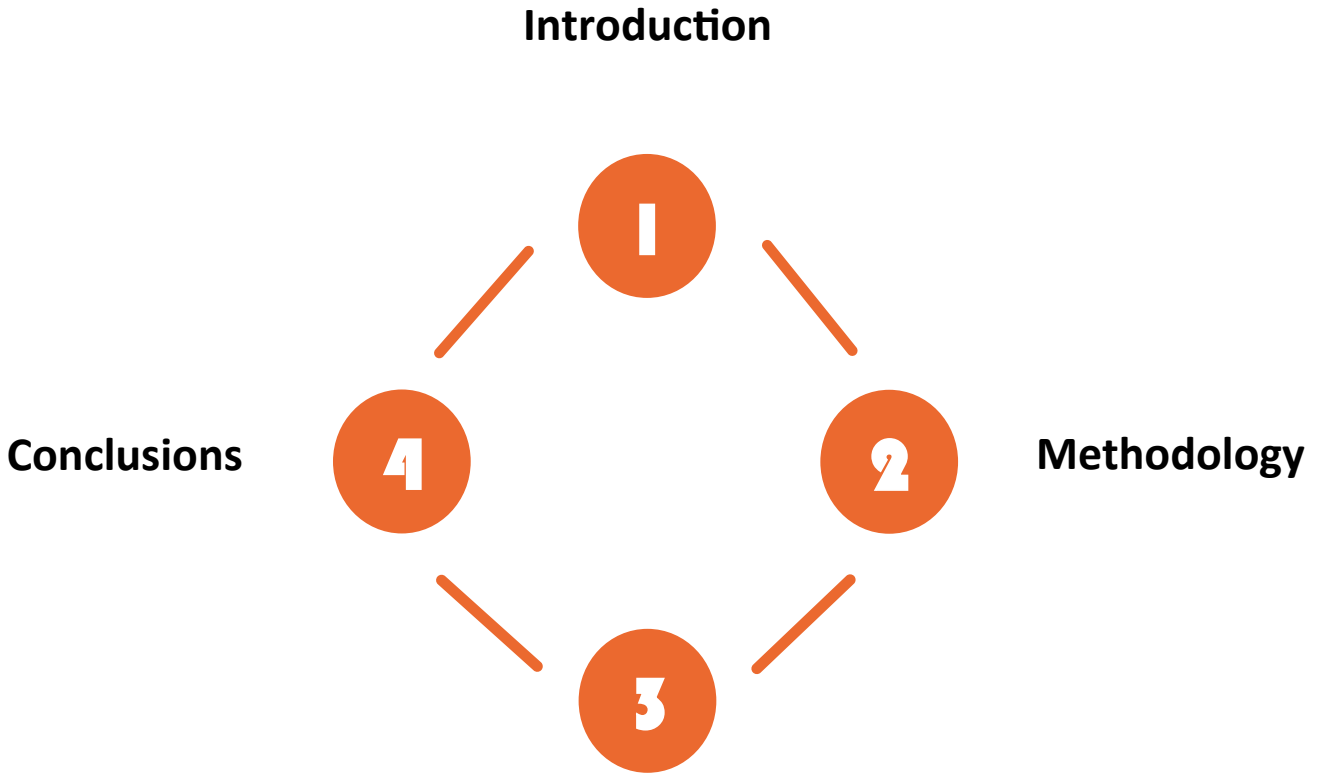
ENERGY RETROFIT SCENARIOS: MATERIAL FLOWS AND CIRCULARITY

Emilie Gobbo
Sophie Trachte
Catherine Massart

BAMB
BUILDING AS MATERIAL BANKS

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

1 Summary



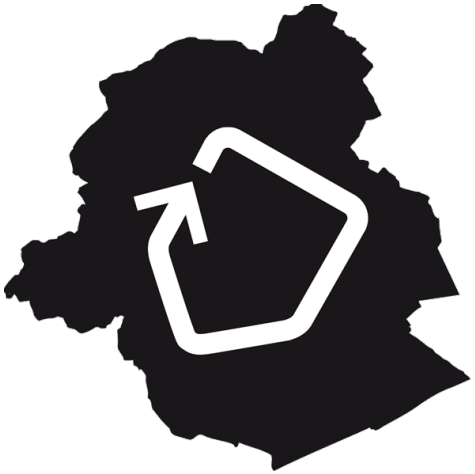
BAMB
BUILDING AS MATERIAL BANKS
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

1 Introduction: the ERDF-BBSM project

Your region and Europe invest in your future!

BRUSSELS-CAPITAL REGION

EUROPEAN UNION
European Regional Development Fund



LE BATI BRUXELLOIS SOURCE DE NOUVEAUX MATERIAUX

- "urban metabolism" of the Brussels-Capital Region (RBC) > bottom-up approach
- key sector: the construction industry

> Identify and encourage the creation of positive-value loops and eliminating the concept of waste

- study representative typologies and extrapolate
- opportunities for creating new channels offered by the sector's entire value chain
- technical and legal aspects related to recovery (re-use and recycling)
- impact of design on potential current and future use of end-of-life materials as new materials (reversible design and design for change).

