SUSTAINABLE BUILDING CONFERENCE 2013 – GRAZ, 25-28 SEPTEMBER 2013

RELEVANCE OF THE RECYCLING POTENTIAL (MODULE D) IN BUILDING LCA: A case study on the retrofitting of a house in Seraing

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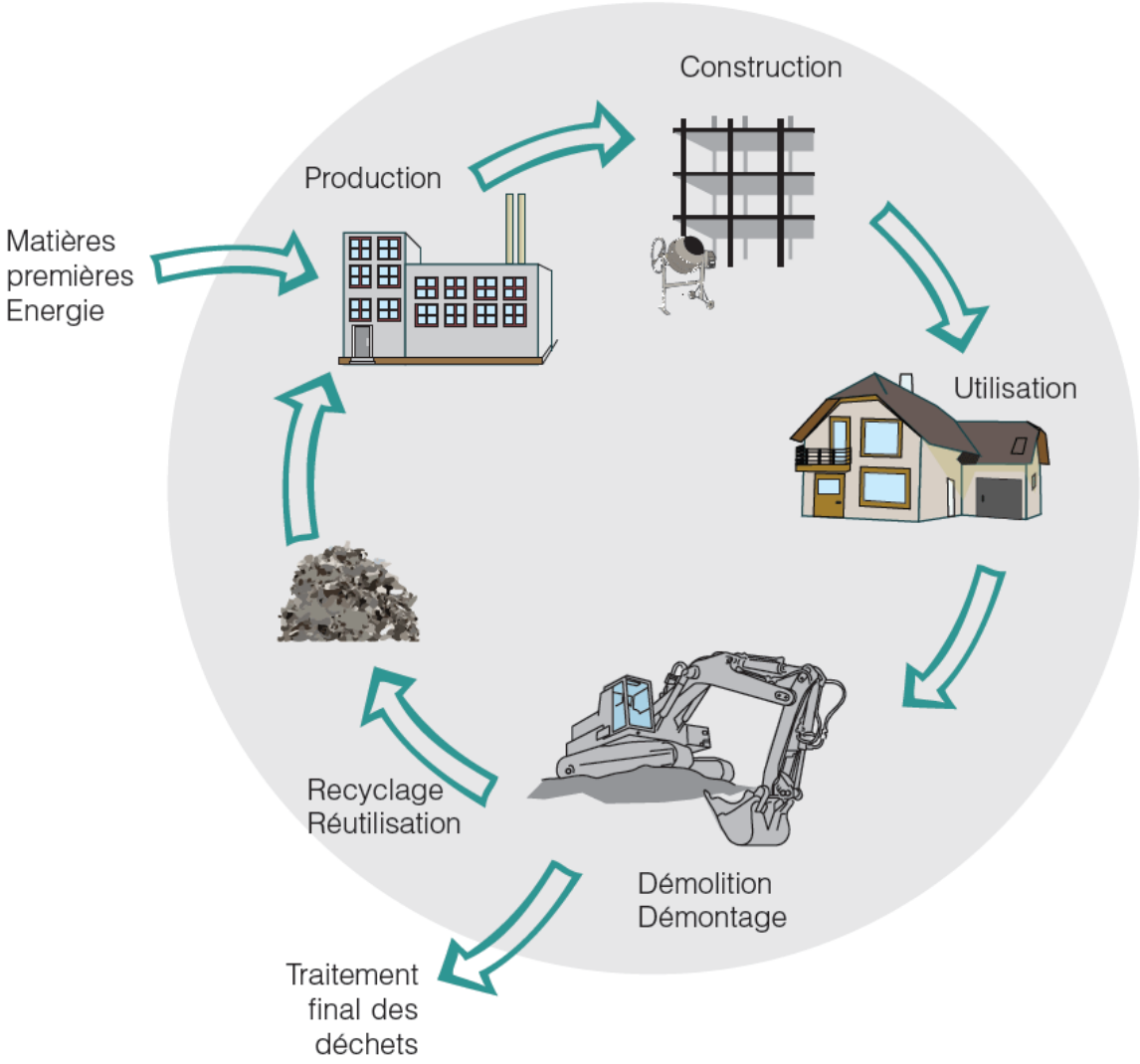
Overview presentation

- Introduction
- LCA and module D
- Building case study
- Results
- Discussion and conclusions

