



Aalto University
School of Arts, Design
and Architecture

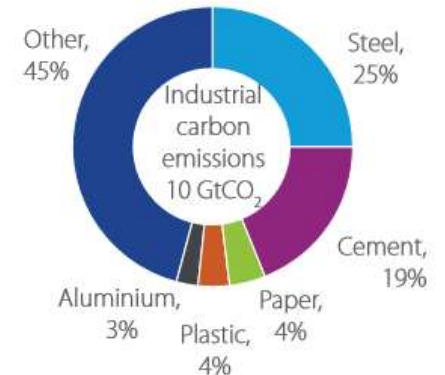
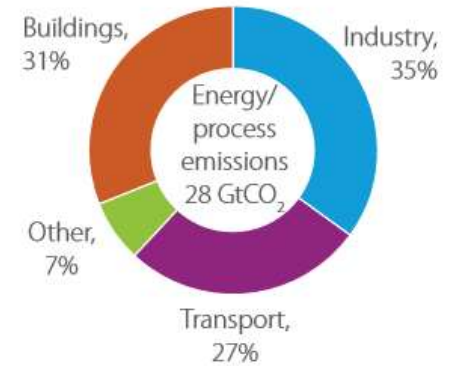
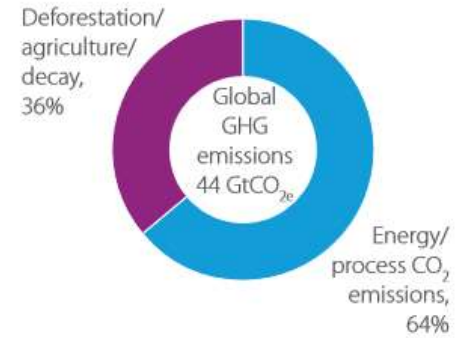
Sustainable design course 2024: Group work theme – Concrete

Theme description for the group work on the course (sessions 9–13)

Mikko Jalas

Allwood et al ch2

- **Most of CO₂ emissions are due to energy use and processes.**
- **Industrial processes are the single biggest source of CO₂**
- **Steel, cement, aluminum, paper and plastics are most important materials ‘behind’ CO₂ emissions.**



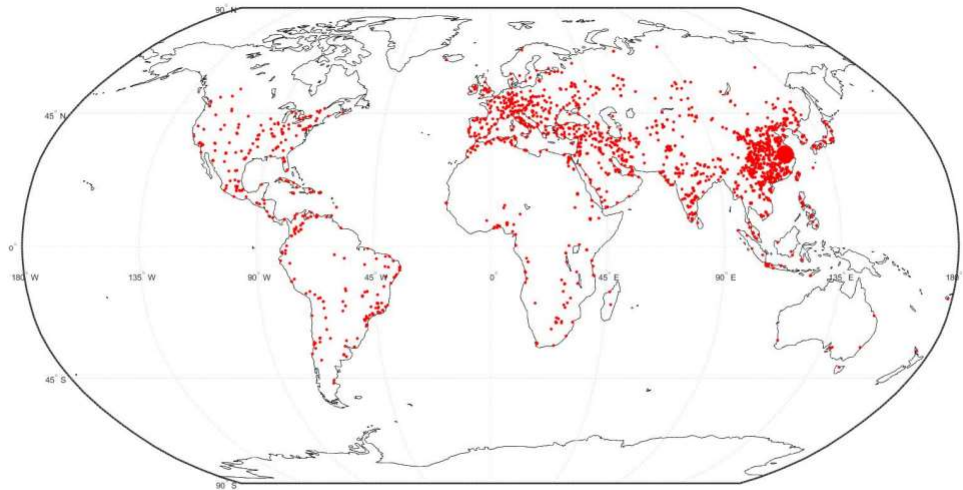
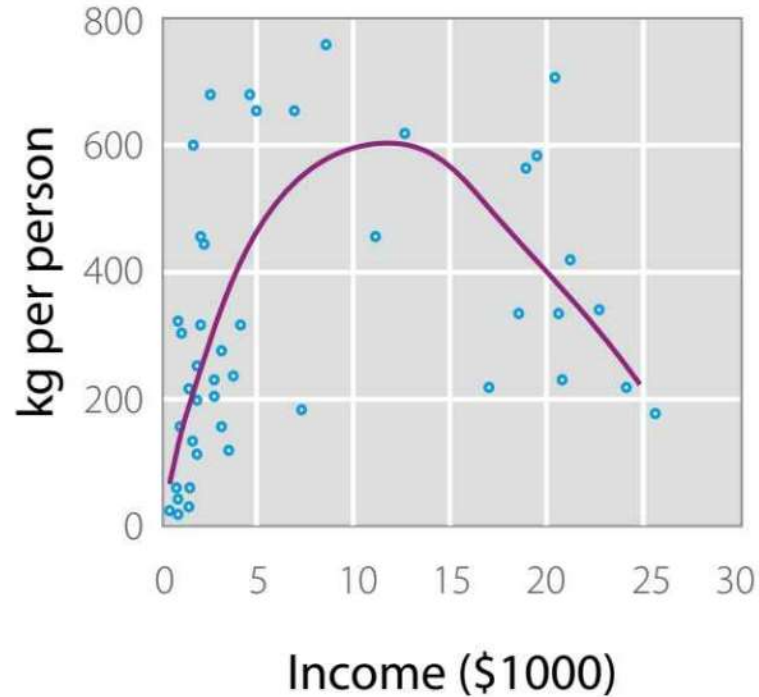