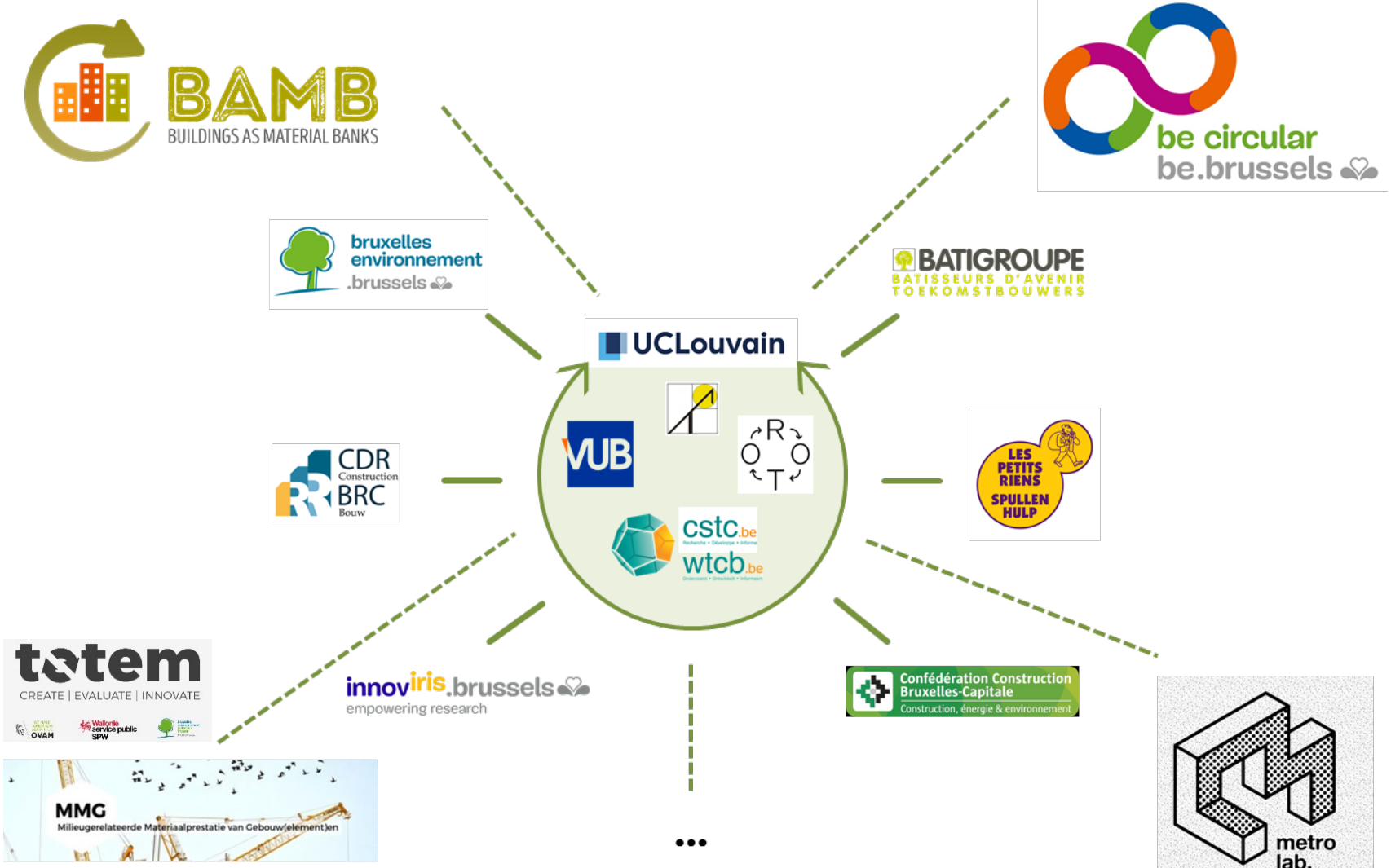
> tool for anticipating, planning, managing and successfully exploiting the local material resources of the building stock and construction industry in the RBC

www.bbsm.brussels

BAMB
BUILDING AS MATERIAL BANKS

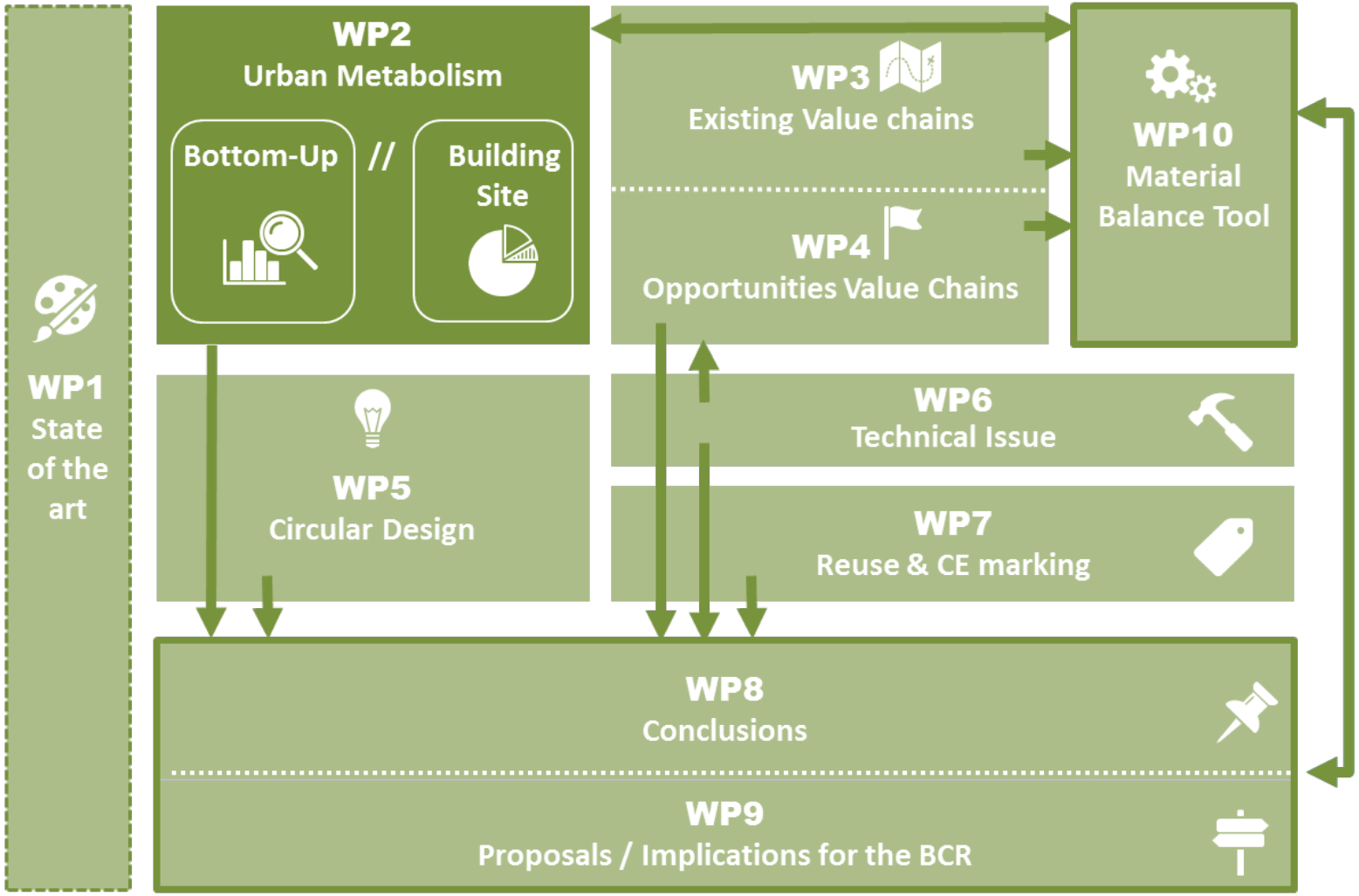
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

