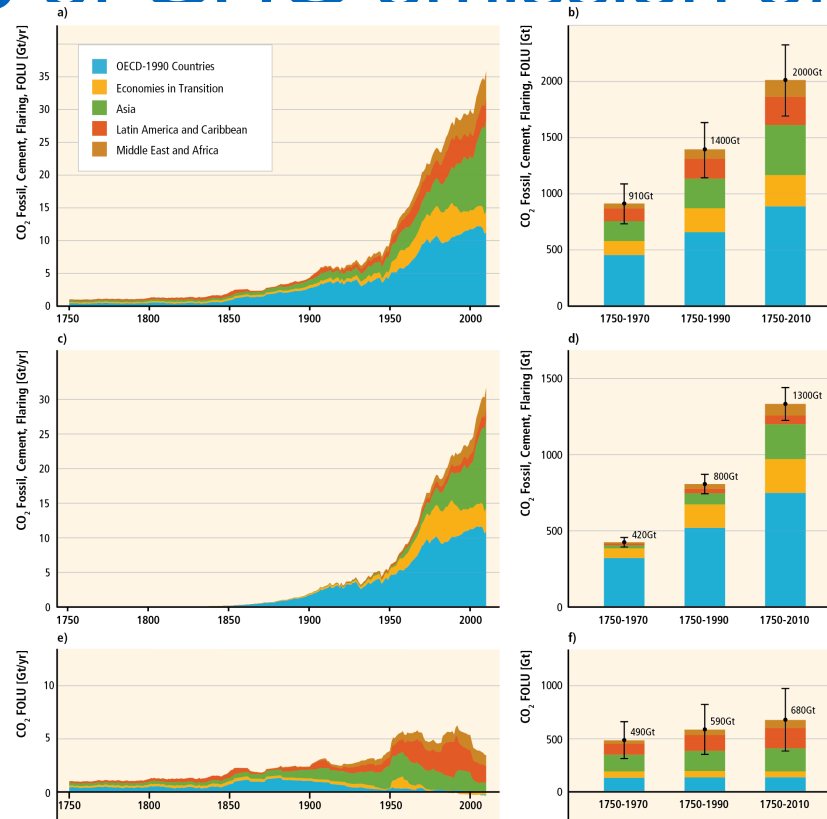
GHG emission source shares globally

49 GtCO₂ in total



IPCC – Climate Change 2014: Mitigation of Climate Change

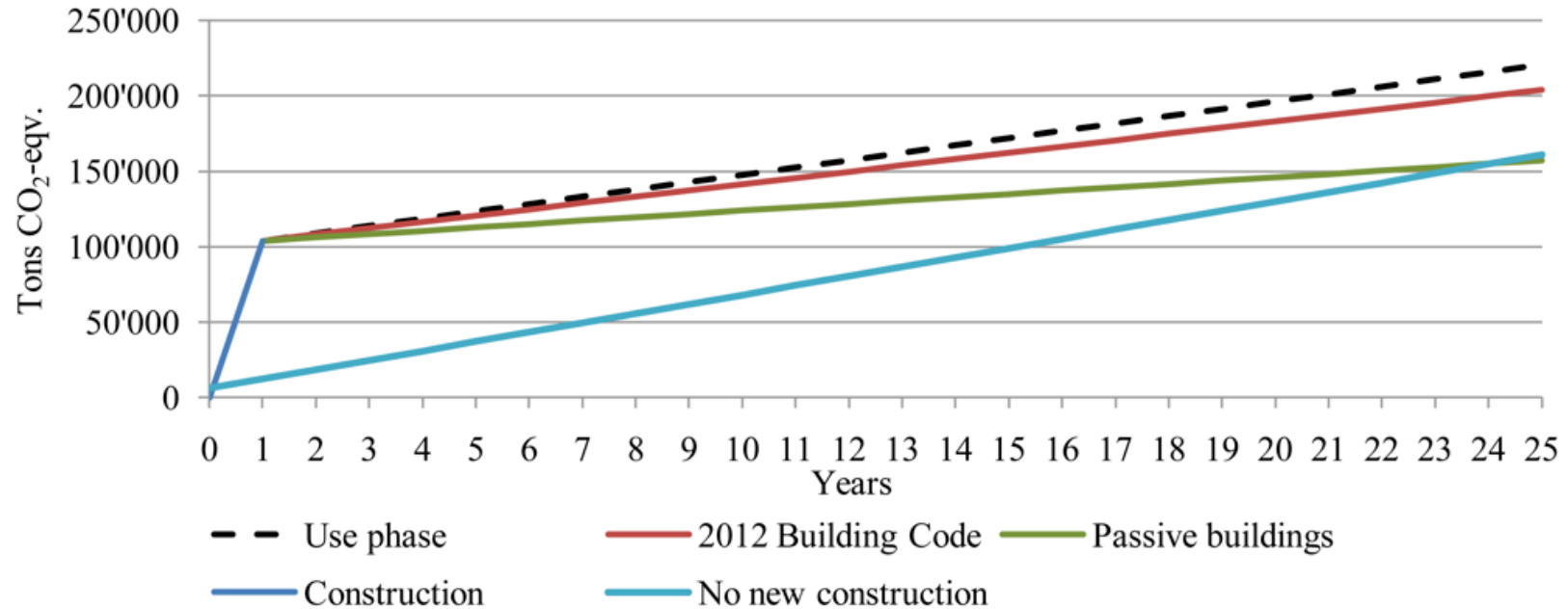
Importance of GHG emission of building sector



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



Heinonen, J. Säynäjoki, A., Junnila, S. A Longitudinal Study on the Carbon Emissions of a New Residential Development. Sustainability, Vol. 3. 2011.

