Existing databases as means to explore the potential of the building stock as material bank

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

Existing buildings are material banks

Existing building stock represents a great amount of building materials, which could become available for reuse and recycling in the future.

Facades

Floors

Interior wall

Doors & windows

Insulation

Roofings

How much m² ?
Which materials ?

BIM ✓

EPC ✓

?

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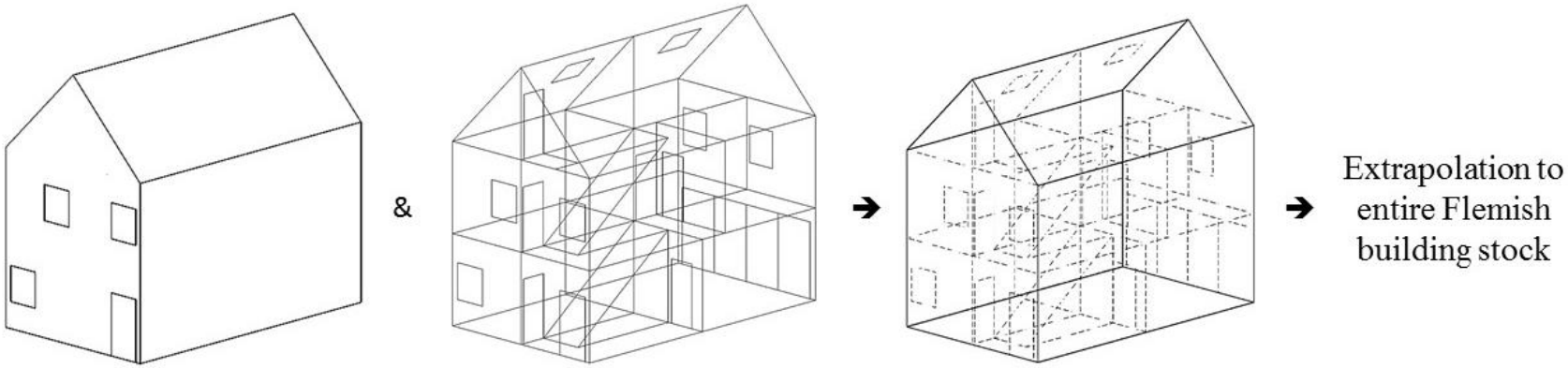
Combining two existing databases to reflect the (future) potential of the existing building stock as material bank.



EPC database: **Essencia database:** **Combined database:**

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Combining two existing databases to reflect the (future) potential of the existing building stock as material bank.

	EPC database	Essencia database
Owner	Flemish Energy Agency (VEA)	Essencia Marketing
Number of buildings	> 1.000.000	6.000 buildings (+ yearly 1.000 buildings)
Typologies	All residential typologies	All residential typologies
Construction period	< 1850 – ….	2010 - ….
Data available for	Building envelope	Complete building
Collection method	By certified energy expert based on inspection protocol	Onsite measurements of buildings during construction phase
Reliability of data	Representative for geometry, less for materials	Representative for geometry and for materials
Type of material data	Mix of specific and default	Specific data
Regional relevance	Flemish Region	Belgium

Estimated data for material quantities for whole residential building stock in Flemish region

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Example of combining databases: estimation of the interior wall area in existing buildings

Interior wall area = the area of all interior walls in the building, including the inner leaf of exterior (party) walls, minus the area of windows and doors .

EPC Database

↓

No data on interior wall

Essencia Database

↓

Detailed data on interior wall

↓

Formulas derived to calculate m² interior wall based on general building parameters and building envelope data

Estimation of the material quantities used in interior wall area in existing buildings in Flanders

- Per building
- Per group of buildings

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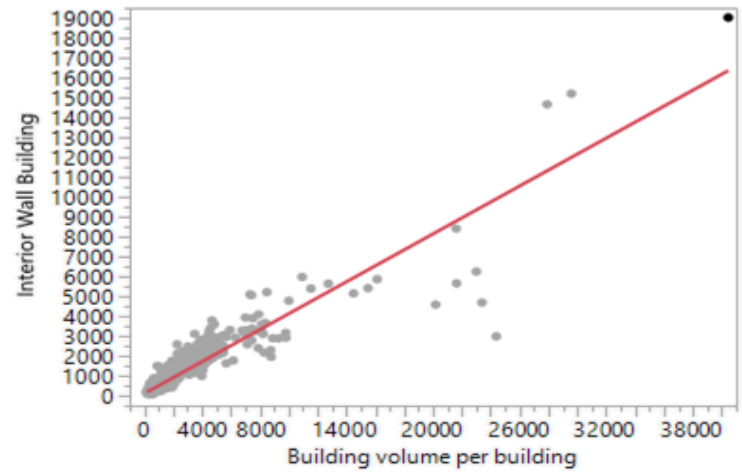
Two estimation equations of the interior wall area