BBSM Project: Partners & Synergies



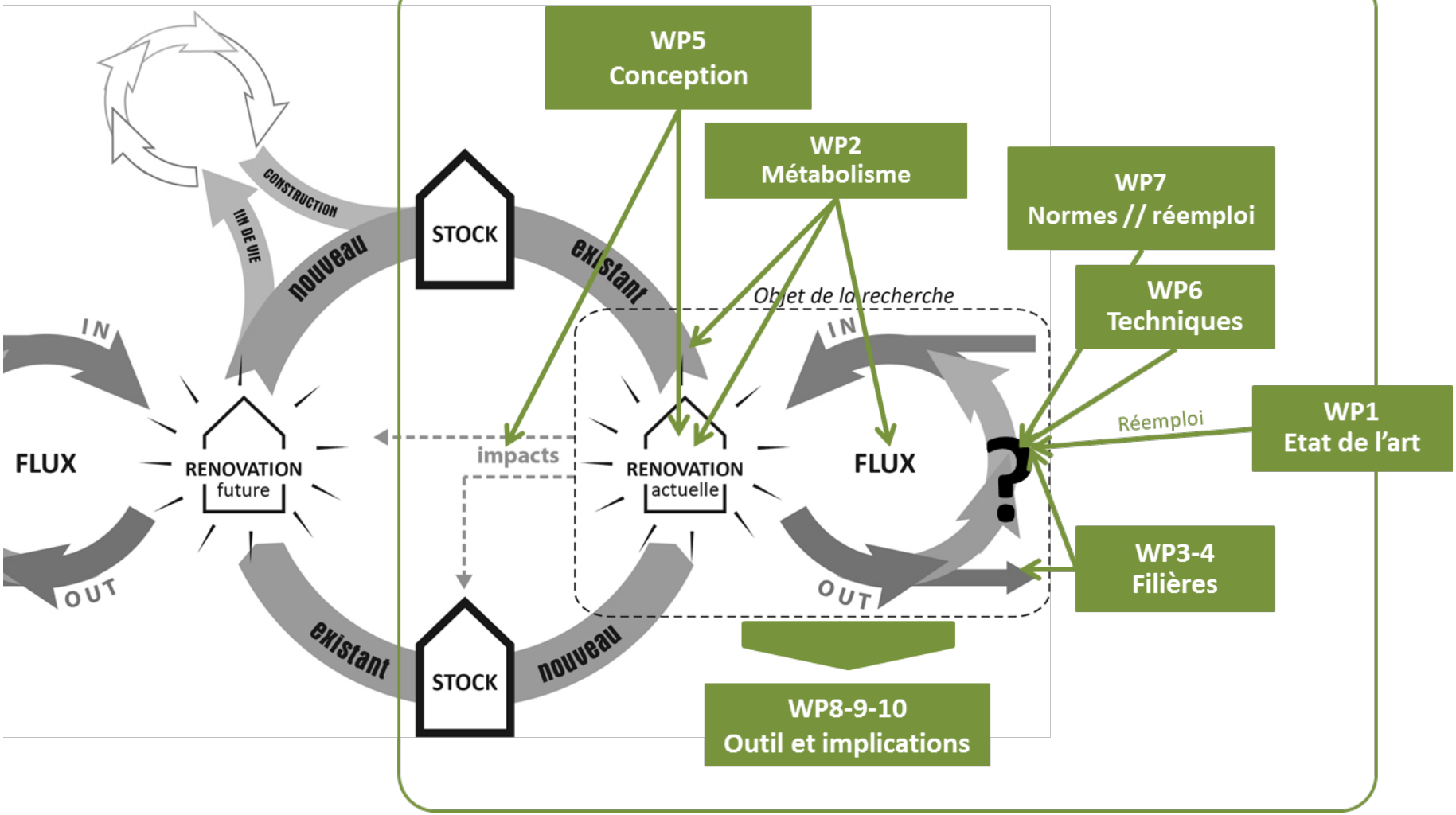
BAMB
BUILDING AS MATERIAL BANKS
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

BBSM Project: Work Packages



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

BBSM Project: Work Packages



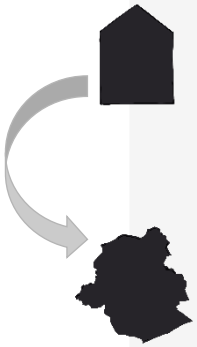
BAMB
BUILDING AS MATERIAL BANKS
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

2 Zoom ont the WP2: Urban Metabolism

What?

- To achieve a better kwowledge of the deposits of material contained in the Brussels's Building stock
- To evaluate and anticipate the impact of the energy retrofit processes on these deposits and on the IN & OUT flows
- To achieve a better knowledge of the practices of sorting and waste management and the possibilities of valorization

How?

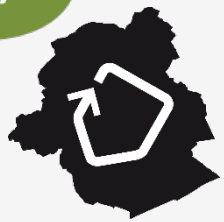


By developping a bottom-up approach

A. UM > development in 3 steps:
1. typologies> existing deposit
2. Energy retrofit scenarios (D / R, Reno) > IN / OUT flows & impacts
3. extrapolation to the region (in WP9-implications)

B. Site monitoring (D / R, C, R):
1. inventories
2. waste management on site
3. valorization opportunities

Why?



