Learnings from a round robin test of assessing the environmental impacts of the be2226 office building

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Member countries of IEA EBC Annex 72

LCA Discussion Forum 71,
18. June 2019
Zurich, Switzerland

Overview

- Introduction and goal
- National / regional methods
- Construction material
- Electricity mixes
- Results
- Issues during assessment
- Conclusions

Introduction

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- Exercise within the IEA EBC Annex 72
- Inventory data and BIM model established by TU Graz
- 22 institutions assessed the office building
- National / regional methods and databases were applied
- Focus: greenhouse gas emissions

Goal

- Present and "illustrate" national assessment methods on the basis of an identical building
- Analyse and compare methods, indicators and forms of presentation
- Identify major commonalities and discrepancies in view of developing harmonised methodology guidelines

National / regional methods

22 institutions assessed the office building be2226

National / regional methods

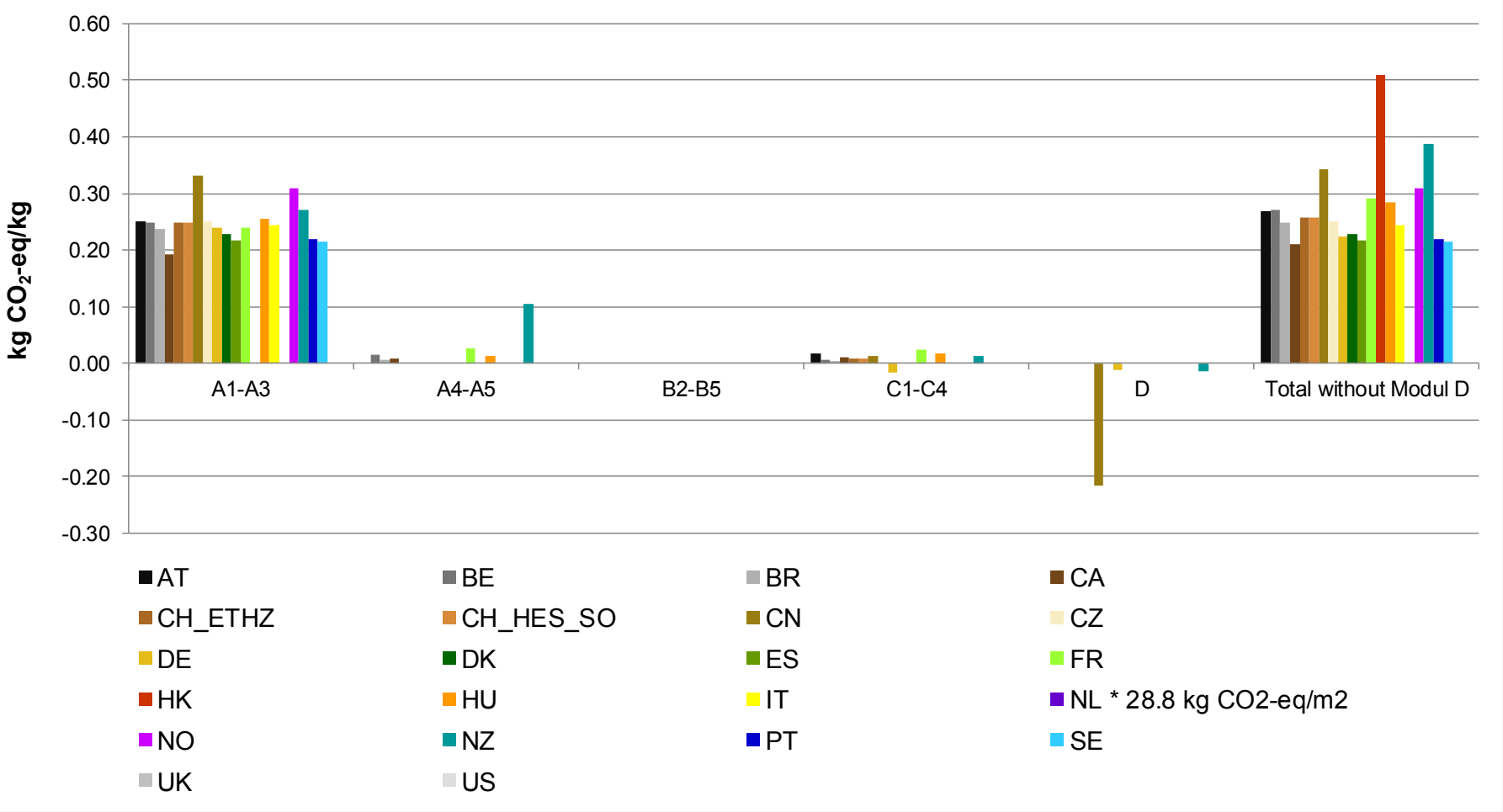
- reference study period:
  - 50 years: 15 countries
  - 60 years: 5 countries
  - 80 years: 1 country (Denmark)