Introduction

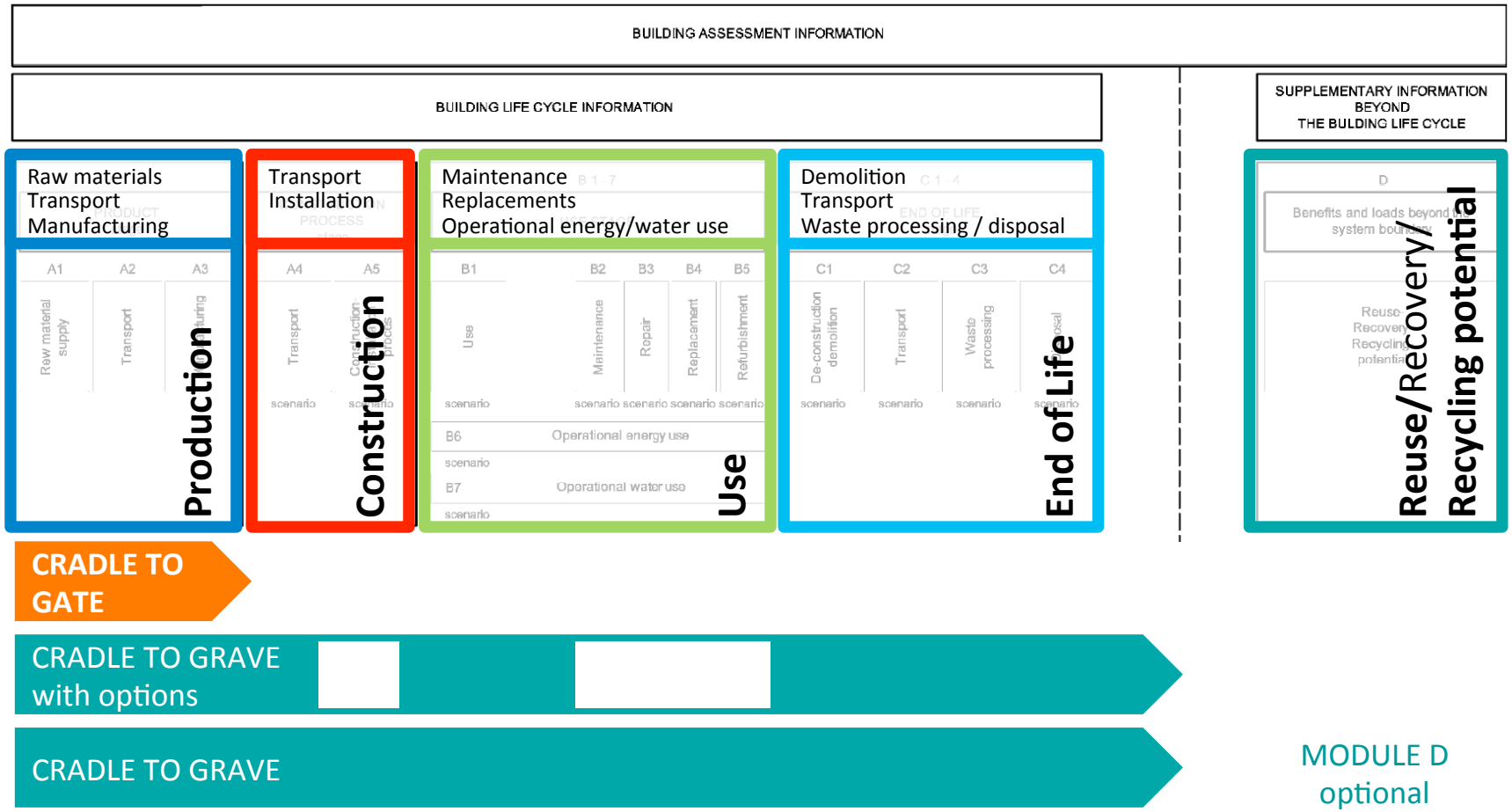
Life Cycle Assessment of buildings

- EN 15804 (2012)
- EN 15978 (2012)



Introduction

Framework EN 15804 / EN 15978



Introduction

Module D in EN 15804 / EN 15978

= environmental **loads and benefits beyond** the buildings life cycle resulting from…

- recycling of materials
- reuse of products
- (recovery of) energy leaving the product system

- optional ? → « potential »

Module D – example

recycling… of virgin bricks

Theoretic values!

Recycled Content (**RC**) = **0%**

Module D – example

recycling… of bricks containing recycled ceramics

Theoretic values!

Recycled Content (**RC**) = **30%**

Problem and goal

Module D

- Not often included in LCA
- Argued to be important for metals
- What is impact for other building materials?

Relevance of including module D in building LCA ?

