Interreg
France-Wallonie-Vlaanderen
UNION EUROPÉENNE
EUROPESE UNIE

VALDEM

VALDEM PROJECT: FROM LCA OF DEMOLITION WASTE TO CIRCULAR ECONOMY OF BUILDINGS

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- ❑ Context
- ❑ VALDEM project
- ❑ Life Cycle Management
- ❑ Recycling of waste concrete blocks

Context:

- Building and construction sector:
  - more than 1/3 of global resource consumption
  - generation of solid waste: 40% of the total waste volume
  - EU: CDW = largest waste stream (1/3 of all EU waste)

- CDW (Construction & Demolition Waste): mostly not recycled
- Causes:
  - heterogeneity
  - dispersion
  - economic viability

VALDEM project: objectives

VALDEM aims to improve demolition waste treatment to reach a circular economy in North of France and Wallonia (BE):

Identify waste flow and create new recycling sector

- optimize building EoL management: new deconstruction, sorting and recycling processes
- increase recycling
- generate high quality secondary materials (up-cycling)

Validate the approach by using Life Cycle Assessment

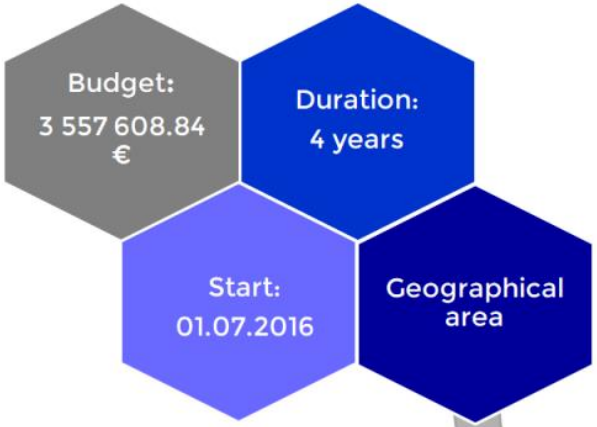
Demonstrate the transferability of the results to industries

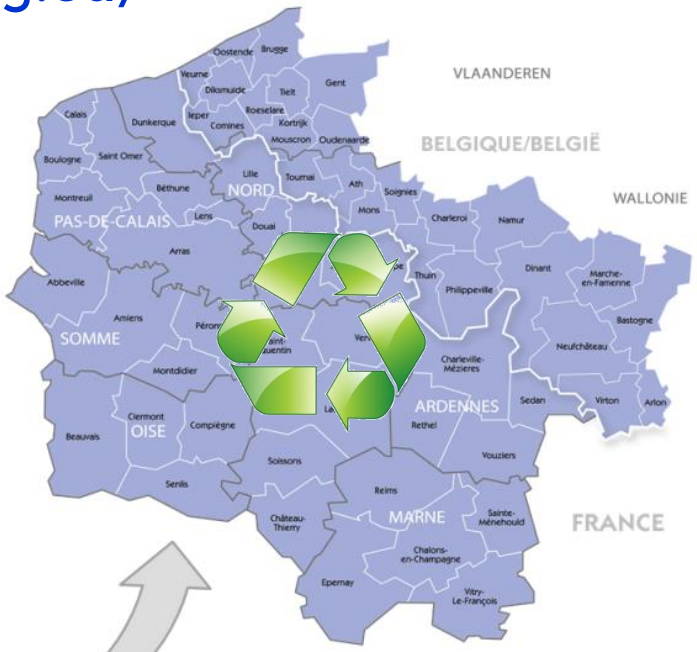
Conduct a monitoring of regulations and highlight opportunities

VALDEM project: scope

General information:

http://www.valdem-interreg.eu/





Co-founders:

Région Hauts-de-France

ADEME
Agence de l'Environnement et de la Maîtrise de l'Energie

www.enmieux.be

FEDER
LE FONDS EUROPÉEN DE DÉVELOPPEMENT RÉGIONAL ET LA WALLONIE INVESTISSENT DANS VOTRE AVENIR

Wallonie

AVEC LE SOUTIEN DU FONDS EUROPÉEN DE DÉVELOPPEMENT RÉGIONAL
MET STEUN VAN HET EUROPEES FONDS VOOR REGIONALE ONTWIKKELING

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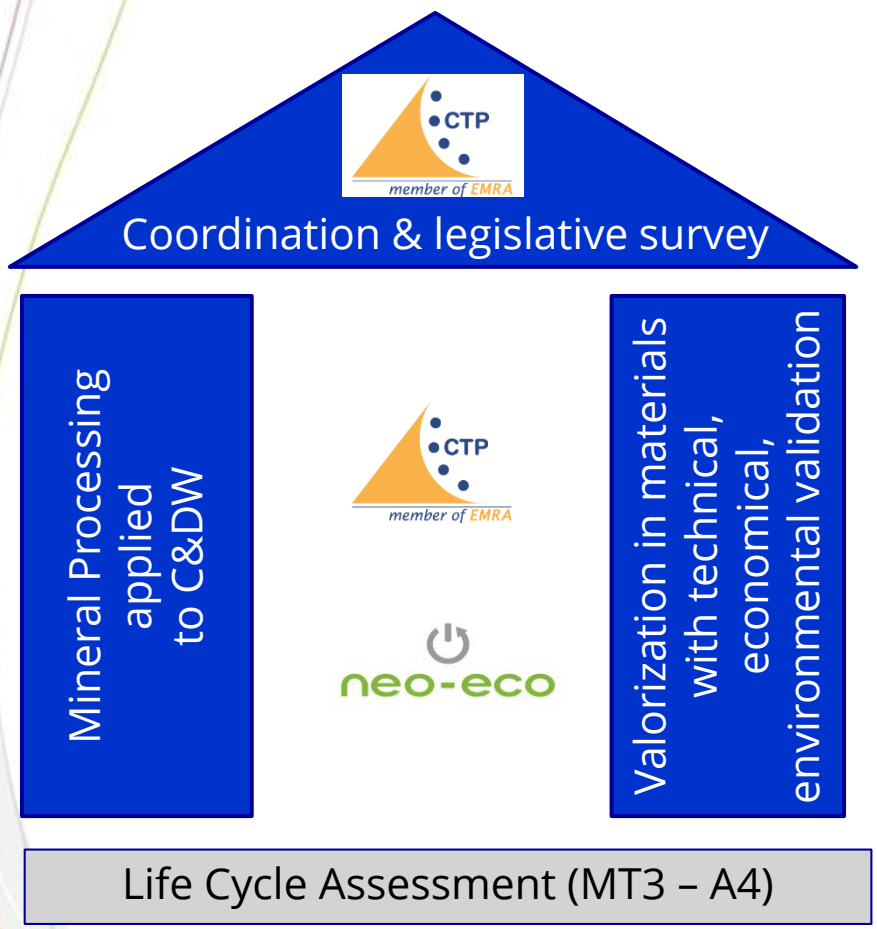
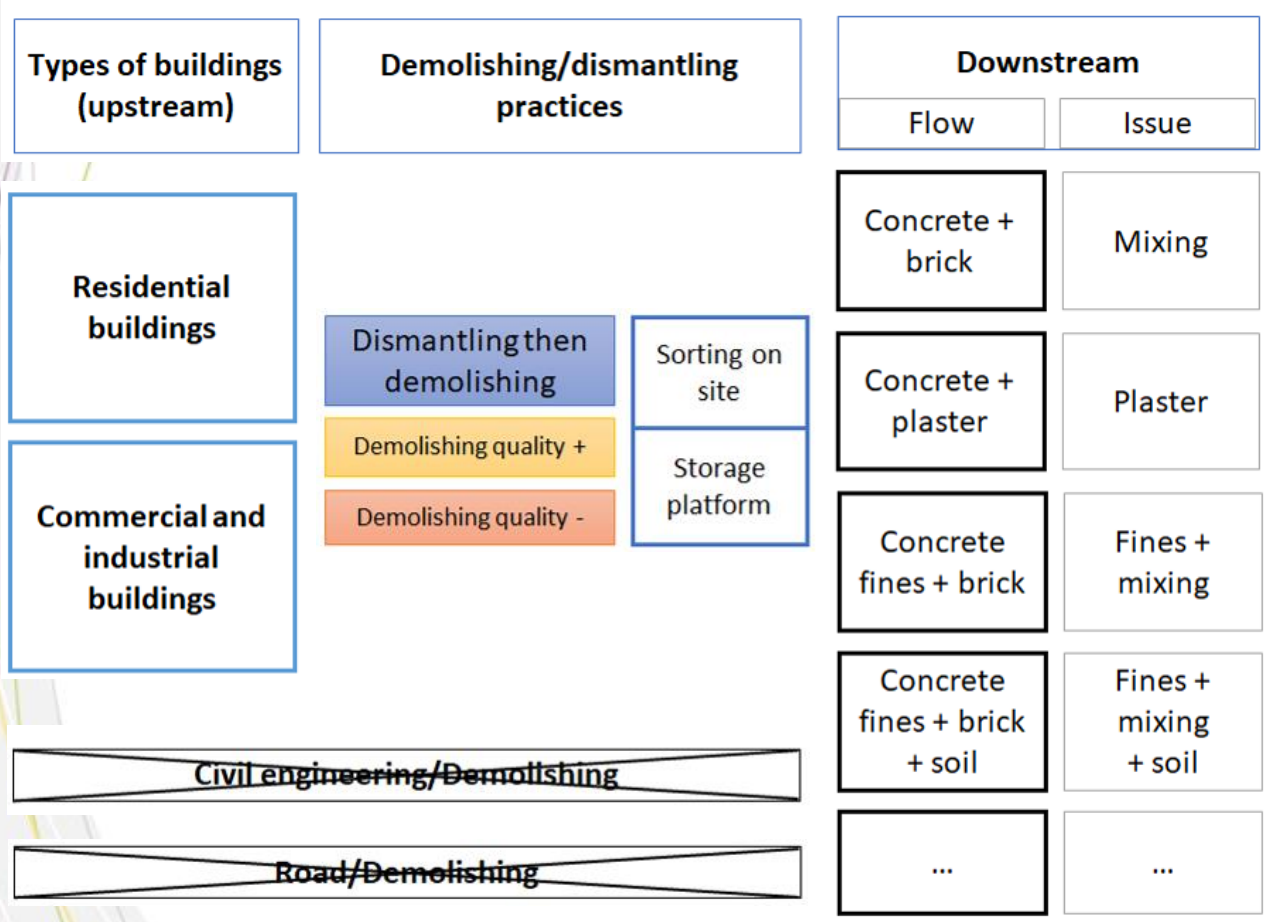
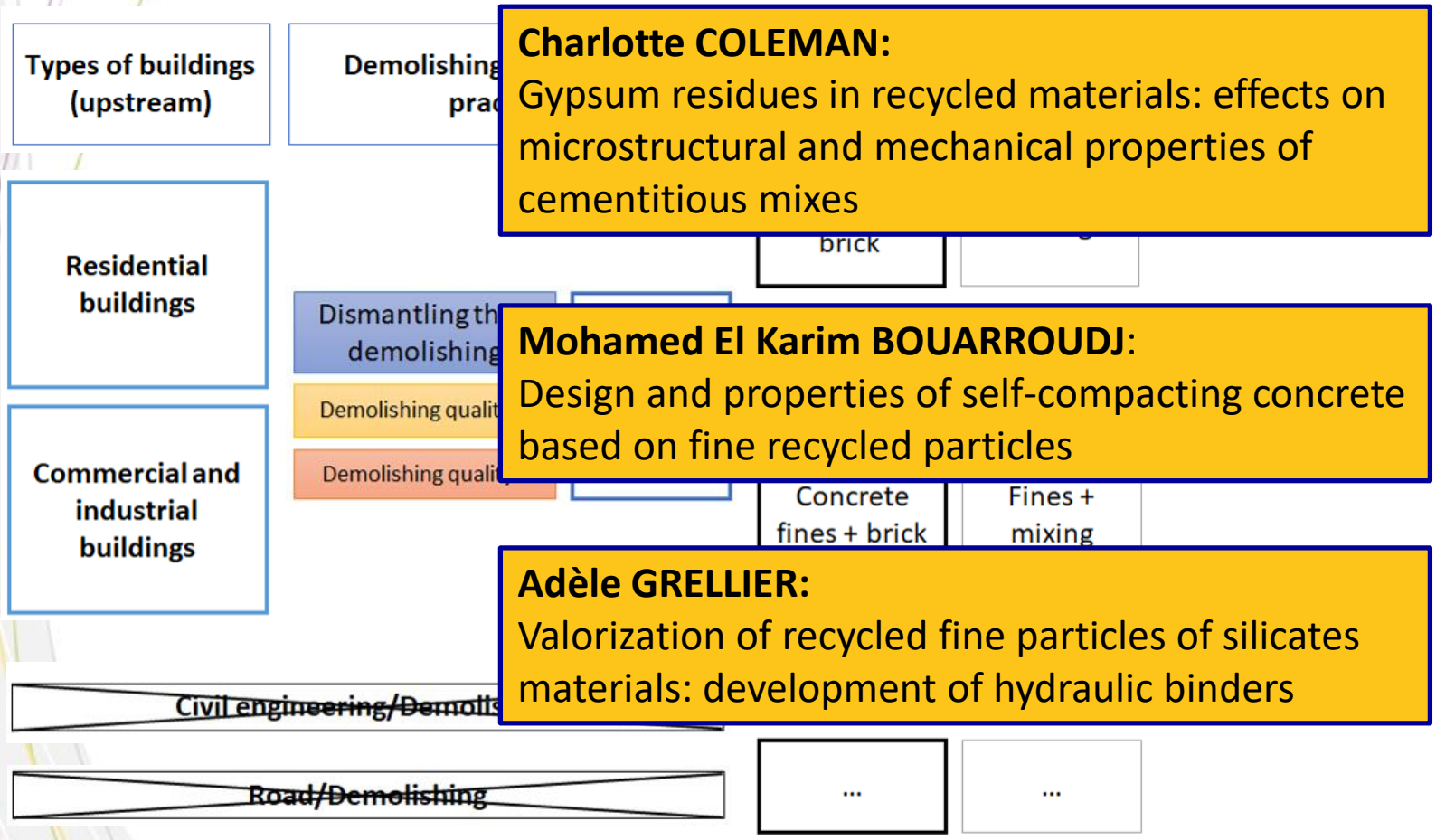
VALDEM project: partnership