- background data used
  - ecoinvent v2.1 - 3.5 (partly adapted to national context)
  - Country specific databases (e.g. KBOB, Ökobau.dat)
  - EPDs

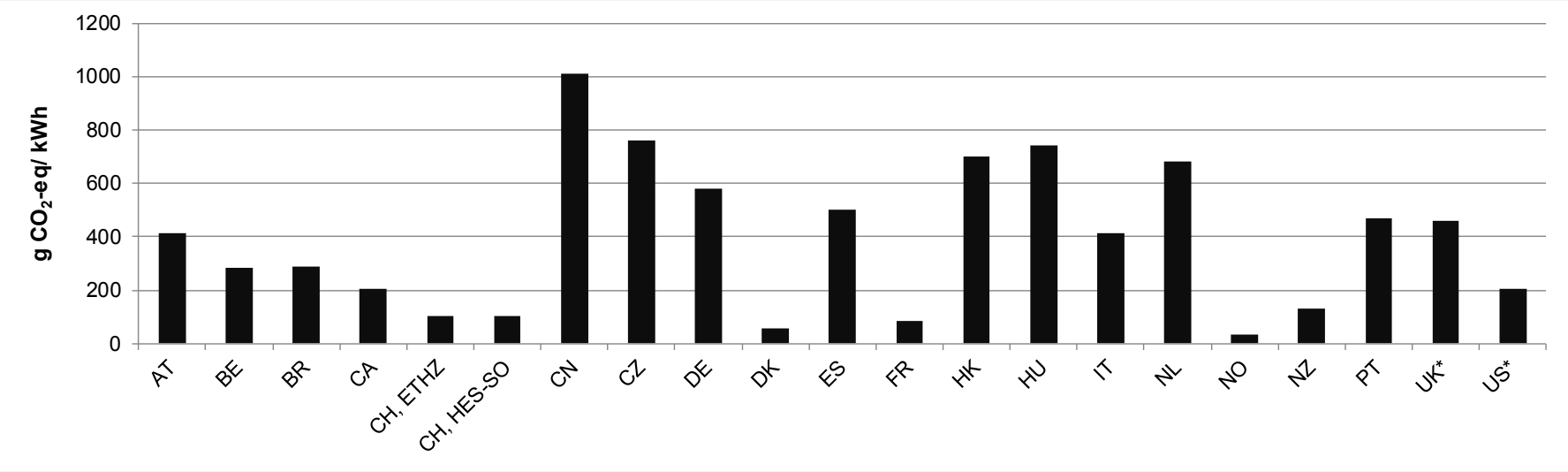
National / regional methods
Life cycle stages

Life cycle stages	A1-A3	B4	B6	C3	C4
AT	X	X	X	X	X
BE	X	X	X	X	X
BR	X	X	X		
CA	X	X	X	X	X
CH, ETHZ	X	X	X	X	X
CH, HES-SO	X	X	X	X	X
CN	X	X	X		X
CZ	X	X	X		
DE	X	X	X	X	X
DK	X	X	X	X	X
ES	X	X	X	X	X
FR	X	X	X	X	
HK	X	X	X	X	X
HU	X	X	X	X	X
IT	X	X	X		
NL	X	X	X	X	X
NO	X	X	X	X	X
NZ	X	X	X	X	X
PT	X		X		
SE	X				
UK	X	X	X	X	X
US	X	X	X	X	X