- Impact compared to other life cycle stages
- Discussion of module D impact

→ Case study analysis

Case study

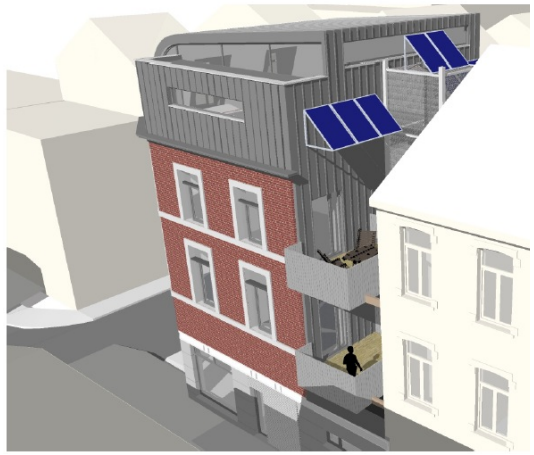
Existing building

- multi-family house
- 4 storeys
- Main composition:
  - Brick walls
  - Sloped roof with ceramic tiles

Case study

Building renovation with steel roof

- Main structure of existing walls and floors
- Insulated from inside (system wall, mineral wool, gypsum boards)
- Aluminium windows and doors
- Interior walls (system wall, min wool, gypsum boards)
- Steel roof structure and steel roof covering



Methodology LCA

Life cycle assessment at building level

- Cradle-to-grave
- Including module D

Methodology

- Principles ISO 14040, EN15804, EN 15978
- Software Simapro, Ecoinvent v2.2
- Impact method: ReCiPe Endpoint / Hierarchist

- RSL of 60 years
- Including replacement for SL < RSL
- Excluding technical installations

Methodology LCA

System boundary

- Materials to recycling: system boundary at gate of sorting plant
- Module D:
  - Recycling potential of materials
  - Exported energy generated by PV panels
  - No energy recovery (lack of data)
  - Based on Belgian waste and recycling scenarios

Scenario's recycling potential

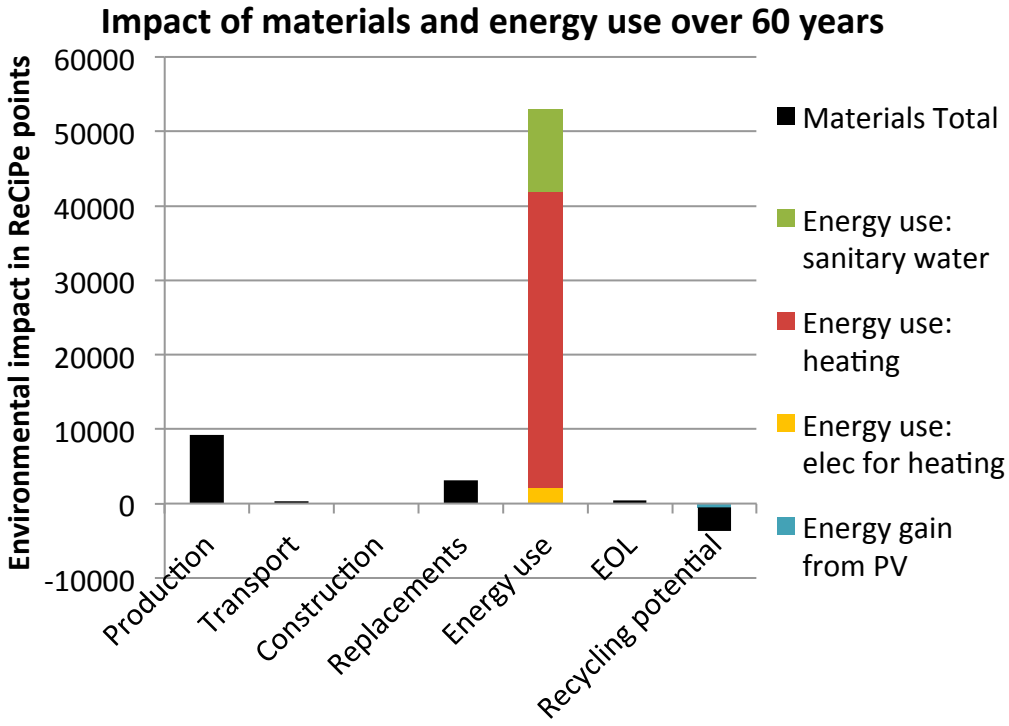
Material to be recycled	Secondary material
Steel	Secondary steel (closed loop)
Concrete, screed, …	Secondary granulates for roadwork (open loop)
Concrete blocks, bricks, facing tiles, …	Secondary granulates for roadwork (open loop)
Untreated sawn timber, wooden boards, parquet …	Wood chips (open loop)
Interior plaster (crushed with concrete granulates)	Secondary granulates for roadwork (open loop)
Facing tiles, ceramic wall and floor tiles, …	Secondary granulates for roadwork (open loop)
PE-foil, vapour barrier, …	Secondary PE granulates (open loop)
Gypsum plaster board	Gypsum plaster (open loop)
Aluminium in window frames	Secondary aluminium (closed loop)
Glass	Glass cullets (closed loop)

