



Co-funded by the Horizon 2020
Framework Programme
of the European Union



Building as material banks: utopie ou future réalité à Bruxelles ?

30 Avril, 2019
Bruxelles



UNIVERSITEIT TWENTE.



40% d'émissions
GES



➤ 33% des déchets
produits



➤ 50% des ressources
extraites

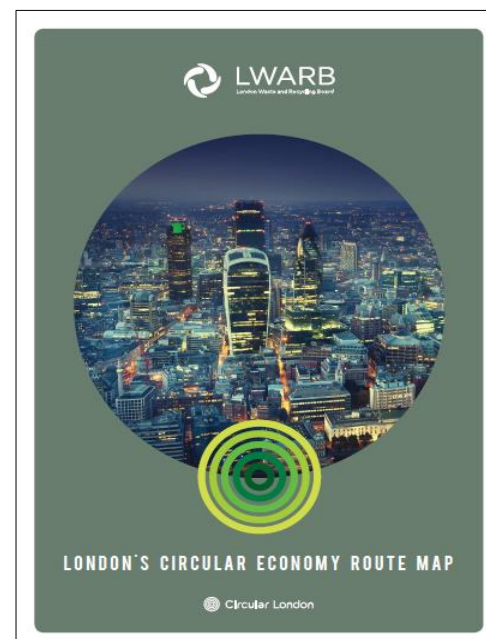


ECONOMIE CIRCULAIRE : UN MOUVEMENT EN MARCHÉ

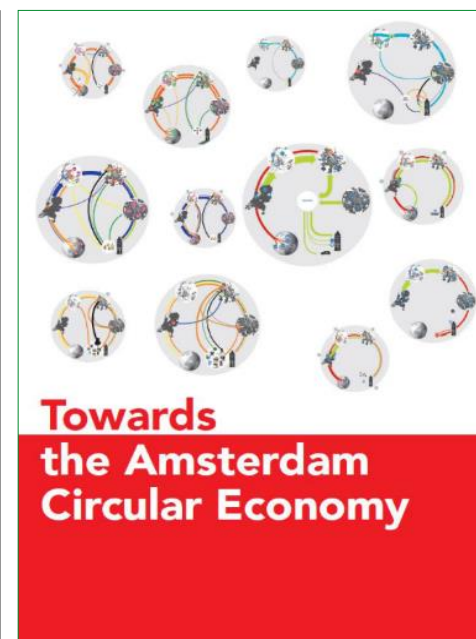
➤ L'UE redynamise son économie tout en préservant ses ressources

- Feuille de route pour une Europe efficace dans l'utilisation des ressources (2011)
- Boucler la boucle – un plan d'action en faveur de l'économie circulaire (2015)

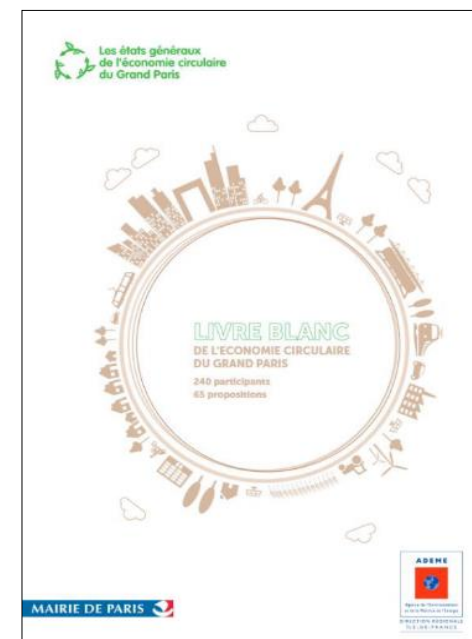
➤ Des villes se lancent...