Figure 2: Global cement production sites. Larger circles represent production sites of significantly higher capacity than the others. Data are obtained from [\[24, 25\]](#).

Demand for cement

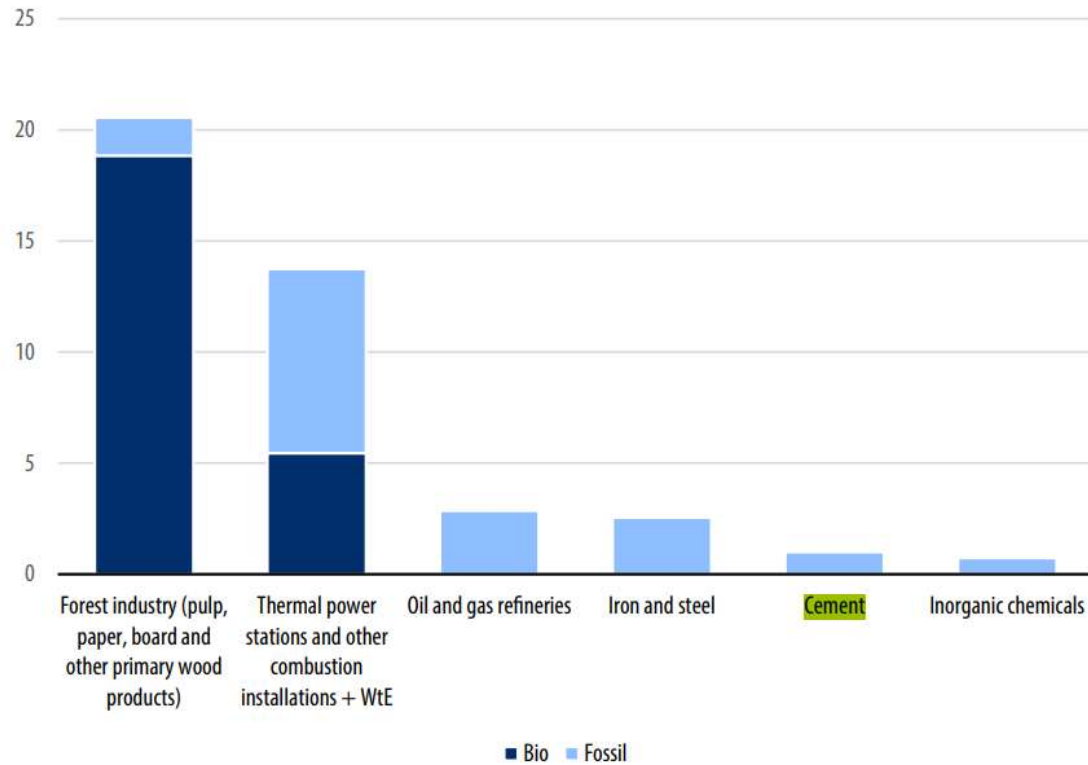


x 3-4 for concrete

**Demand for concrete
Finland about 1
m³/capita**

**Globally about
1,5m³/capita**

Figure 11. Industrial CO₂ emissions from facilities in Finland 2020. Data from EEA (2023a).