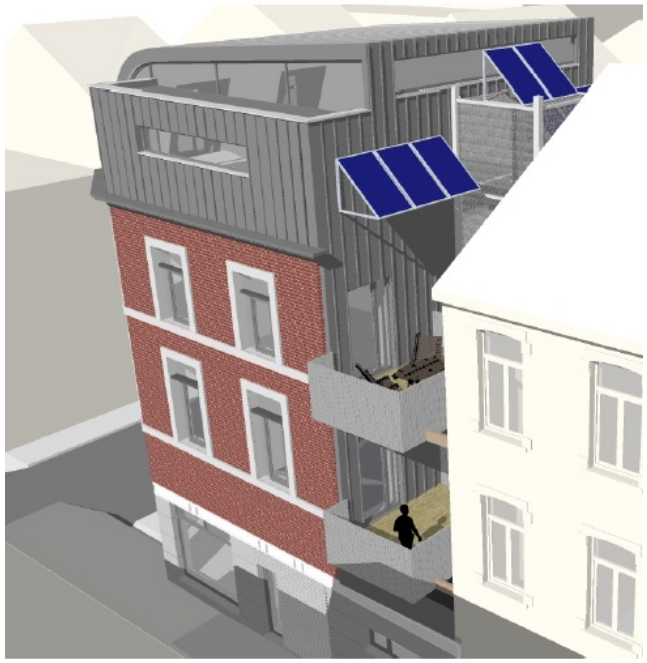
Results LCA – total building

Total impact per life cycle stage

- Largest impact in use phase

! impacts energy use will be lower for **passive/NZE** buildings



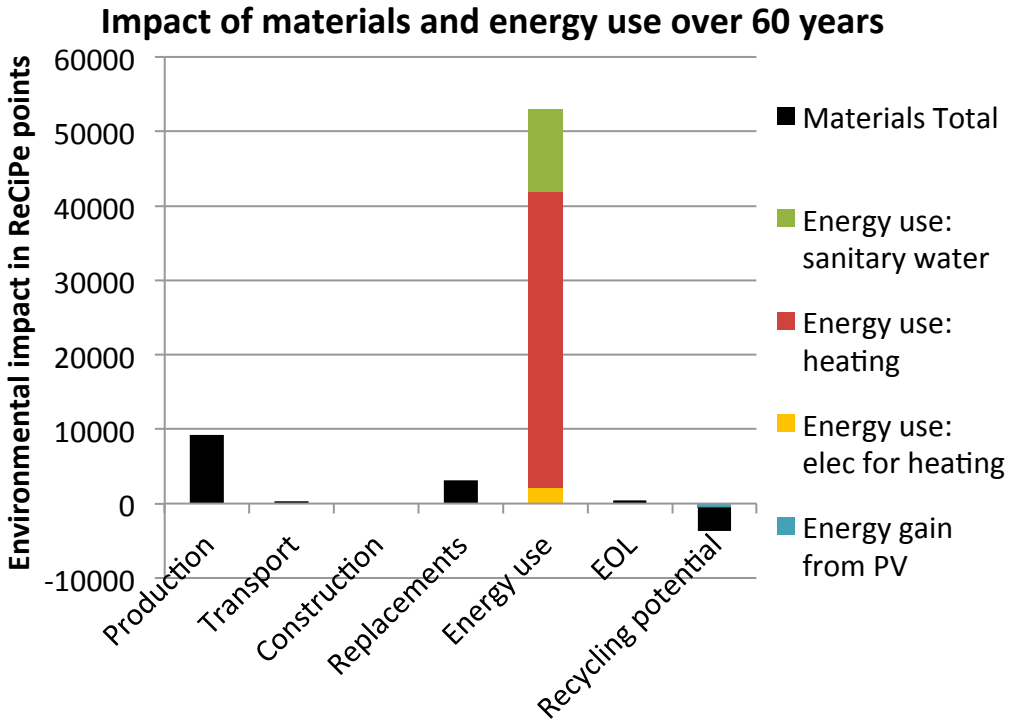


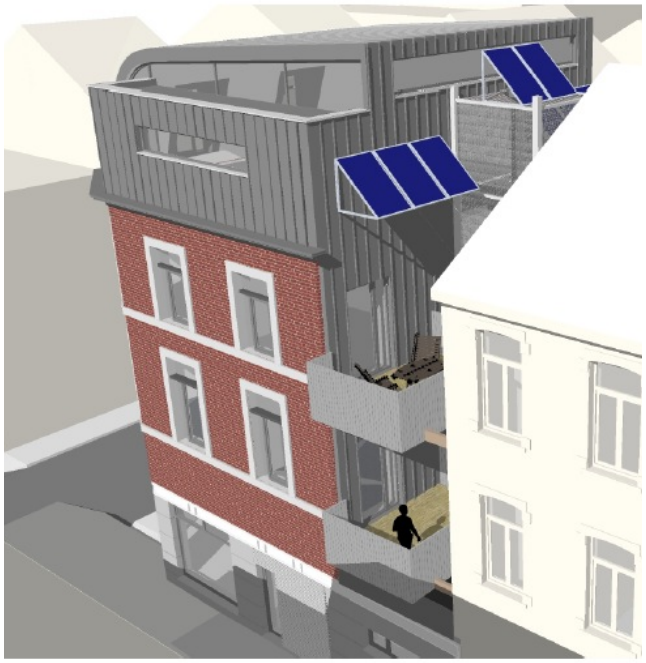
Results LCA – total building

Module D in total building

- order of magnitude of replacements
- module D > construction phase and EOL phase