Case study research method and the reference building



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

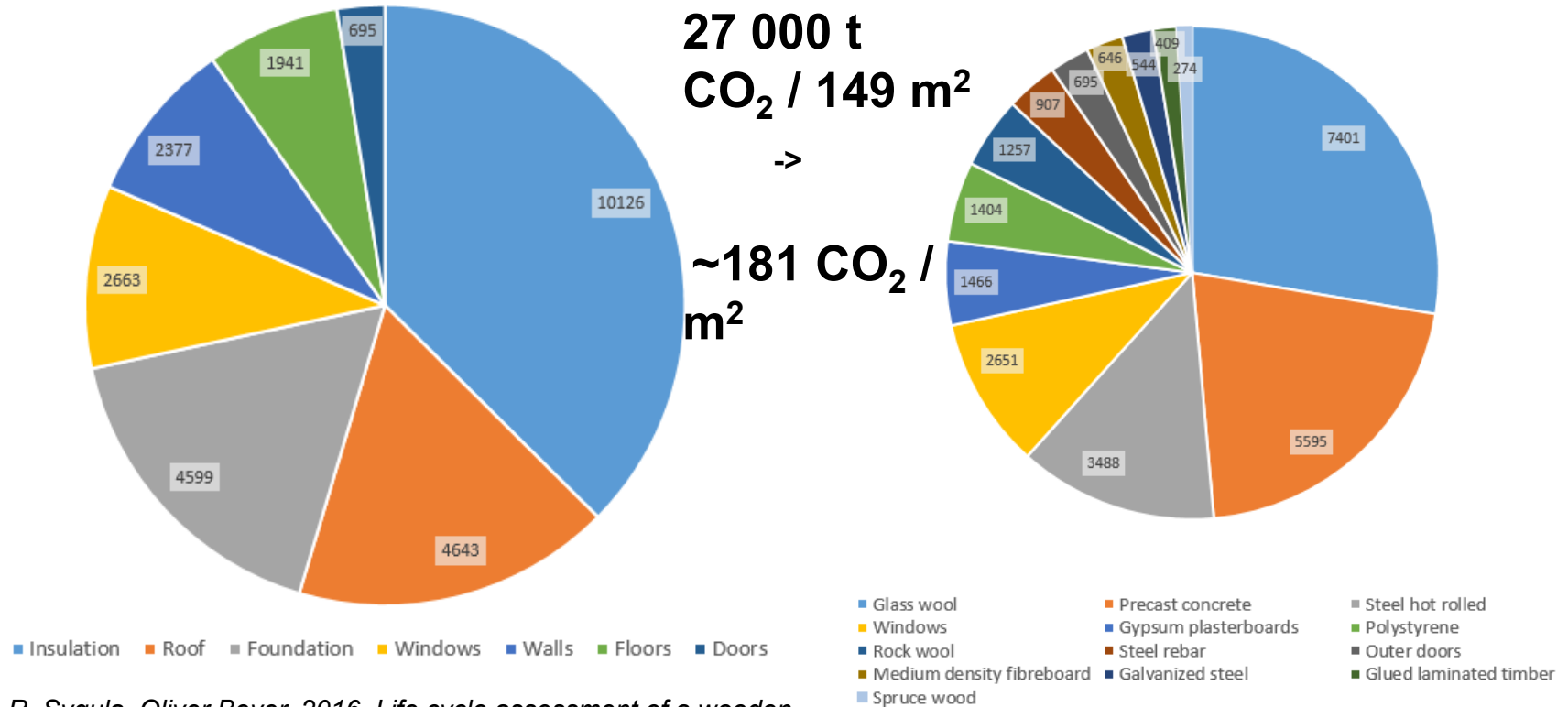


Actual average national electricity emissions