Construction material – Brick

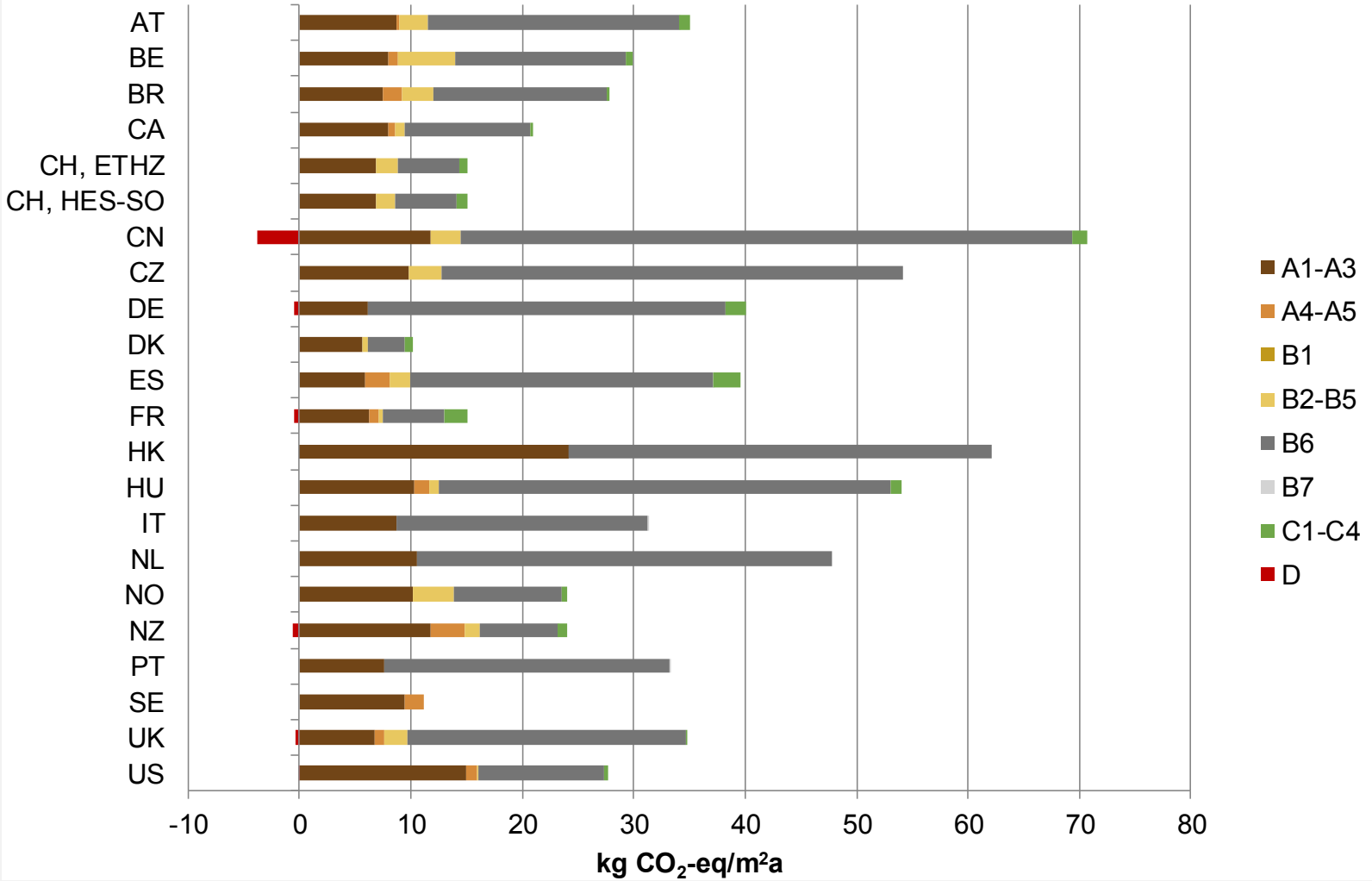


Electricity mixes



- GHG emissions of electricity mixes differ by factor 30
- Reflect real existing differences in national electricity supply
- Denmark is the only country reporting a future average mix based on renewable energies only

Results – Greenhouse gas emissions (annualised)