! Case with large amount of **metals**



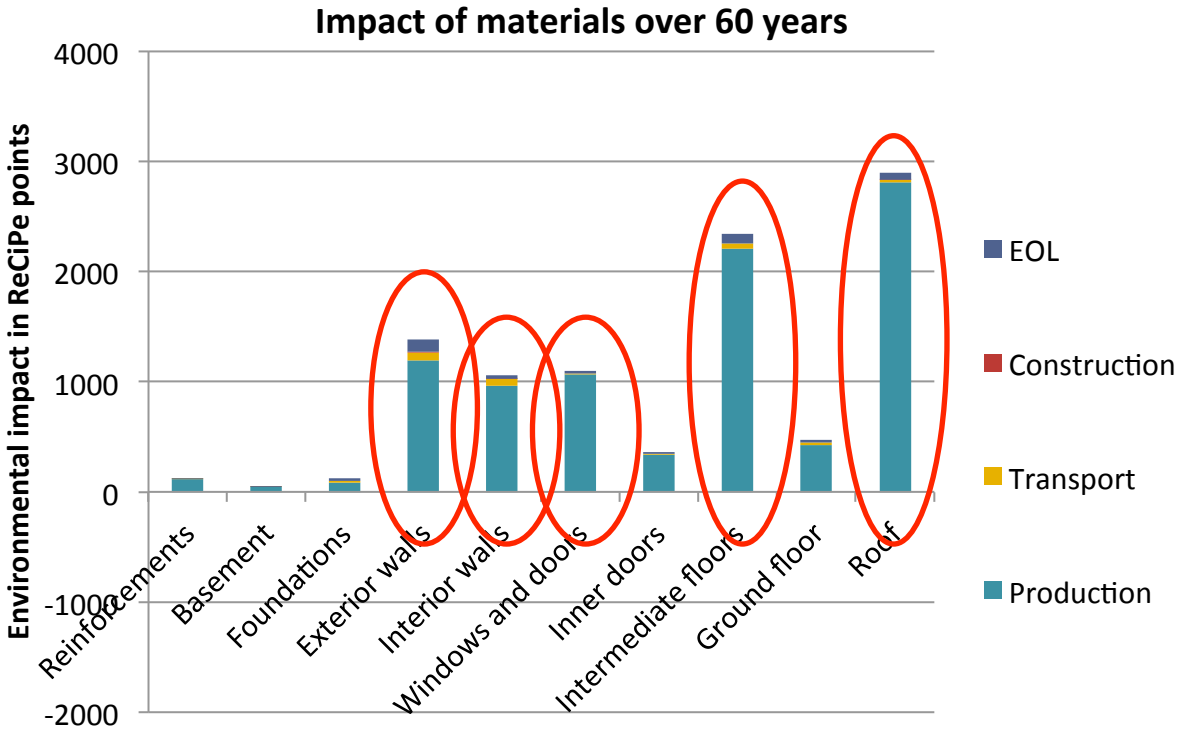


Results LCA – building elements

Production, installation and EOL

- Roof : low-alloyed steel (66%)
- Intermediate floors : parquet used for finishing layer (43%), OSB (14%), …
- Exterios walls : concrete block walls (19%), facing bricks (18%), mineral wool (10%), PUR rigid foam board (10%), steel (8%)…
- Interior walls : ceramic wall tiles (35%), steel beams (28%), gypsum board (17%), …
- Windows : aluminium frames (78%), …