Bivariate fit



Based on the Essencia database of 6000 buildings built after 2010, 2 formulas are derived to estimate the interior wall area of 1 building or multiple buildings

1) Interior wall area per building in m² (R^2 k-fold = 0.88)

*= 275.9 + 0.37 * building volume per building in m³*
+ (building typology: "terraced" 19.6, "semi-detached" 0.11, "detached" -19.7)
+ (type of house: "Apartment" 166.4, "single family dwelling" -166.4)

2) Interior wall area per building in m² (R^2 k-fold = 0.87)

*= 106.58 + 0.40 * building volume per building in m³*

Application to the EPC database

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Application to EPC database

Parameter	Est. eq. (1)
Average building volume in Flanders of a terraced house (in m^3)[a]	460
Quantity of interior wall area per terraced house (in m^2)	299.30
Extrapolated interior wall area for terraced houses in Flanders (in m^2) (n= 647 144)[b]	193 690 199
Average building volume in Flanders of semi-detached house (in m^3)[a]	474
Quantity of interior wall area per semi-detached house (in m^2)	284.99
Extrapolated interior wall area for semi-detached houses in Flanders (in m^2) (n= 570 240)[b]	162 512 698
Average building volume in Flanders of a detached house (in m^3)[a]	613
Quantity of interior wall area per detached house (in m^2)	316.61
Extrapolated interior wall area for detached houses in Flanders (in m^2) (n= 887 508)[b]	280 993 908
Total extrapolated interior wall area for the Flemish building stock (in m^2) (n= 2 104 892)[b]	**637 196 804**
	Est. eq. (2)
Average building volume in Flanders of a house (in m^3)[a]	519
Quantity of interior wall area per house (in m^2)	314,18
Extrapolated interior wall area for the Flemish building stock (in m^2) (n= 2 104 892)[b]	**661 314 969**

[a] Verbeeck, G. and W. Ceulemans, Samenvattend rapport: Analyse van de EPC databank. Resultaten tot en met 2014. [4]

[b] Land register of the Flemish dwellings stock on 1/1/2015. [7]

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Application to EPC database
=> Example for quantities of clay bricks

Parameter	Est. eq. (1)	Est. eq. (2)
Extrapolation of the interior wall area to the Flemish dwelling stock (in m²)	637 196 804	661 314 969
Estimated market share of clay bricks for interior wall[a]	85.4%	
Estimated amount of clay bricks embedded in the interior walls in the Flemish dwelling stock (in m²)	544 166 071	564 762 983

[a] Essencia Marketing; average market share since 2010 – 2017 in Flanders.

➡ The two estimation equations result in a difference of 3.7 %

Remark !

Validity check needed for buildings older than 2010

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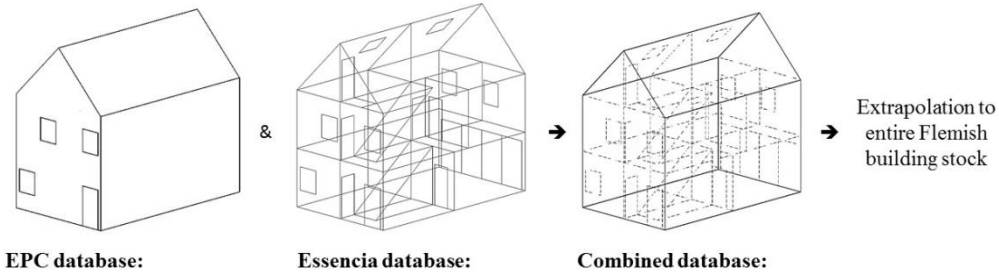
Conclusion



At this point, the estimation equations provide **the best possible approximation** for the interior wall area in the existing building stock. The same method can be applied for other building elements (facades, floors, windows, …).

Thus, the **combination** of different databases and the extension of the data availability through **predictive modelling** and **extrapolation** could provide a starting point for **the development of a BAMB database for Belgium**.

Although extra checks on the suitability of the estimation equations for older buildings are necessary.

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Thank you for your attention

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