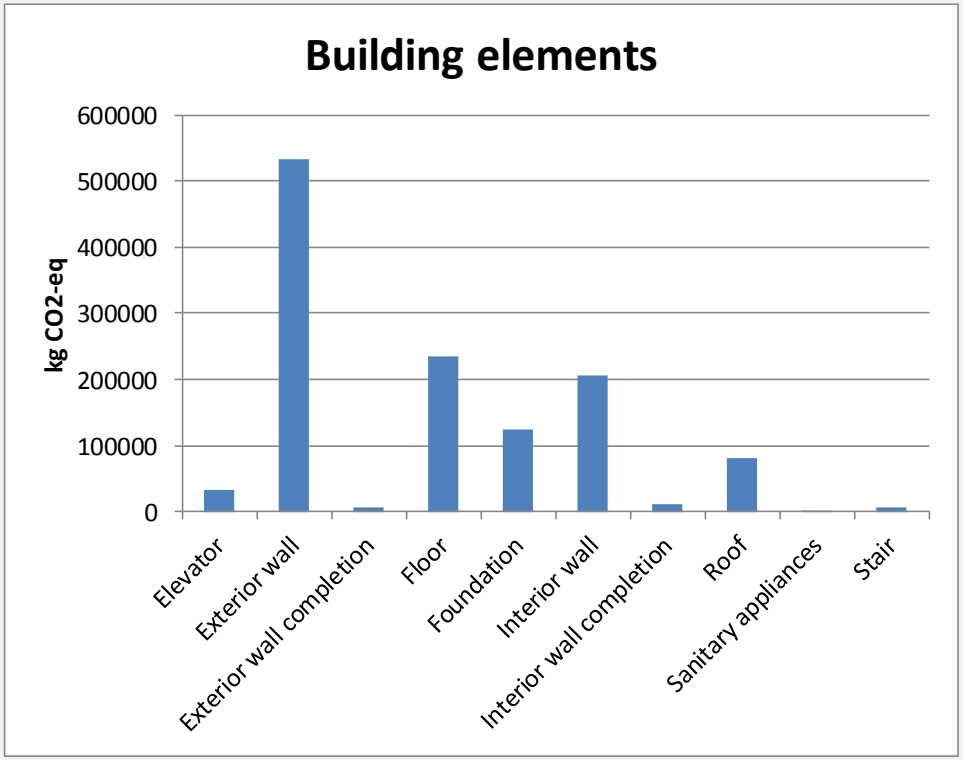
Results – Greenhouse gas emissions (annualised)

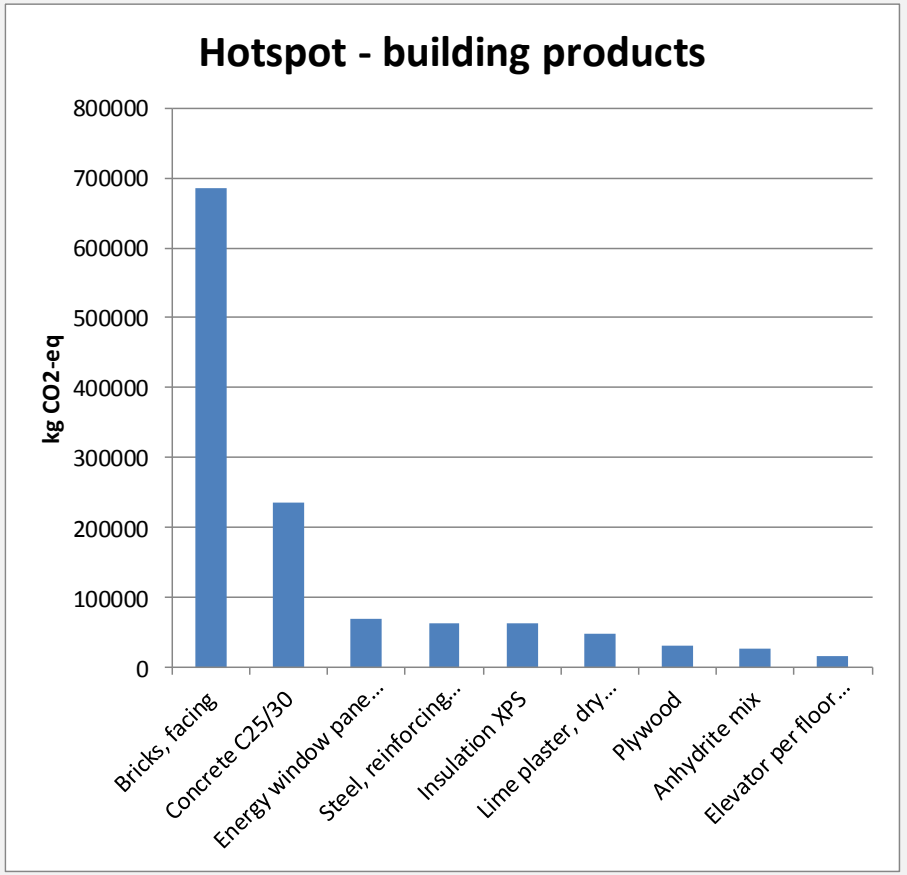
- A1-A3 varies by factor 2.6 (excl. Hong-Kong)
  - difference in building life time
  - CO_2-intensity of bricks and concrete
- A4, A5 addressed by 13 countries
  - important with high import distances (NZ)
- B2-B5 highly variable but minor contribution
  - missing elements (e.g. electrical system)
  - different life times of materials (and thus # replacements)