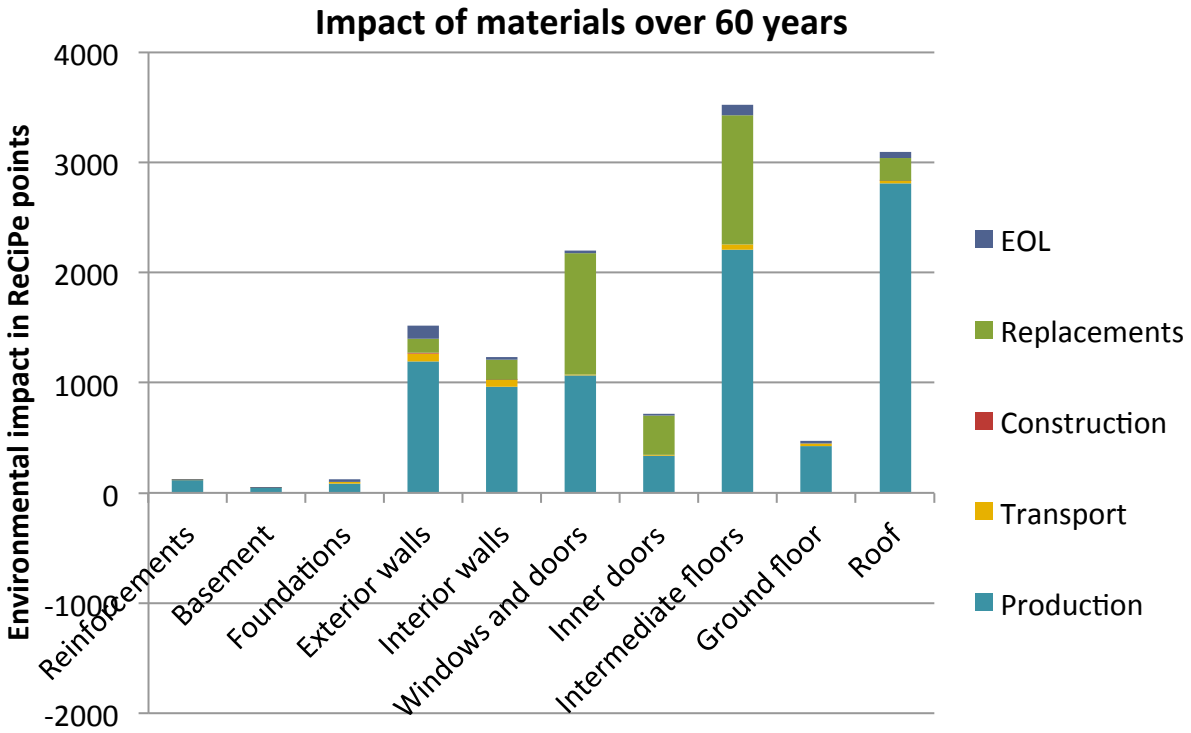
! Agricultural land use



Results LCA – building elements

Replacements

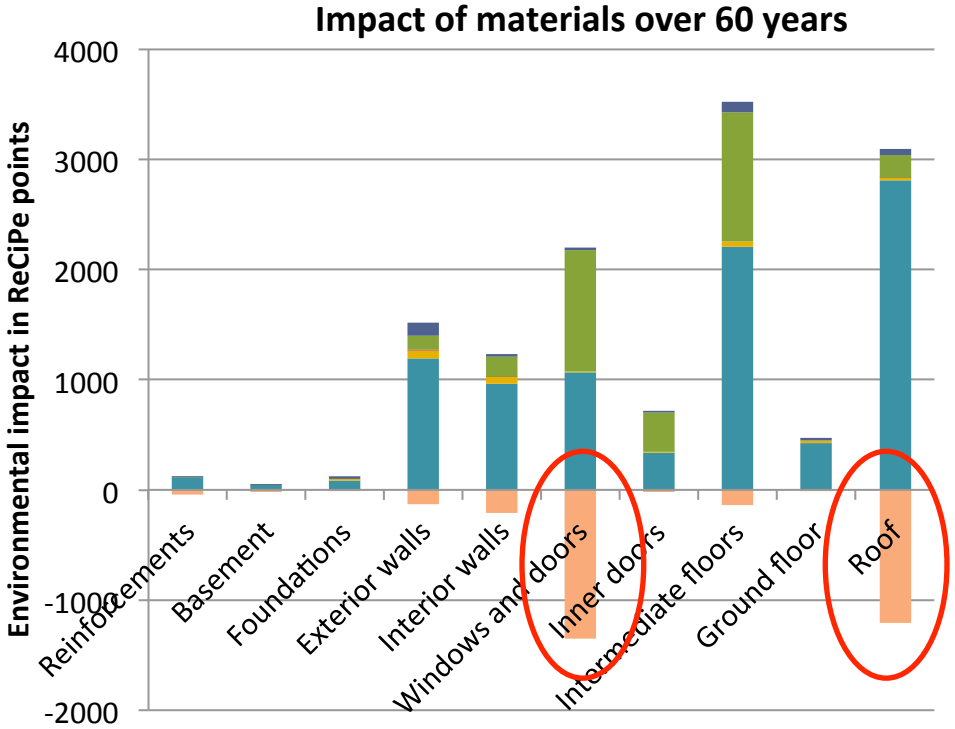
- Windows
- Intermediate floors

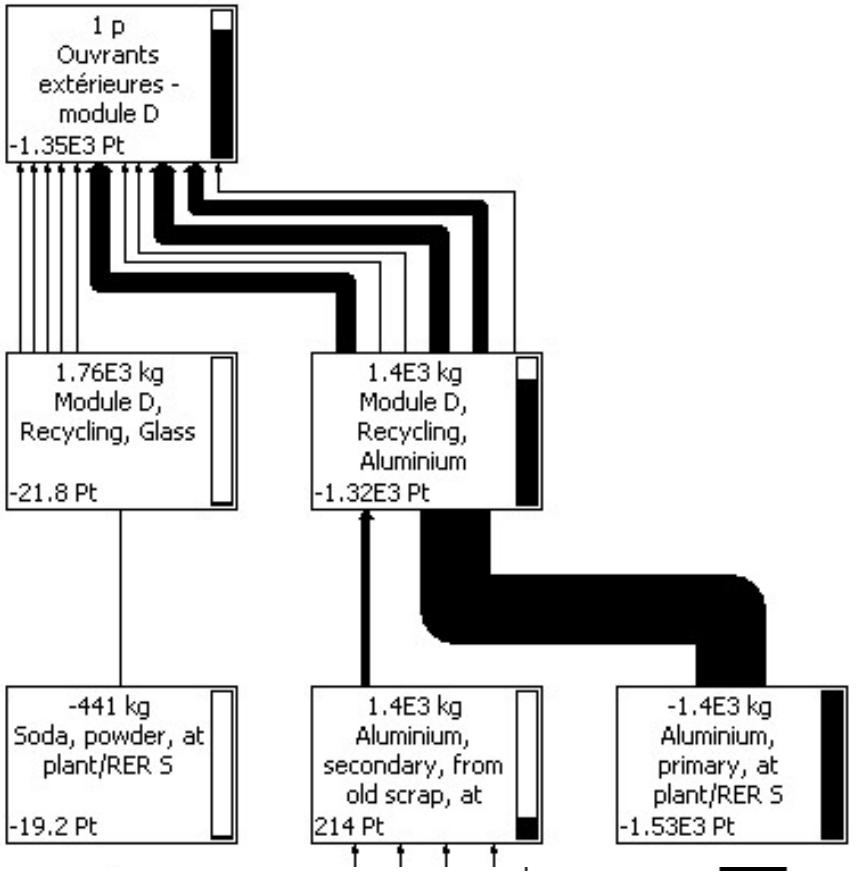


Results LCA – building elements

Module D

- Steel roof → 98% related to steel