Life Cycle Management: detailed scope



Life Cycle Management: detailed scope



Charlotte COLEMAN:
Gypsum residues in recycled materials: effects on microstructural and mechanical properties of cementitious mixes

Mohamed El Karim BOUARROUDJ:
Design and properties of self-compacting concrete based on fine recycled particles

Adèle GRELLIER:
Valorization of recycled fine particles of silicates materials: development of hydraulic binders

Life Cycle Management: concrete actions

Identify hot spots and key aspects → meta-analysis

- waste inventory (recycling parks)
- potential waste flows (regional data)

Comparative LCA:

- technical information from consortium partners
- evaluation of benefits and impacts of proposed solutions
- limit impact transfer to generate the maximum value for the stakeholders

Transfer of results to the main actors (recycling operators, building contractors, product manufacturers, policy ...) in the 3 regions

Life Cycle Management: outputs

Bring scientific and concrete elements (based on data from the ground and at macro-level)

on how recycling of CDW can improve environmental impact of buildings along their life (current and future)

and move forward to a circular economy in construction sector

Recycling of production waste of concrete blocks CONREPAD – BEWARE fellowships

- Pr Luc Courard, Dr Ir Zengfeng Zhao (ULiège – GeMMe)
- PREFER company (Flémalle/Engis, BE)
- Production of concrete blocks with recycled concrete aggregates (RCA) from production waste
- Block BD14292: 29 x 14 x 19 cm, with 2 holes
- 30% RCA: properties ok → feasibility validated

- Comparative LCA: concrete blocks without and with RCA

Goal and Scope

Goal:

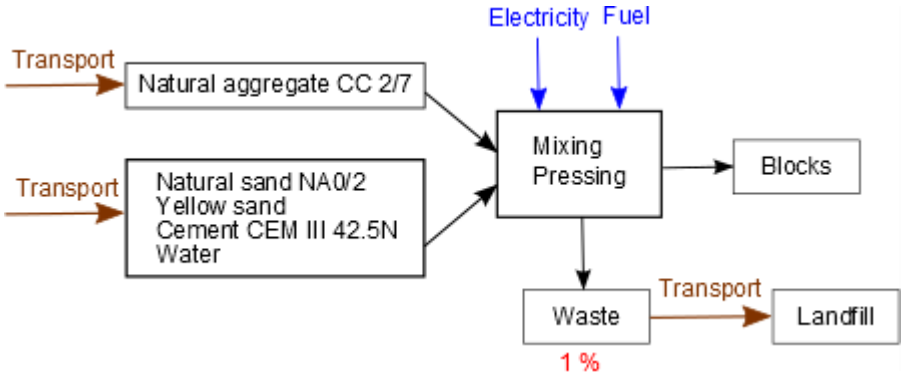
- To study the influence of the recycling of production waste in substitution of natural aggregates in the production of concrete blocks