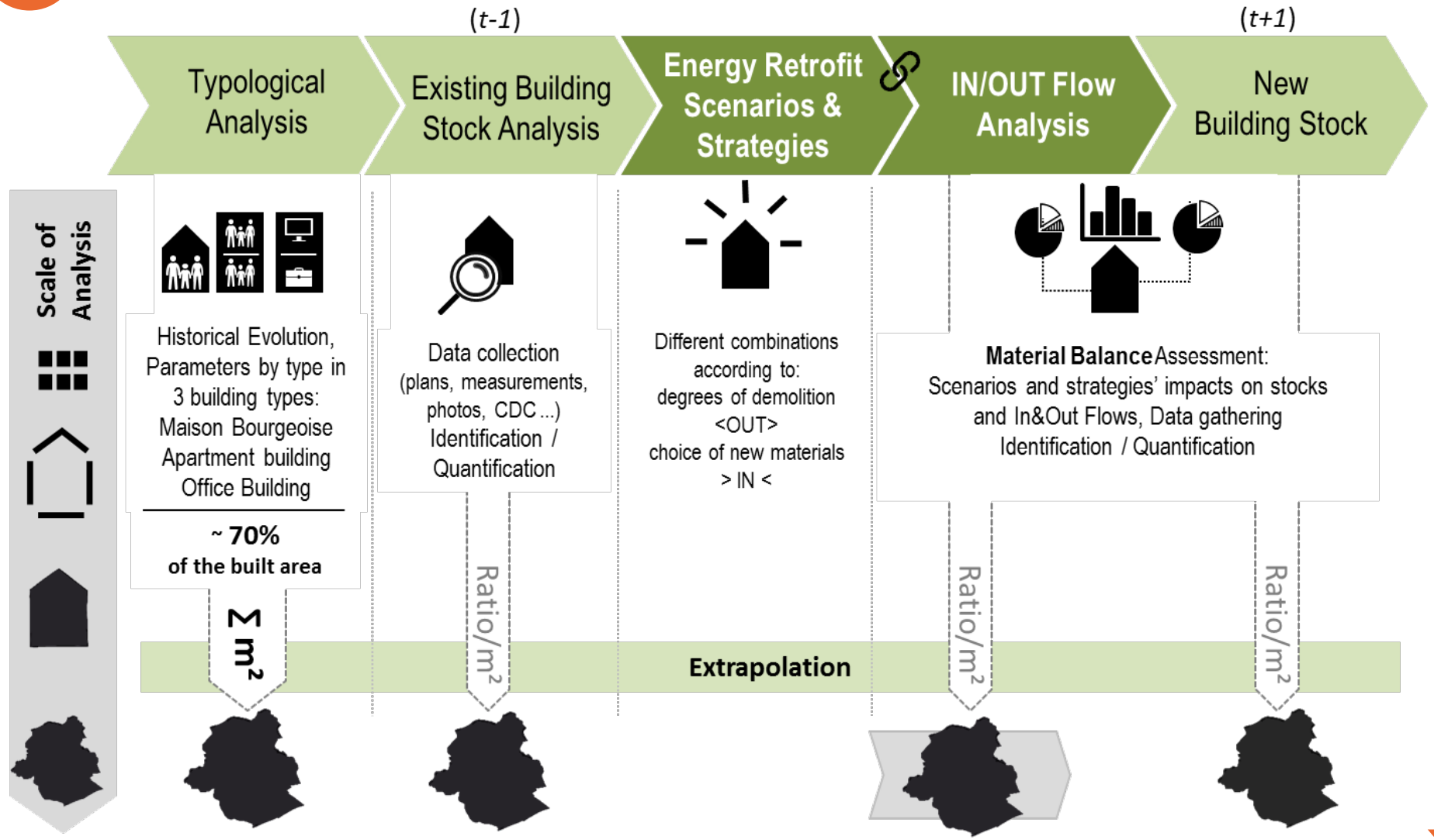
To reach a more efficient management of materials consumed (materials) and rejected (waste) by the activity of the Brussels's construction sector in a circular economy approach > **Urban Mining**