Results – Greenhouse gas emissions (annualised)

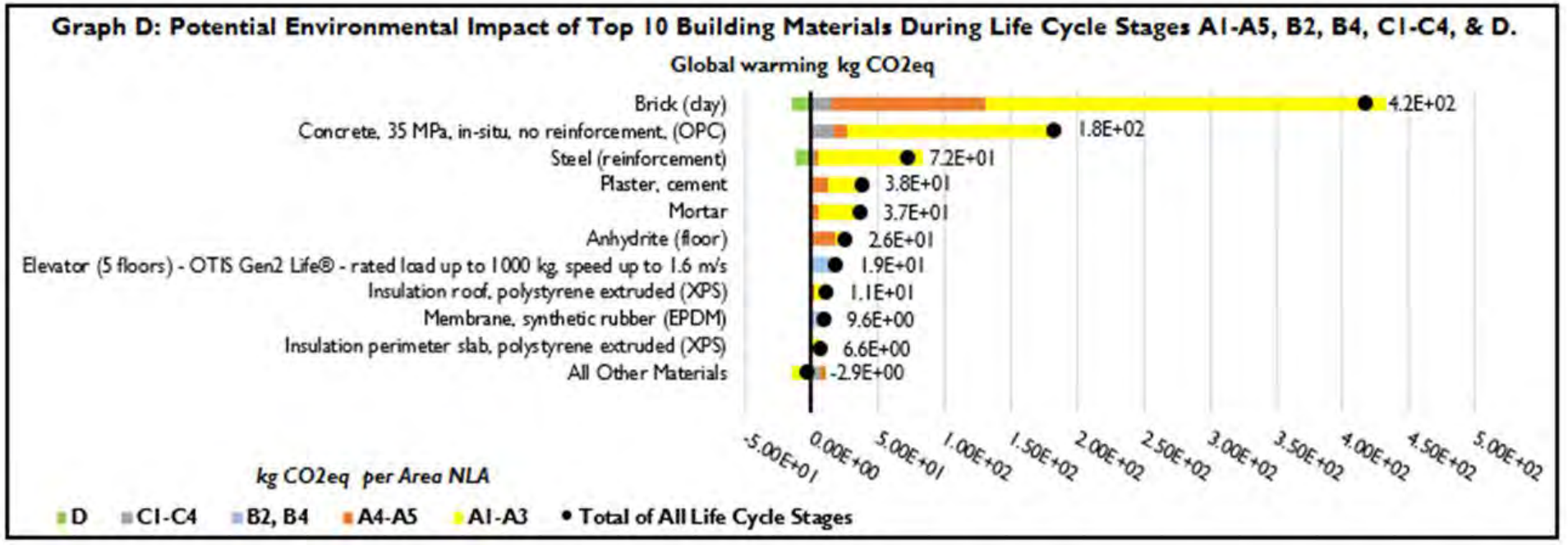
- C1-C4 minor contribution
  - relatively small share of plastics/insulation material
- D: hardly visible on building level
  - largest contribution from recycling steel (reinforcing) and bricks, CN assessment

Results – Denmark: detailed assessment





Results – New Zealand: detailed assessment



Issues during assessment

- Missing life cycle inventory data for specific materials (e.g. vacuum insulation panels)
- Different aggregation stages in the information provided and the data available (e.g. reinforced concrete)
- Differences in the units of building data and the available LCA (e.g. pieces vs. m^3 of stairs)

Conclusion

- Largest contributions from production (A1-A3) and operation (B6)
- Most influencing factors
  - GHG intensity of electricity mix
  - GHG intensity of main construction materials
  - reference study period

- Differences in modelling and methodology are less important
- Optimal (low) GHG emissions building solutions depend on national context
- Outlook: Assessment of Chinese high-rise residential building

Acknowledgement Authors national

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- Website
  http://annex72.iea-ebc.org/
- LinkedIn
  www.linkedin.com/groups/13604349
- ResearchGate
  https://www.researchgate.net/project/IEA-EBC-Annex-72-Assessing-life-cycle-related-environmental-impacts-caused-by-buildings