Scope:

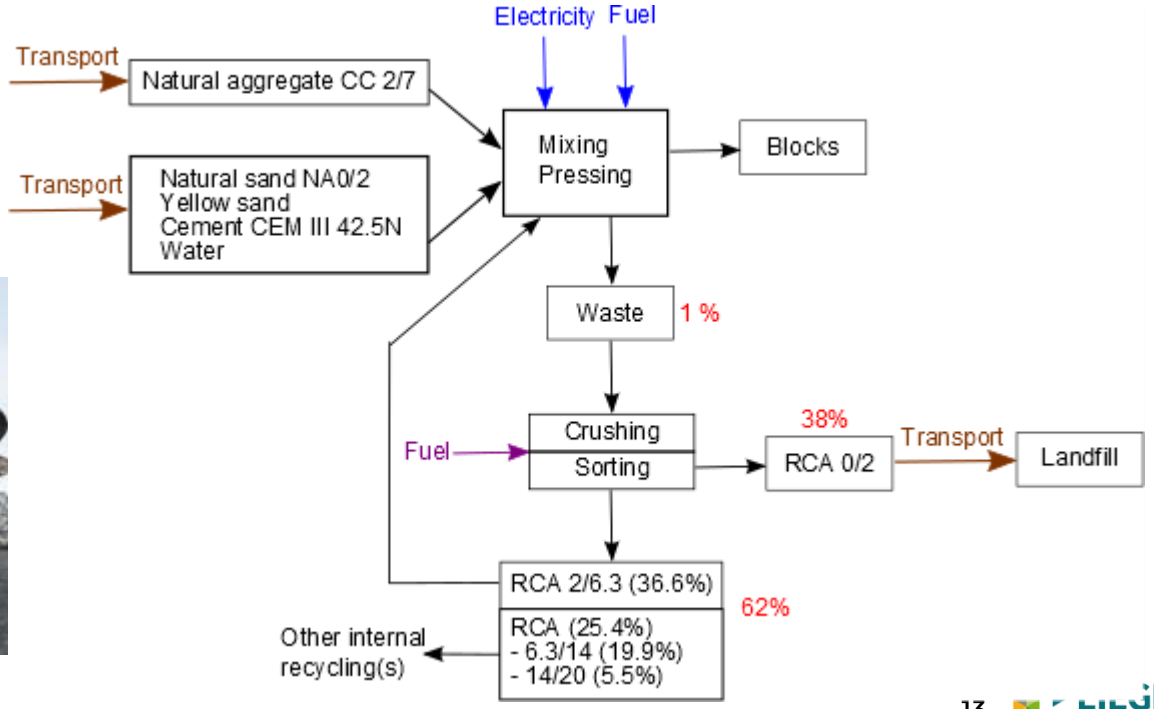
- Cradle-to-gate (comparative) LCA
- Substitution of 30% of natural aggregates with recycled concrete aggregates (RCA) from production waste
- FU: 1 m³ of concrete blocks, on the basis of a 1 year production

System boundaries

1. Natural aggregate only (B_RCA0)



2. 30% RCA (B_RCA30)



Inventory

1. Composition of blocks (kg for 1 m³)

	B_RCA0 (0%)	B_RCA30 (30%)
Natural aggregate CC 2/7	1010	707
Recycled concrete aggregate 2/7	0	282
Natural river sand NA0/2	822	822
Yellow sand	63	63
Cement CEM III/A	175	175
Water	41.3	55

2. Production

- 1 m³ = 2,170 kg
- 101,500 m³/year (total for the 2 production sites – 65.5% and 34.5%)
- Waste: 1% → 1,015 m³/year (2,202,550 kg) → on-site storage
  Mobile crusher Metso LT12113 (250 t/h - 115 m³/h) : 1x /year