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



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**

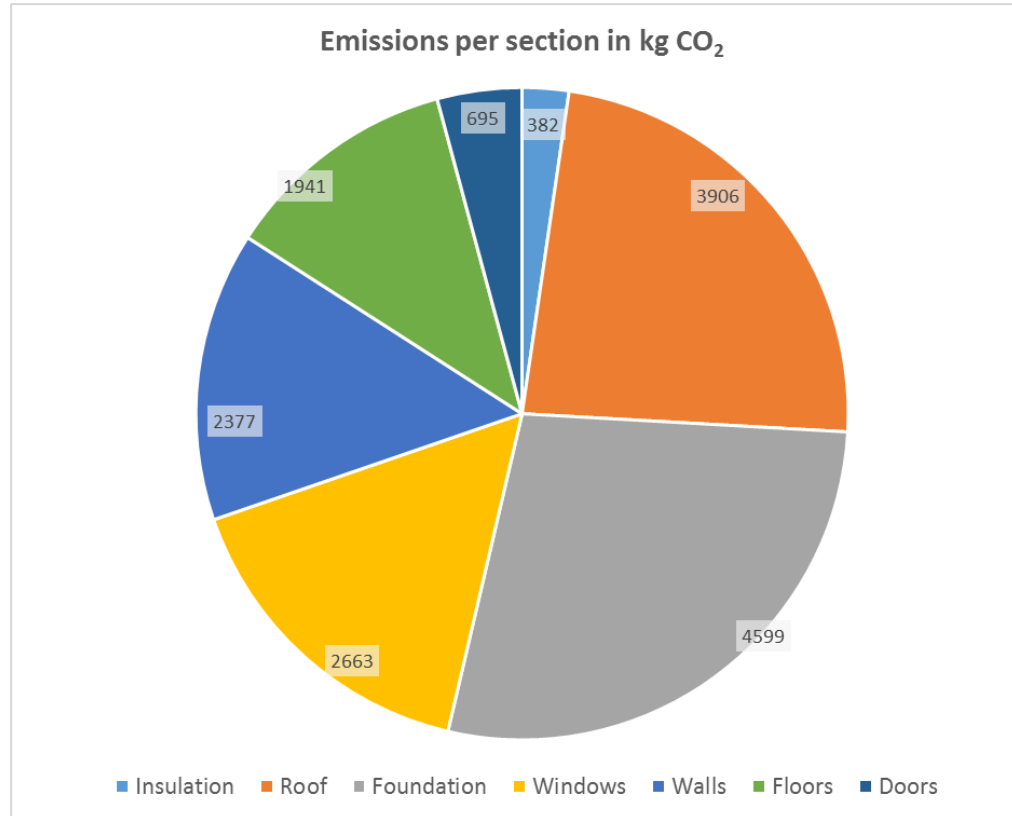
GHG emissions from updated reference building