Key Material Flows Anticipation

BAMB BUILDING AS MATERIAL BANKS

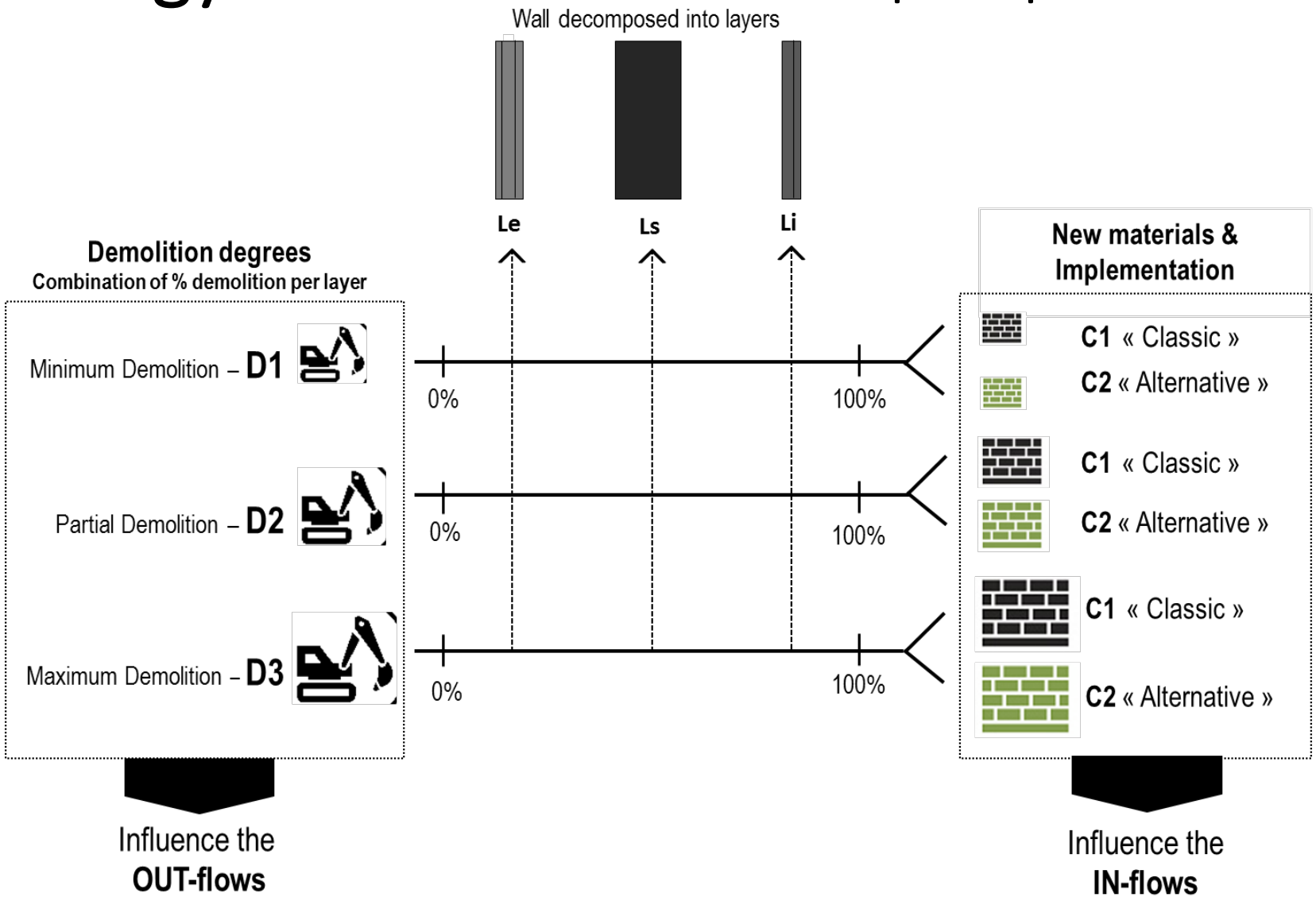
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

2 Methodology



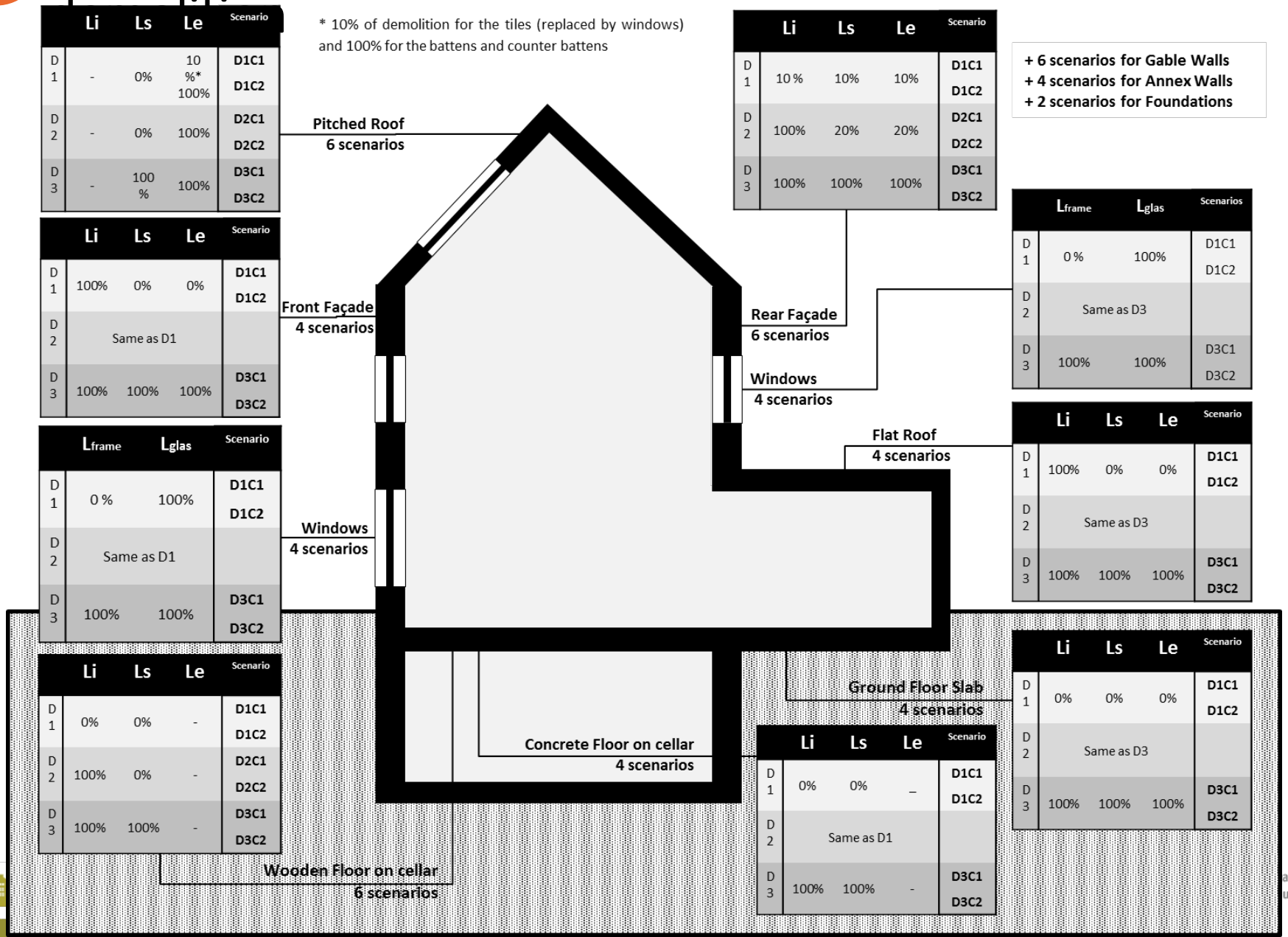
BAMB BUILDING AS MATERIAL BANKS
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