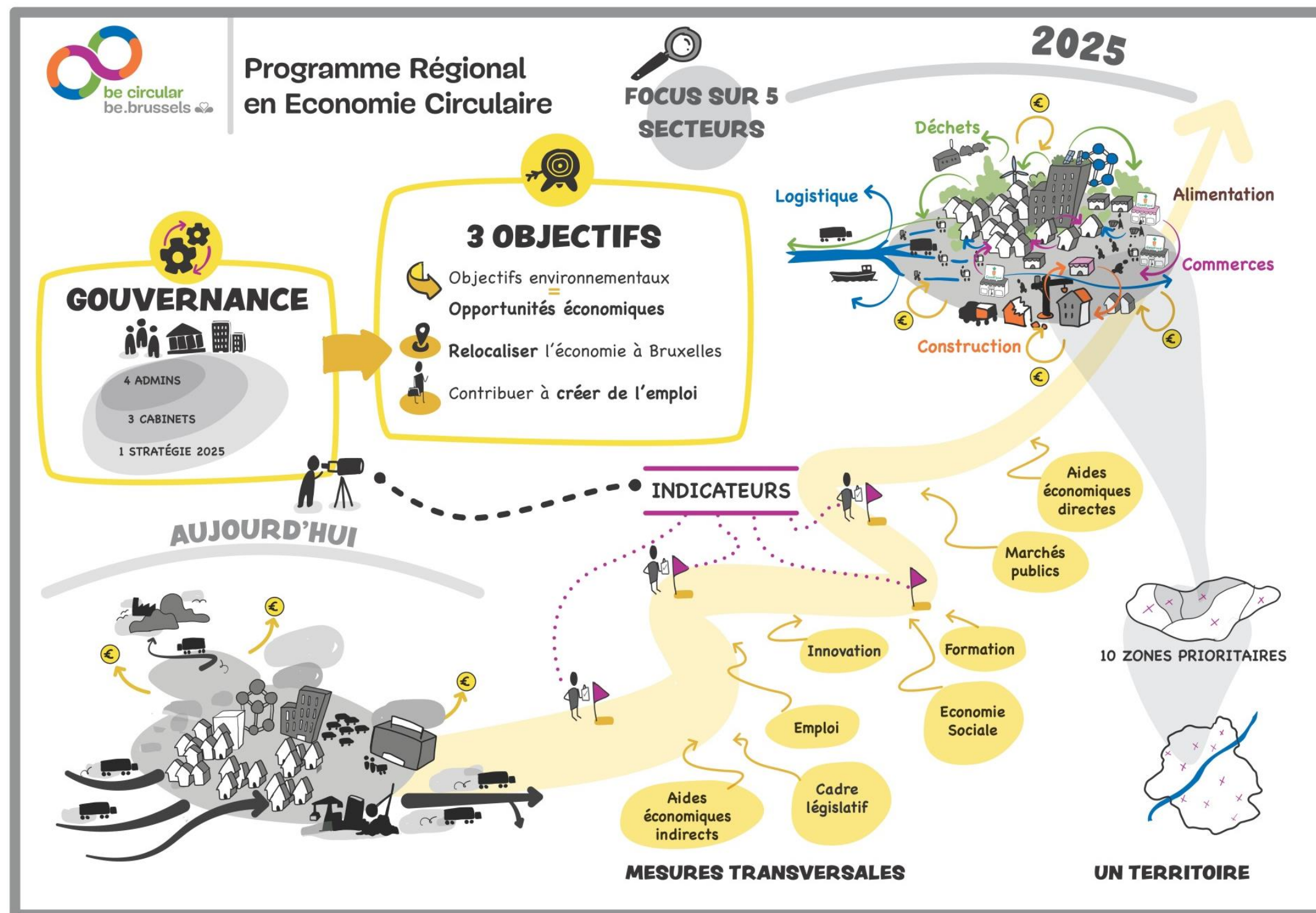
LONDRES



AMSTERDAM



PARIS

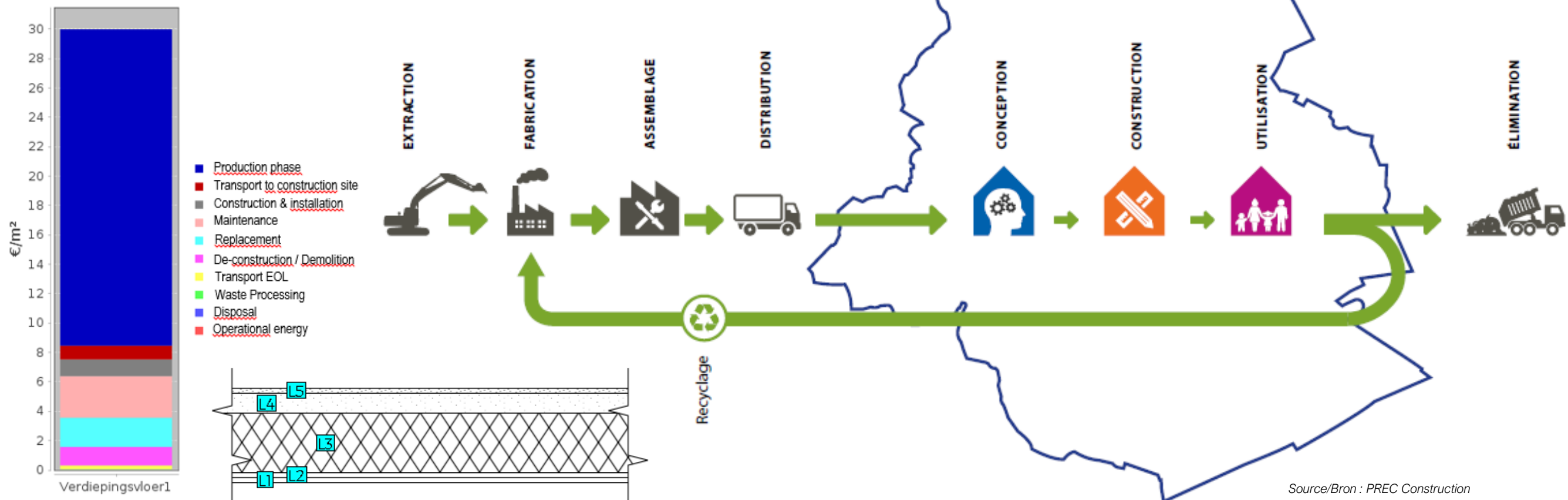


PREC CONSTRUCTION : ETAT DES LIEUX

EN 2018, UN MODÈLE LINÉAIRE avec une boucle de recyclage développée, **MAIS...**

- Recyclage hors RBC ...
- Recyclage en downcycling ...
- Recyclage surtout **d'inertes** ...