- Aluminium windows → 98% related to aluminium
  (despite RR of 70% for glass panes)





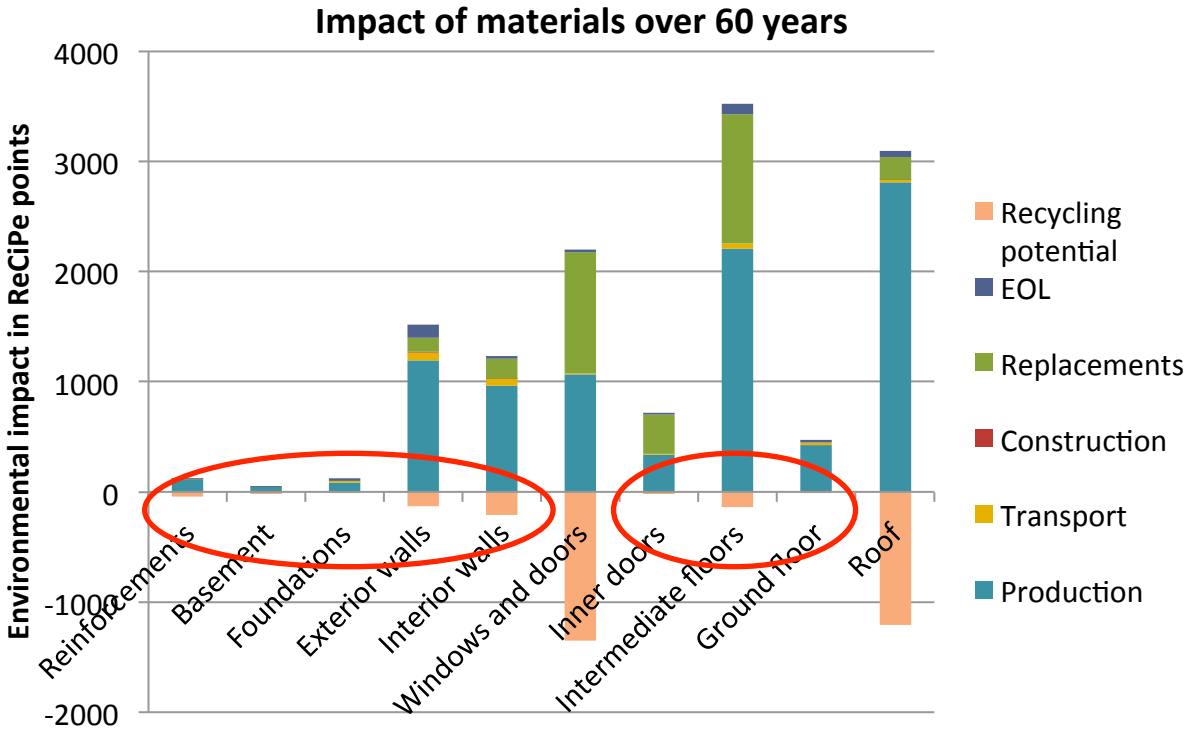
Results LCA – building elements

Module D

- SMALL for other building elements
  - Low recyclability (e.g. mineral wool, gypsum board)
  - Low benefits related to recycling (e.g. concrete, bricks)