2 Energy Retrofit Scenarios: principles



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

2 Energy Retrofit Scenarios: degree of



	Li	Ls	Le	Scenario
D1	-	0%	10 %* 100%	D1C1 D1C2
D2	-	0%	100%	D2C1 D2C2
D3	-	100 %	100%	D3C1 D3C2

	Li	Ls	Le	Scenario
D1	10 %	10%	10%	D1C1 D1C2
D2	100%	20%	20%	D2C1 D2C2
D3	100%	100%	100%	D3C1 D3C2

	Li	Ls	Le	Scenario
D1	100%	0%	0%	D1C1 D1C2
D2	Same as D1			
D3	100%	100%	100%	D3C1 D3C2

	Lframe	Lglas	Scenarios
D1	0 %	100%	D1C1 D1C2
D2	Same as D3		
D3	100%	100%	D3C1 D3C2

	Lframe	Lglas	Scenario
D1	0 %	100%	D1C1 D1C2
D2	Same as D1		
D3	100%	100%	D3C1 D3C2

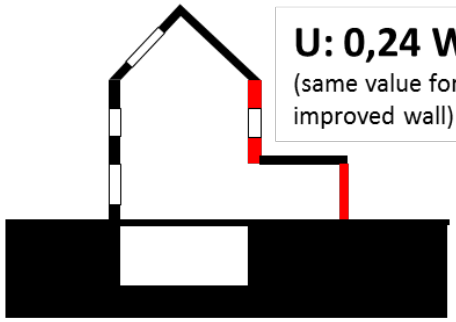
	Li	Ls	Le	Scenario
D1	100%	0%	0%	D1C1 D1C2
D2	Same as D3			
D3	100%	100%	100%	D3C1 D3C2

	Li	Ls	Le	Scenario
D1	0%	0%	-	D1C1 D1C2
D2	100%	0%	-	D2C1 D2C2
D3	100%	100%	-	D3C1 D3C2

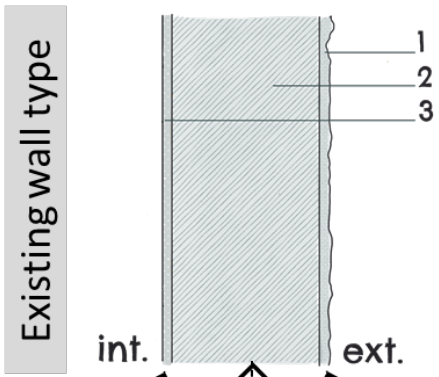
	Li	Ls	Le	Scenario
D1	0%	0%	–	D1C1 D1C2
D2	Same as D1			
D3	100%	100%	-	D3C1 D3C2

	Li	Ls	Le	Scenario
D1	0%	0%	0%	D1C1 D1C2
D2	Same as D3			
D3	100%	100%	100%	D3C1 D3C2

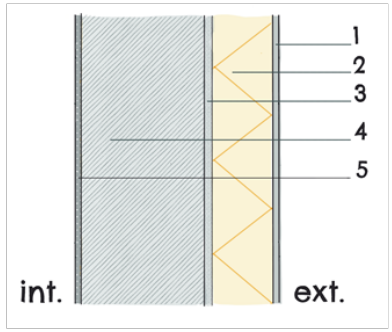
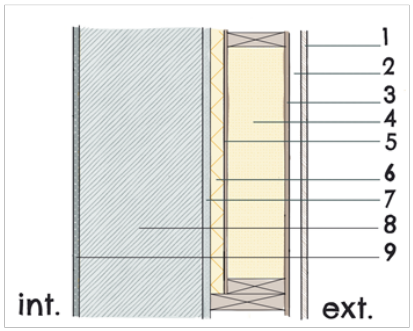
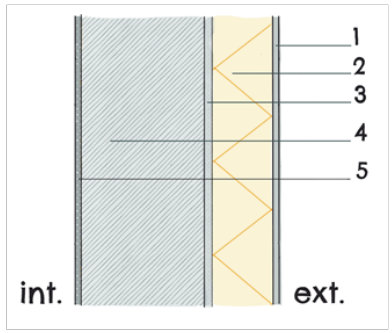
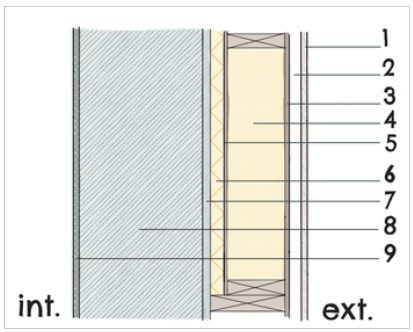
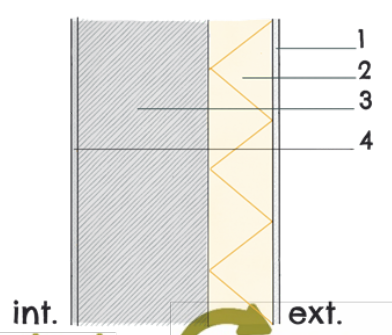
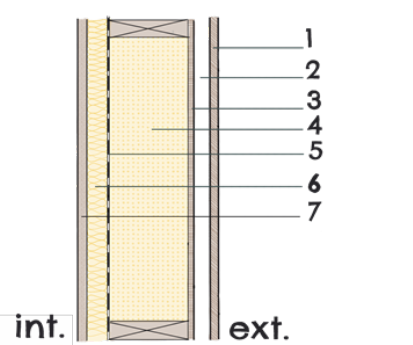
2 Energy Retrofit Scenarios: rear facade



U: 0,24 W/m²K
(same value for each improved wall)



Demolitions: Rear Façade	Li	Ls	Le
D1	10 %	10%	10%
D2	20%	20%	100%
D3	100%	100%	100%