Inventory

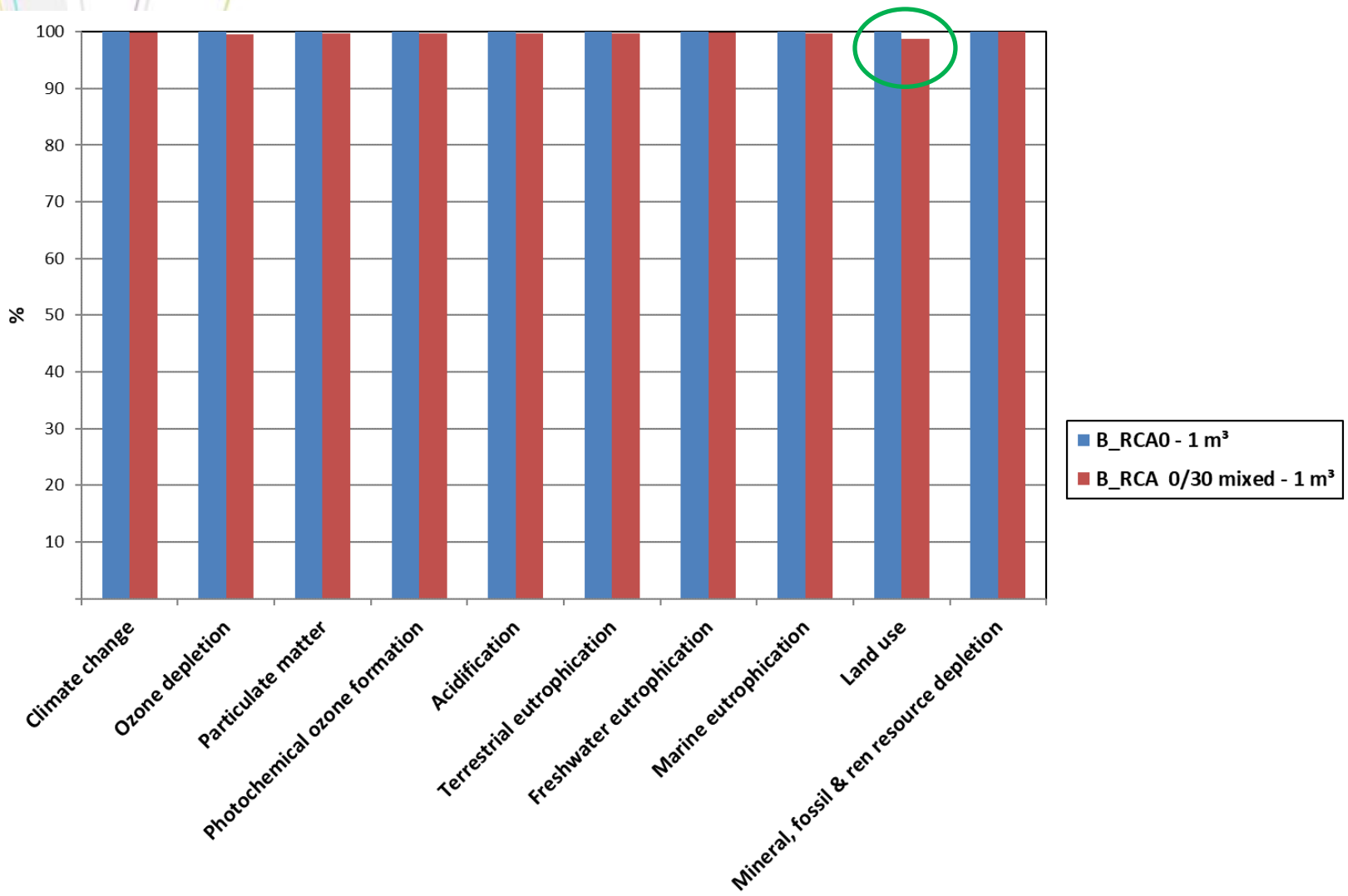
- Recycling: after crushing and sorting:
  - RCA 0/2: 38% → landfill
  - RCA 2/6.3: 36.6% → concrete blocks
  - RCA 6.3/14 + 14/20: 25.4% → other internal recycling (avoided burden)

- RCA 2/6.3 availability: 805,015 kg/year
  ⇒ 2,855 m³ of B_RCA30
  ~ 3 % of the annual production of blocks
- ⇒ To be completed with B_RCA0 (98,645 m³)
- "Mixed" production of RCA0 and RCA30