! **Renovation** case
with existing floors and walls

High recycling rate ≠ high module D impact
→ Module D does not tell the whole recycling story



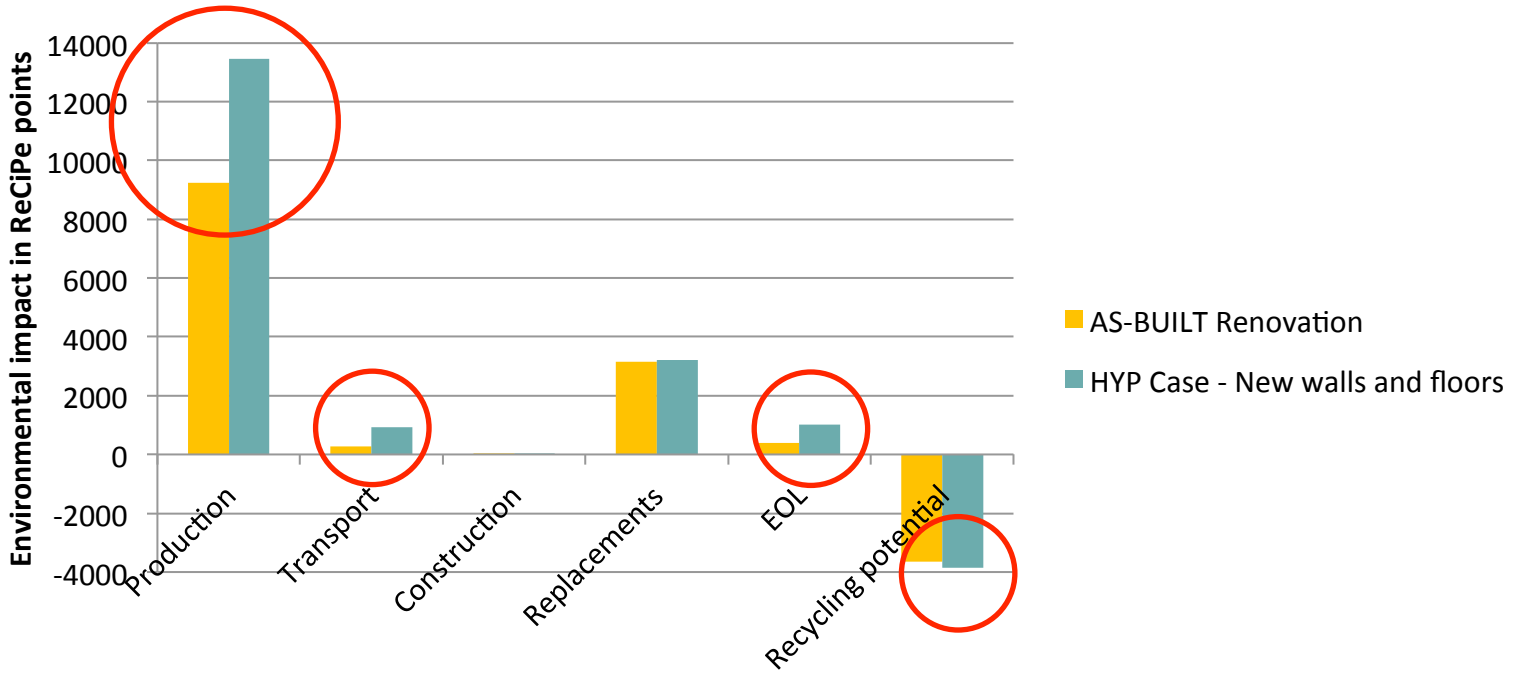
Case study – hypothesis new construction

What if ?

- Higher impact production
- Higher impact transport and EOL → « heavy » materials
- Module D:
  - Concrete blocks RR = 95%, but…
  - only small difference at building level

! HYP case with
new **floors** and **walls**

→ Module D impacts strongly related to use of metals



Conclusions

General

- Impact of use phase largest

Module D in building LCA

- Consideration of module D can be significant in building LCA

BUT…

- Potential benefits strongly related to use of metals
- High recycling rate ≠ high module D impact

Points of attention in calculating module D

- End of waste point
- Functional equivalence
- Data availability production process

→ Paper being presented at LCA conference in Lille – November 4-5, 2013

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