	C1	C2
D1		
D2		
D3		

BAMB BUILDING AS MATERIAL BANKS

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

2 Energy Retrofit Strategies: building scale

SCENARIO X (m^3)	
Front Facade	D1C1
Rear Facade	D1C1
Shared Wall (left gable)	D1C1
Shared Wall (right gable)	D1C1
Annex Walls	D1C1
Windows	D1C1
Pitched Roof	D1C1
Flat Roof (Annex)	D1C1
Slab-on-grade	D1C1
Foundation	D1C1

SCENARIO Z (m^3)	
Front Facade	D3C1
Rear Facade	D3C1
Shared Wall (left gable)	D3C1
Shared Wall (right gable)	D3C1
Annex Walls	D3C1
Windows	D3C1
Pitched Roof	D3C1
Flat Roof (Annex)	D3C1
Ground Floor Slab	D3C1
Foundation	D3C1

choice to operate by wall type between the six possible scenarios

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

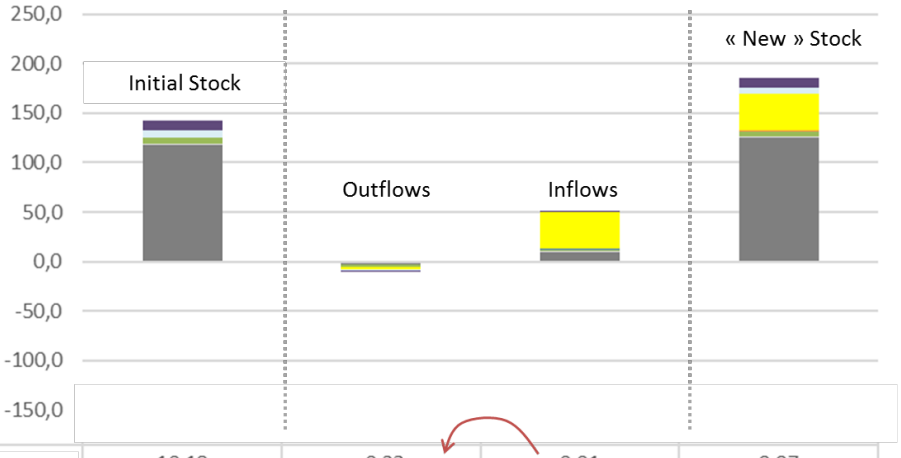
3 Results

Minimum demolition (D1) >< Maximum Demolition (D3)

Both « classical » choices (C1)

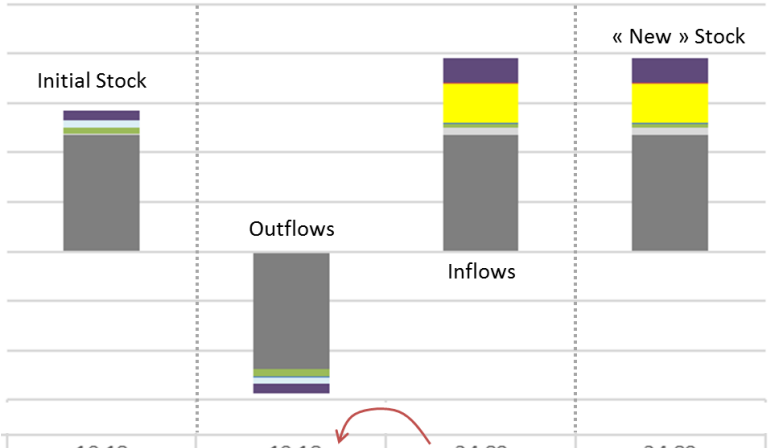
(new materials and implementation)

SCENARIO X (m³)



	Initial Stock	Outflows	Inflows	« New » Stock
other	10,18	-0,23	0,01	9,97
lime	6,636276195	-1,0738044	0	5,56
cement fiber	0	0	0	0,00
composite	0	0	0	0,00
insulation	0	-1,853985328	37,07970655	37,08
plastic	0,1388172	-0,009394059	0,562946171	0,70
metal	0,32166592	0,00	0,30882096	0,63
wood	6,6	-3,224178499	1,56	5,02
gypsum	0,0	-0,13	1,640175	1,64
inert	118,4	-2,50	8,86	124,86

SCENARIO Z (m³)

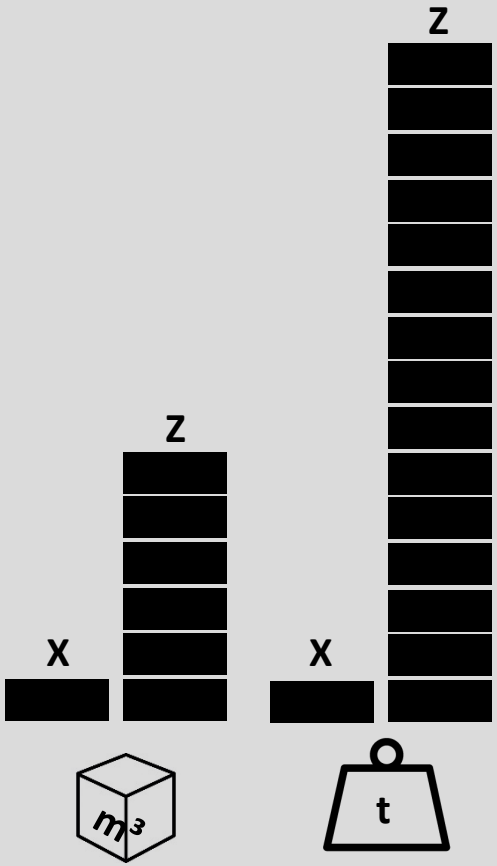


Initial Stock	Outflows	Inflows	« New » Stock
10,18	-10,18	24,89	24,89
6,636276195	-6,636276195	0	0,00
0	0	0	0,00
0	0	1,15191455	1,15
0	-0,00174875	39,83624333	39,84
0,1388172	-0,46393131	0,9899921	0,99
0,32166592	-0,32	0,63048688	0,63
6,6	-7,142824011	3,72	3,72
0,0	-0,24	7,123976195	7,12
118,4	-118,80	117,53	117,53