... **dépendance** pour traiter nos déchets
... **perte de valeur** de la matière
... quid du reste : isolant, ...?



Source/Bron : PREC Construction

PREC CONSTRUCTION : DÉFINIR UNE VISION

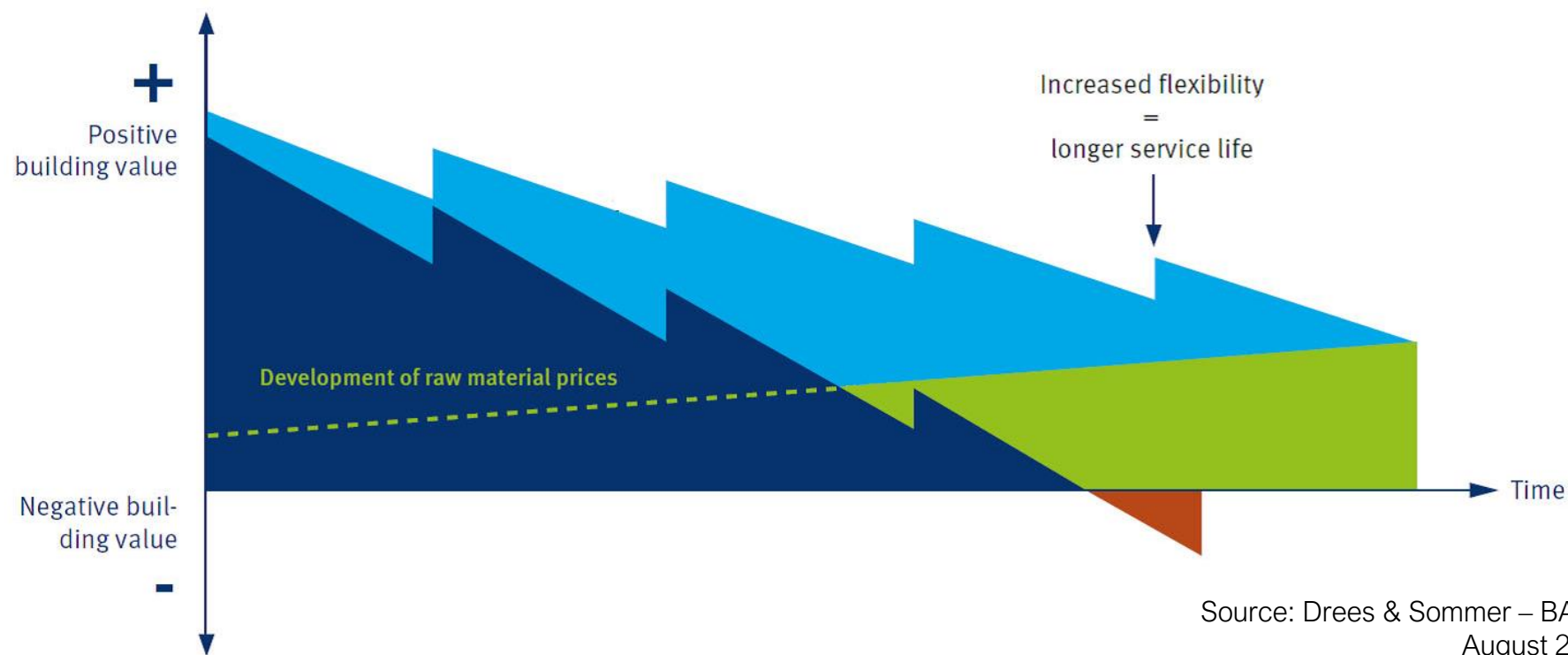
EN 2050, UN MODÈLE CIRCULAIRE qui considère le bâtiment comme une **banque de matériaux**

