LeadENG-project
Building materials of the future

Assist. Prof. Martin B. Østergaard (mbo@bio.aau.dk)

Department of Chemistry and Bioscience

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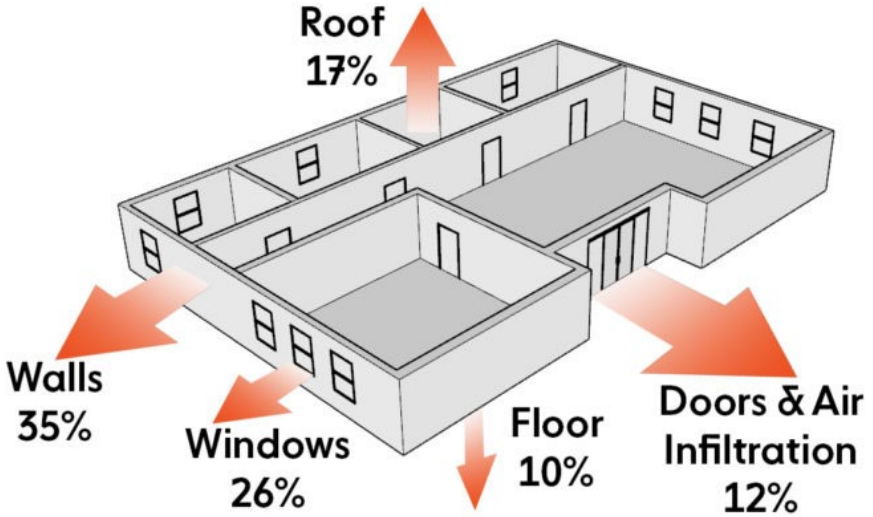
The problem

“Buildings are currently responsible for 39% of global energy related carbon emissions: 28% from operational emissions, from energy needed to heat, cool and power them, and the remaining 11% from materials and construction.”

- World Green Building Council

The solution(s)?

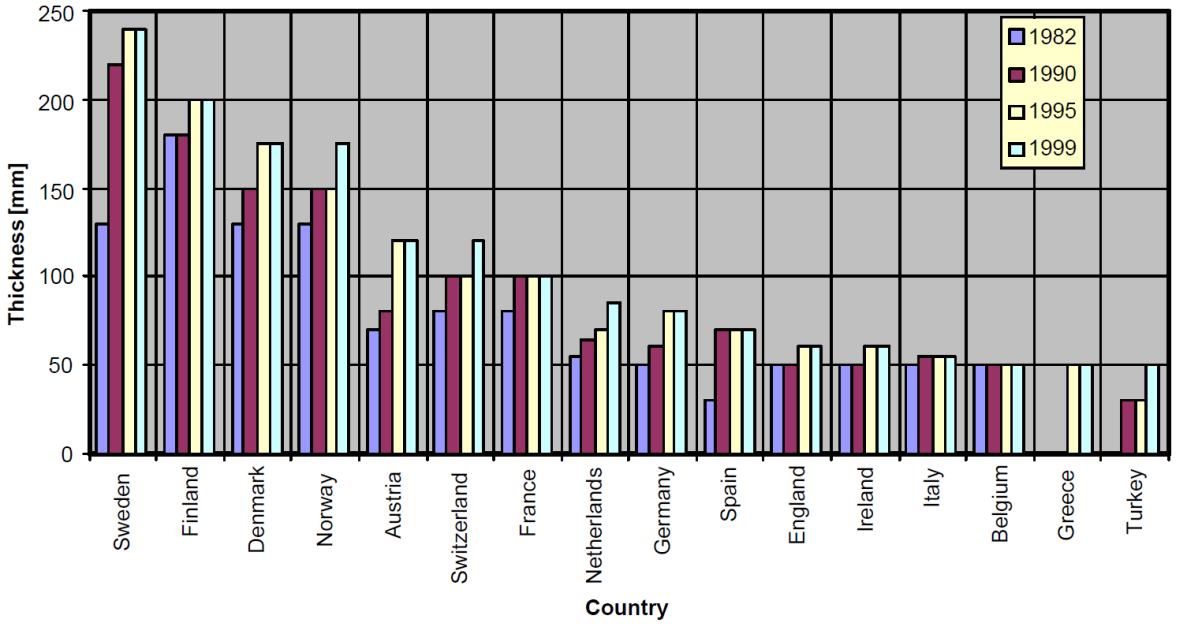
- 28% from operational emissions, from energy needed to heat, cool and power them
  - Improve insulation
- 11% from materials and construction
  - Optimize processes and products
  - Change fuel (often high temperature processes)
  - Treat hard-to-recycle materials as raw materials
  - Use bio-friendly resources