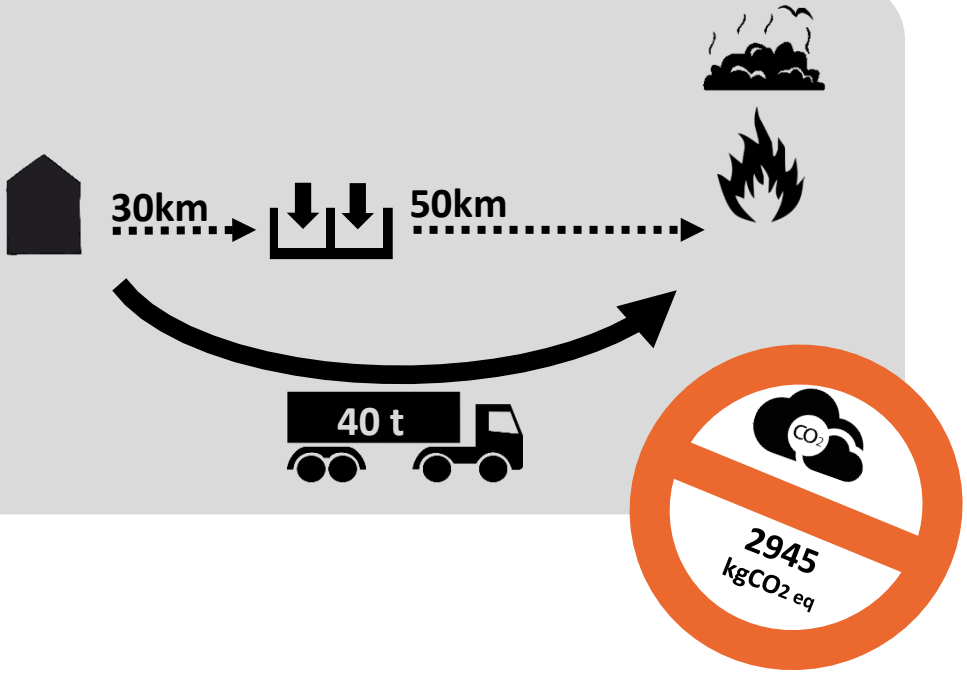
BAMB BUILDING AS MATERIAL BANKS
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

3 Results

∑ Total Flows (in/out)



∑ Outflows > Impact



	Volume [m³]		Weight [t]	
Scenarios	X	Z	X	Z
∑Outflows	9	143	1,880	247,338
∑Inflows	50	196	26,272	184,967
∑Total Flows	59	339	28,152	459,305
Difference Δ	280		431,153	
Multiplicative factor	6		15	

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

4 Conclusions

The research project proposes:

- To compare, anticipate, measure the impact of energy retrofit solutions on material stocks and flows
- A replicable methodology at different scales: to other cities/ regions but also to other building types and walls
- A potential for a better material stocks and flows management: to reach a circular economy in the construction sector

But…

- Not exhaustive in terms of intervention scenarios and building types: the proposed model is voluntary simplified
- It's the beginning of a real application of Urban Mining but it will take some time to be implemented

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

4 Conclusions: future work

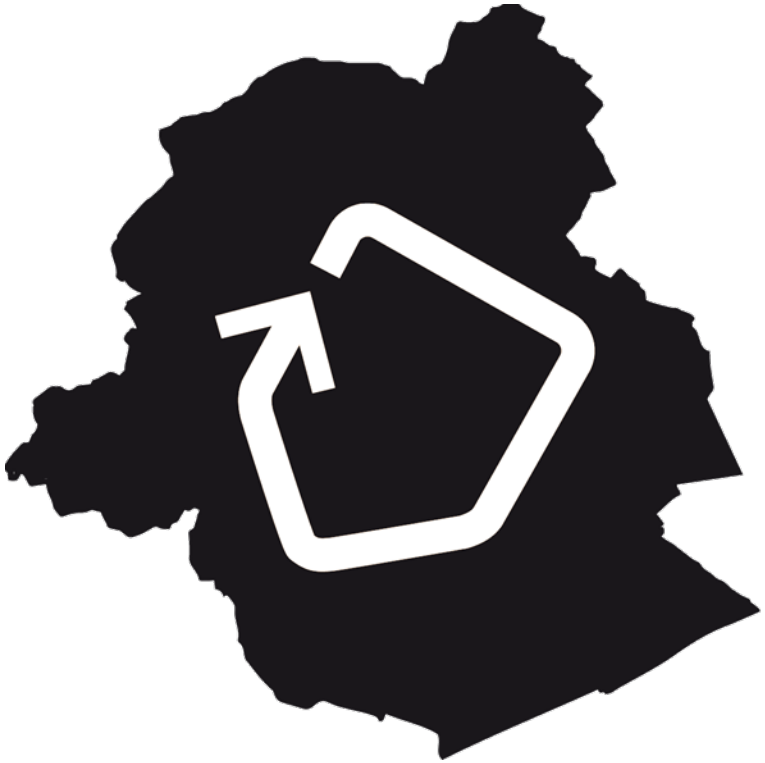
The research will continue in the future to deepen the knowledge of the material deposit contained in buildings and energy retrofit impacts on material flows through:

- Extension of the analysis methodology to other case studies including other Brussel's building types (offices and apartment buildings built after 1945): development of specific intervention scenarios, analysis of the material balance and impacts of the interventions on material stocks and flows.
- Extension in the developed tool to include environmental aspects and recovery potential assessment (trough reuse and recycling)
- Extrapolation of results at the regional level (in an urban mining perspective) based on the cadastral matrix.

>This can move us forward to a more circular economy as advocated by the Brussels-Capital Region and correlates with the principles of urban mining.

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

Thank You



Emilie Gobbo
Architect, Research Fellow
PhD in Architecture and Urban Planning

UCLouvain

Université catholique de Louvain
Architecture et Climat

emilie.gobbo@uclouvain.be
+32 (0) 10/47.26.36

BAMB
BUILDING AS MATERIAL BANKS

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