- réduire la production de déchets
- réduire l'extraction de matières premières
- mais aussi ...
- création de nouvelles activités locales
- création / maintien d'emplois



Source/Bron : PREC Construction

LE BÂTIMENT COMME UNE BANQUE DE MATÉRIAUX



Source: Drees & Sommer – BAMB
August 2017



Fortis Bank Amsterdam 1998

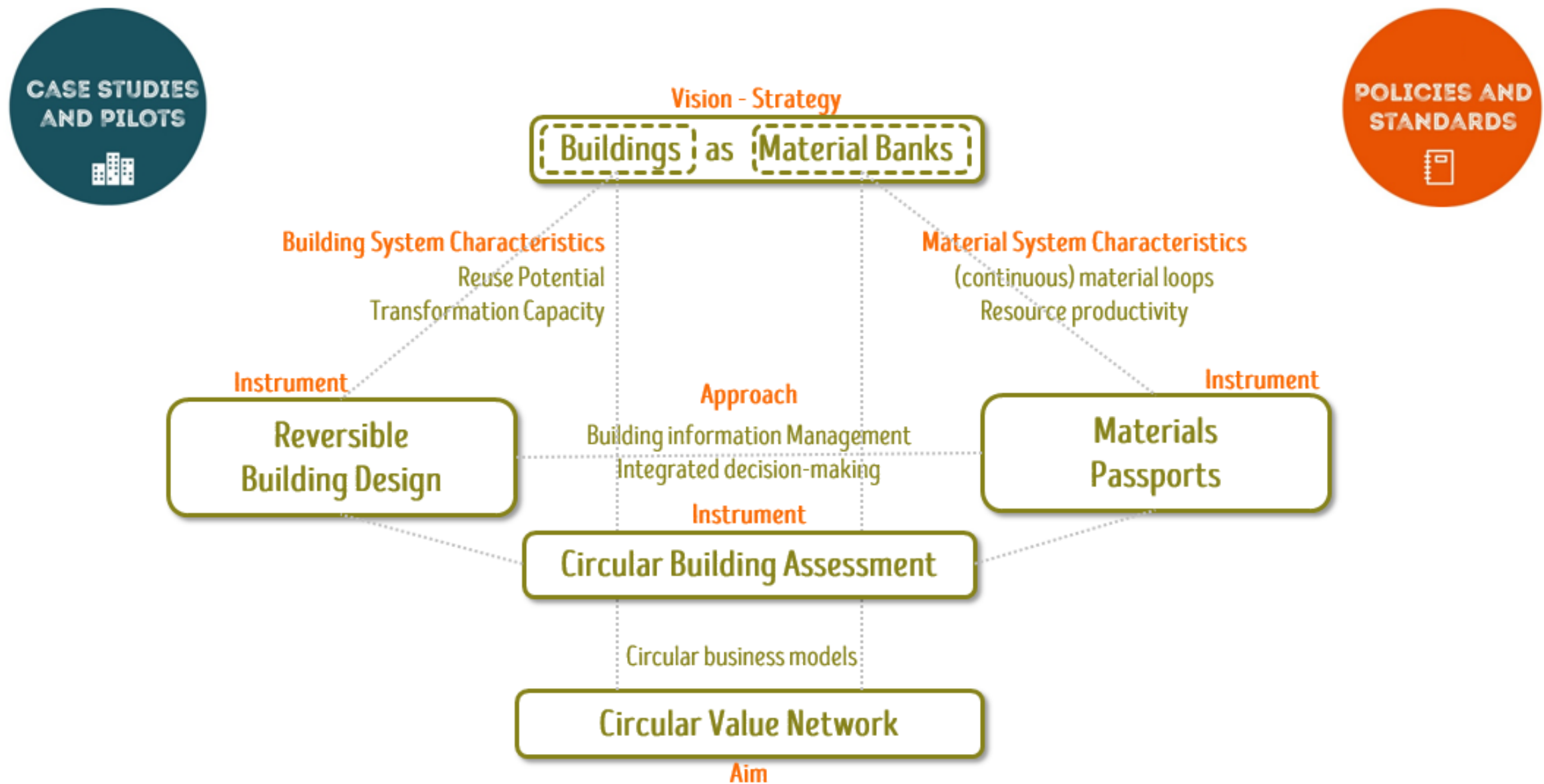


Fortis Bank Amsterdam 2014



Fortis Bank Amsterdam 2014

LE BÂTIMENT COMME UNE BANQUE DE MATÉRIAUX