Insulation materials – glass foams

- Development of the CleanTechBlock
  - Previous projects (BIO+BUILD involved)
- Reduce wall thickness
- Substitute wool-insulation by glass foam
  - Higher strength
  - Reduce the thickness of the brick
  - Based on waste glass, e.g., CRT

Insulation thickness applicable in walls

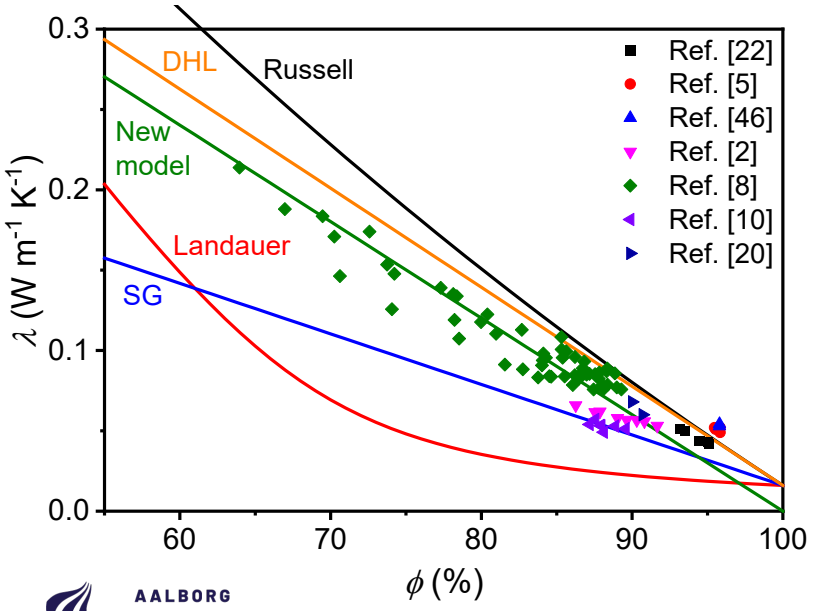


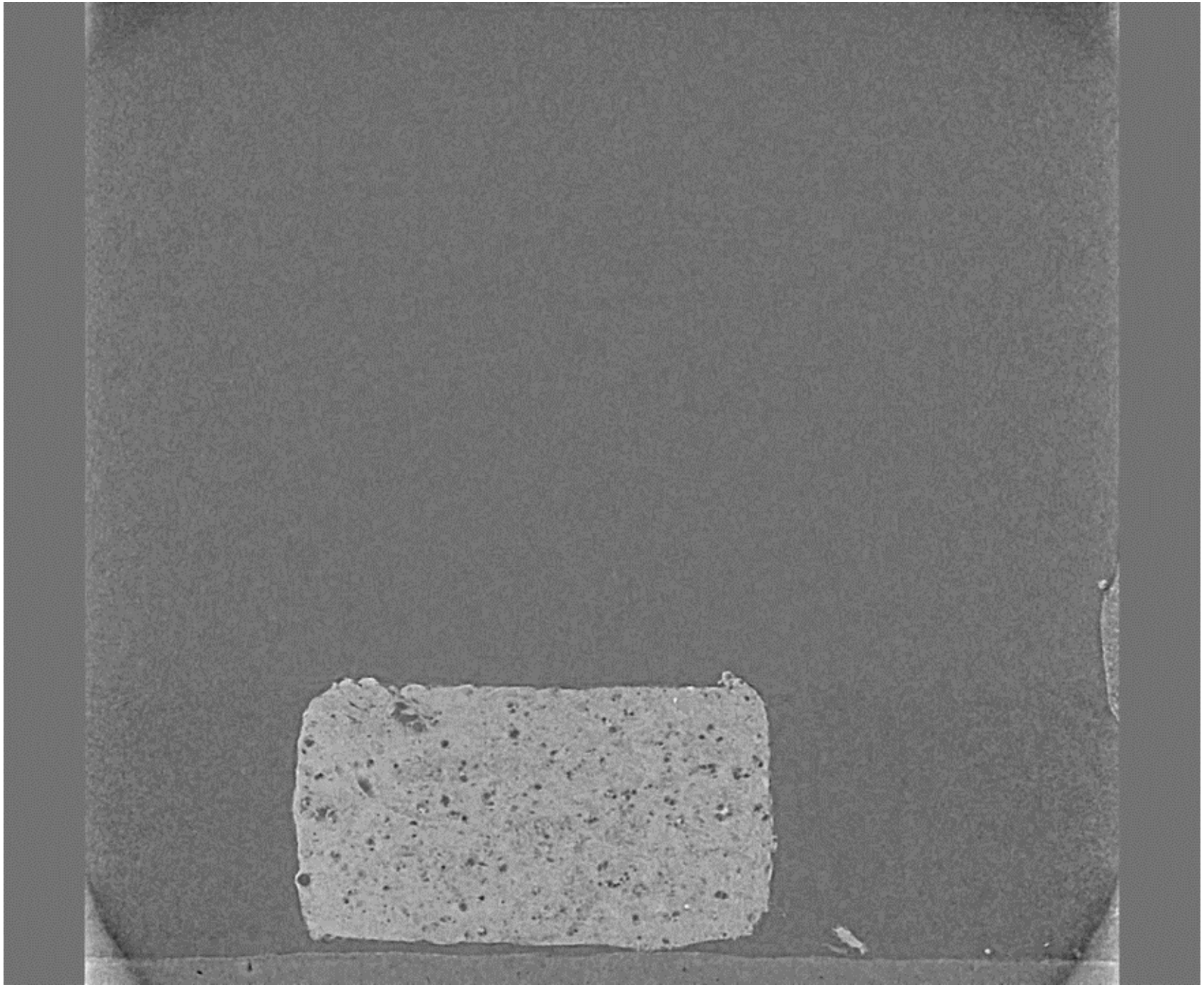
Papadopoulos, Energy and Buildings **37** (2005) 77-86