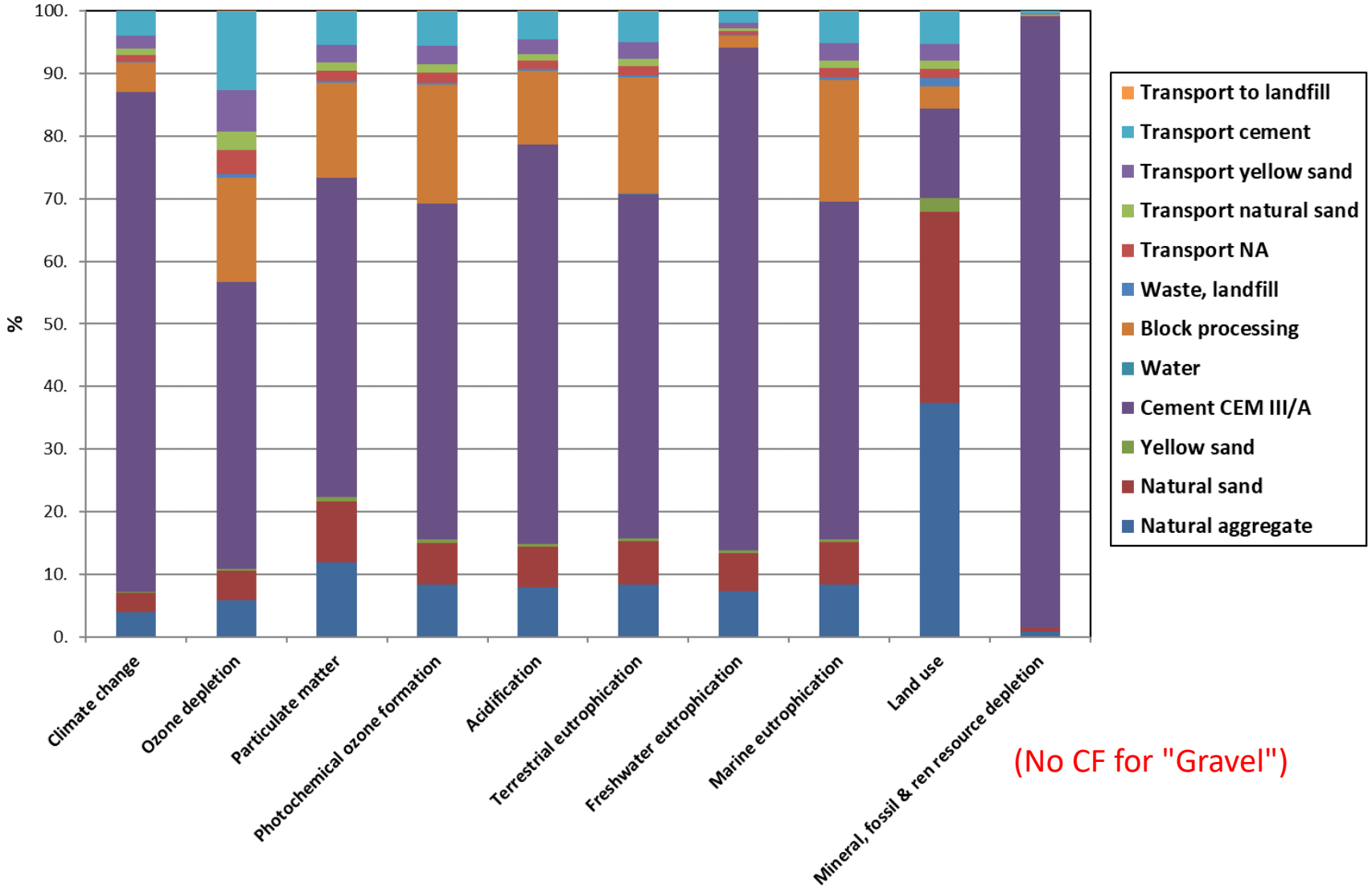
- Inventory for 1 year: B_RCA0 vs mixed production of B_RCA0 and B_RCA30 (incl. mobile crusher etc.)
- Normalized by annual production to have **1 m³ (FU)**

LCA Results – B_RCA0 vs Mixed prod.

Simapro 8.5; Ecoinvent 3.4; ILCD 2011 Midpoint+ (1.10)