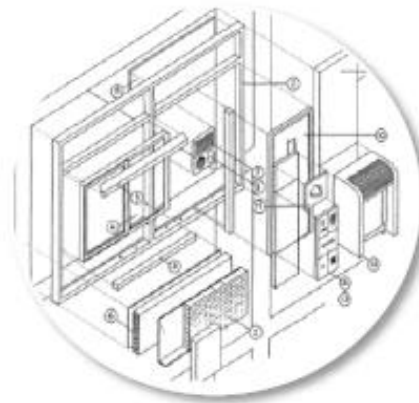


CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

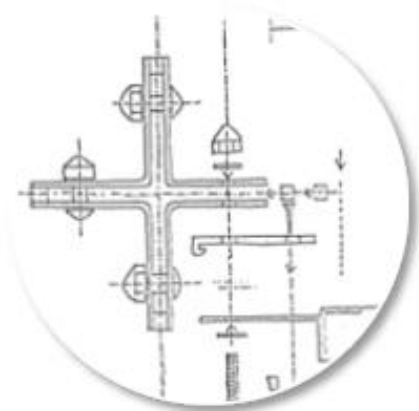
- Réversibilité de l'espace
- Réversibilité des produits et systèmes
- Réversibilité des éléments et matériaux



- Première esquisse



- Conception définitive

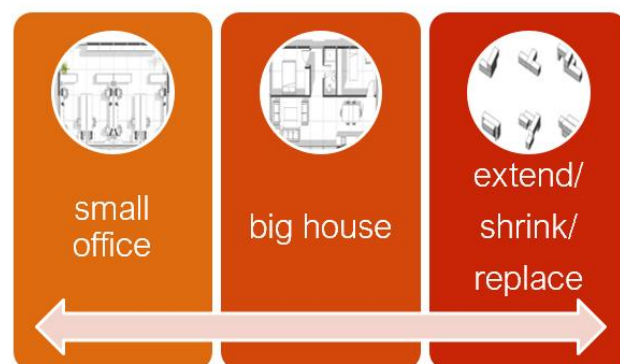
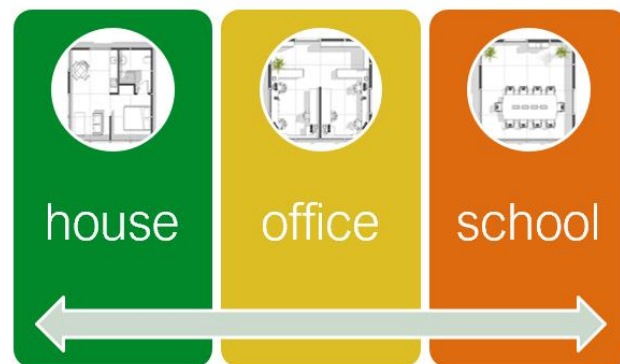
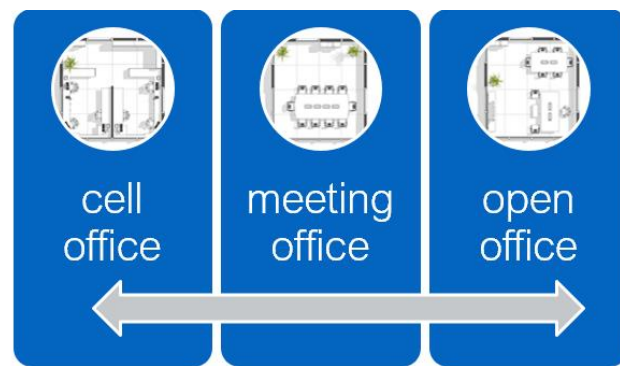