Carbon dioxide use and removal : Prospects and policies (valtioneuvosto.fi)

Manufacturing process

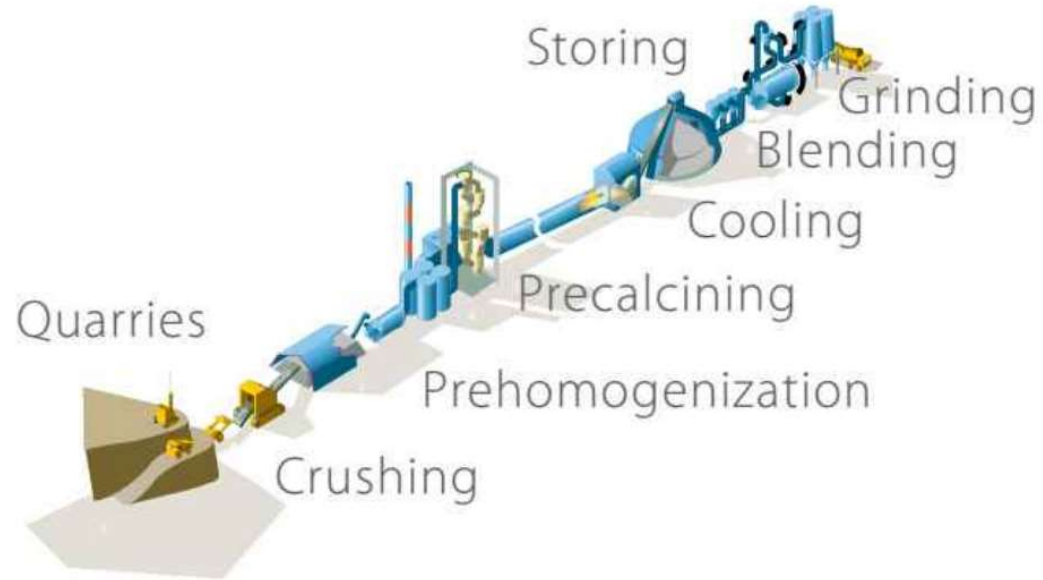


Figure 20.8—Cement production process²⁶

New directions

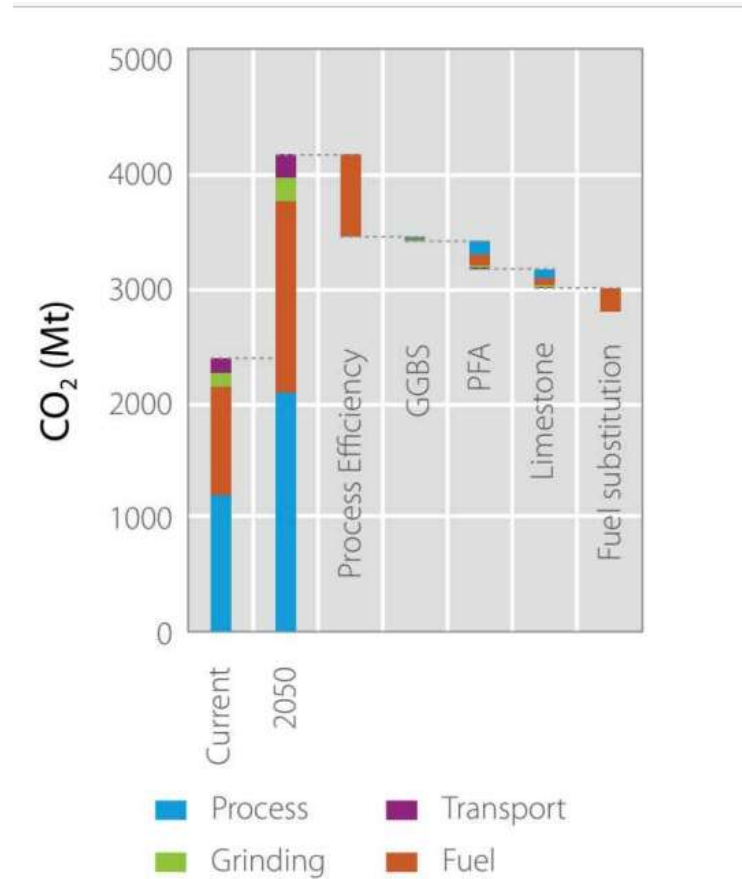
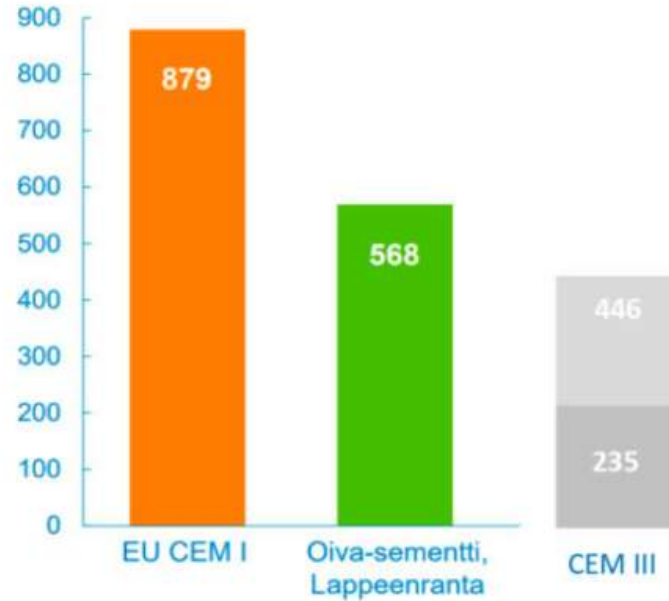


Figure 20.9—Forecast for emissions reductions in the cement industry

New directions

Sementin ominaispäästöt kg-CO₂/sementtitonni



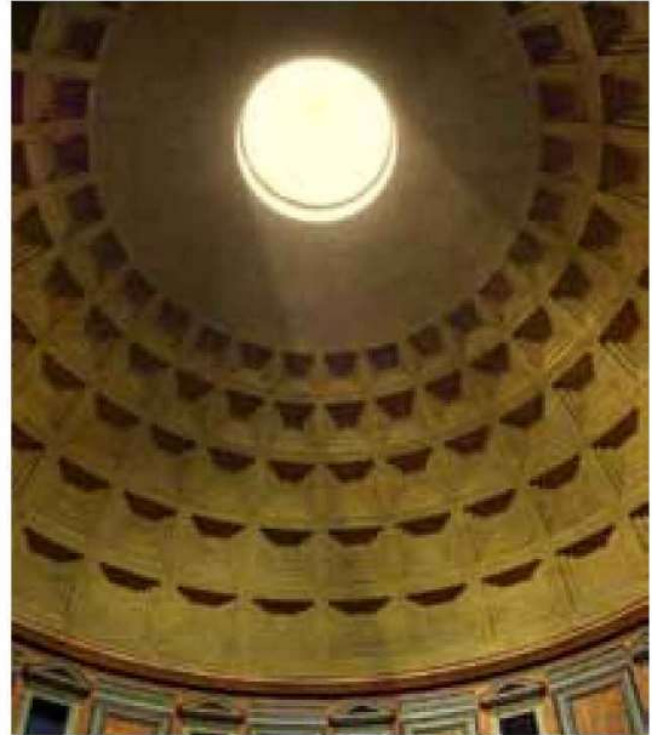
Sementti ja kasvihuonekaasupäästöt - Betoni

Cement

In use for a long time, e.g. the Pantheon

In 1824, a patent for Portland cement

Steel-reinforced concrete is in structural uses coupled with urban infrastructure



The Pantheon Dome

Non-structural use



Opportunities for sustainability improvements in Concrete and cement

Alternative chemistry for concrete

Capture of CO₂ from cement manufacturing

Capture of CO₂ by mineralizing processes in cement

Uses of concrete –with both eyes open