LCA Results – B_RCA0



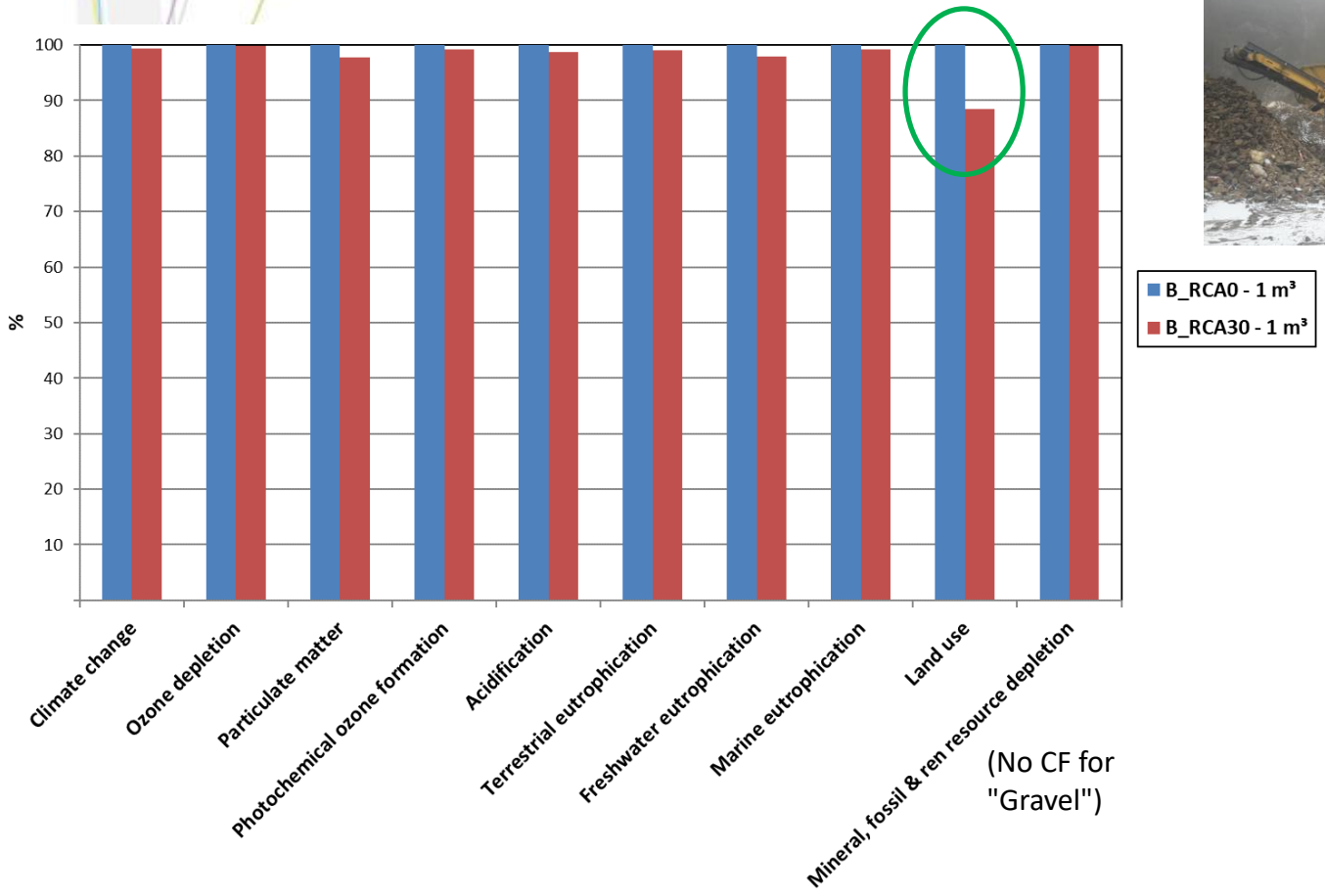
(No CF for "Gravel")

LCA Results – B_RCA0 vs B_RCA30

Vadem: valorization of CDW

Eloy Construction: CDW sorting site → RCA

⇒ Import of RCA2/6.3 from Richopré quarry (Chanxhe, 25 km)



(No CF for "Gravel")

Conclusions

- Very little waste blocks (1%) ⇒ B_RCA30 can represent only 3% of the annual production of PREFER
- Impacts (in all categories) due mainly to cement, not to (natural) aggregates

- ⇒ Very limited benefits (not significant) from the internal recycling of waste blocks compared to the impacts of the whole process

- But higher benefits (land use) if import of RCA from CDW sorting site (external recycling) → B_RCA30

- To confirm from a financial point of view

Take home message

- **Globally, and in a circular economy perspective, internal recycling of waste blocks at PREFER is a good idea!**

- **Especially if internal recycling is completed with RCA from a local external source of CDW**

Acknowledgment:

This work is part of the research project VALDEM (Convention n° 1.1.57 of Interreg France – Wallonie - Vlaanderen 2014-2020) partly financed by the European Regional Development Funds, and Wallonia.

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