Foaming

- Foaming controls the porosity
- Porosity important for thermal conductivity

$$\lambda = \lambda_g(\varphi - 1) + \frac{2}{3}(1 - \varphi)\lambda_s$$





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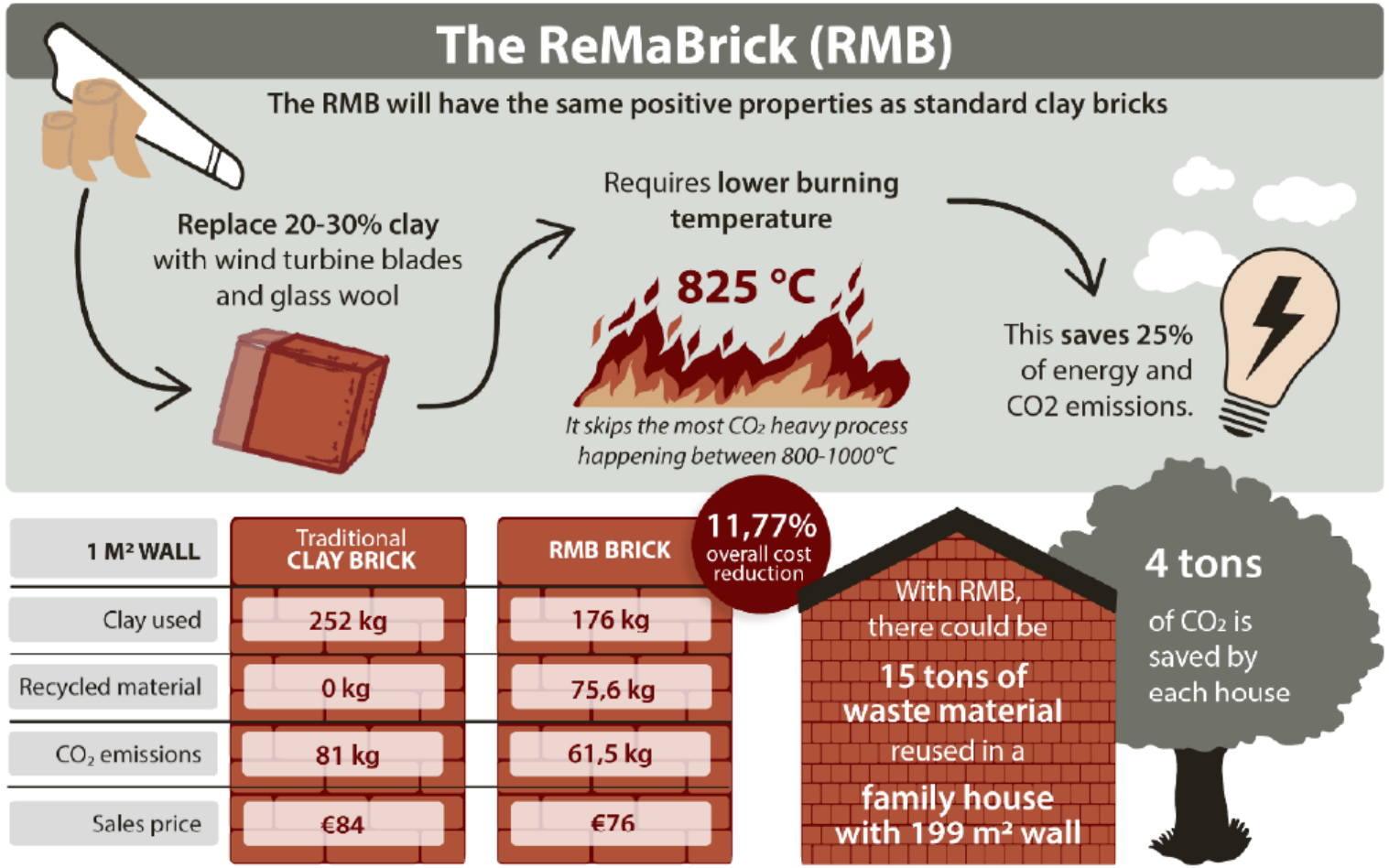
Østergaard et al., Acta Mater **189** (2020) 85-92

Clay Bricks

- >5 billion bricks are produced in EU/year
- High CO_2 footprint
  - Reduced by incorporation of waste material
- 102 000 tons of wind turbine blade will be decommissioned in 2025 globally
  - Filling up landfills



Current AAU-collaborations

BIO-BUILD-MP

- BIO (Chem): Yuanzheng Yue and Martin B. Østergaard
- BUILD: Rasmus L. Jensen, Per Heiselberg, Per Møldrup, and Hicham Johra
- MP: Lars Rosgaard and Johnny Jakobsen

The Sustainable Living lab

- Student green house with potential for experiments
- Showcase for new building materials

Focus areas

- Developing new, more sustainable building materials
- Recycling hard-to-recycle materials
- Use sustainable materials
- Reduce energy and material consumption in production
- Optimize buildings for more efficient energy use
- Improve indoor environment

Chemistry focus

The Nine Sustainable Focus Areas

FLEXIBLE AND EFFICIENT ENERGY USE

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SUSTAINABLE PRODUCTION

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RECYCLING AND CIRCULAR ECONOMY

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