16 500 t
CO₂ / 149 m²

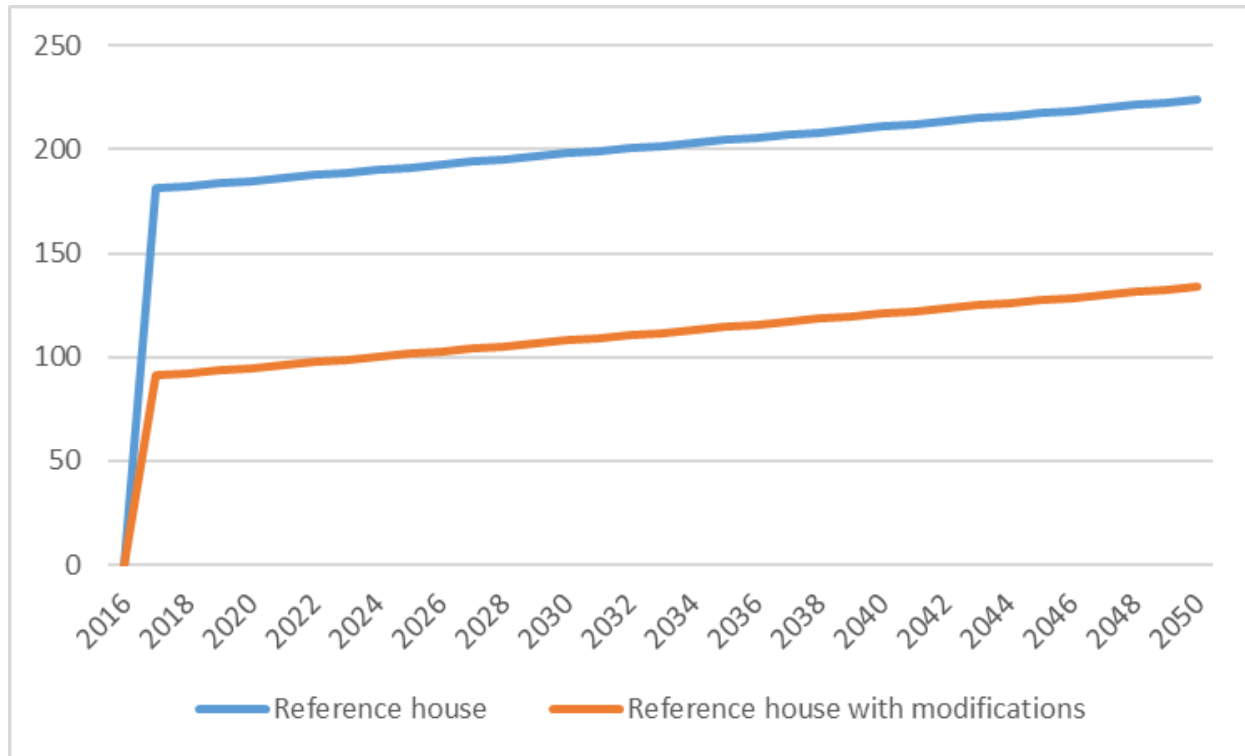
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~91 CO₂ /m²

50% of
original
emissions



Comparison between buildings



Reduction potential to GHG emissions – Globally

- **If only 25% of building sector GHG emissions could be reduces it would represent same amount of GHG emissions than 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**