- Détails techniques

Source: Dr. Elma Durmisevic – BAMB

CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

RÉVERSIBILITÉ DE L'ESPACE

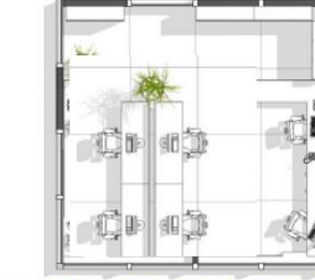


0 Irreversible

Tot 0,2
< 0,4



1 Monofonctionnel



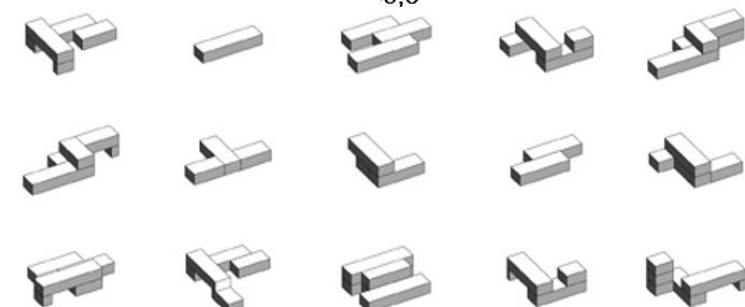
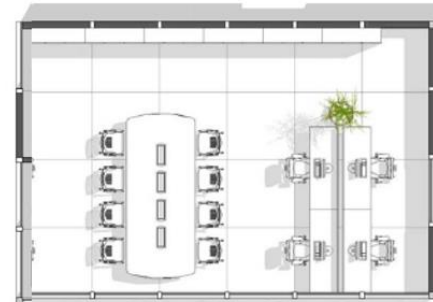
Building
Transformation capacity
 $0,2 < 0,4$

2 Trans-fonctionnel

Building
Transformation Potential
 $0,4 > 0,6$

3 Transformable

Building Transformation
Potential
 $< 0,6$

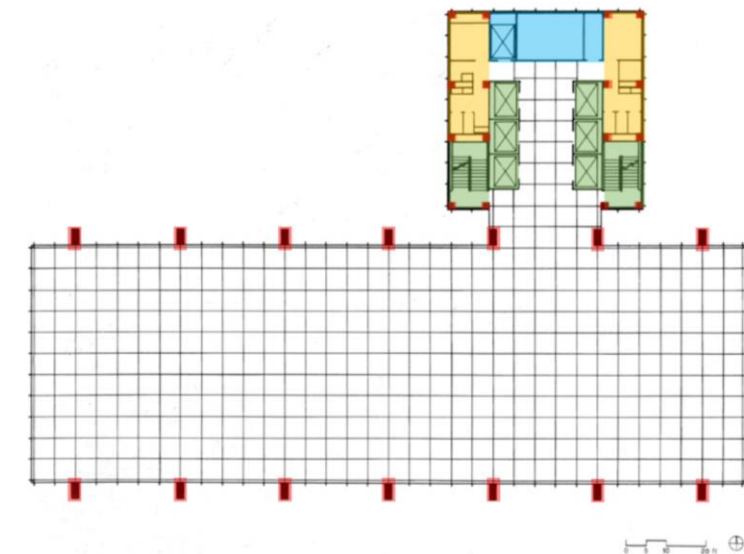


CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

RÉVERSIBILITÉ DE L'ESPACE

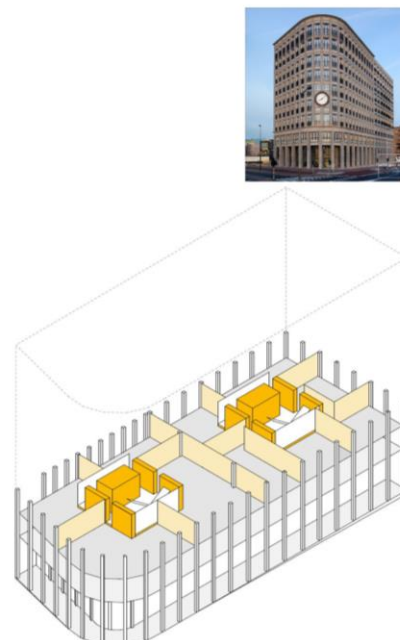
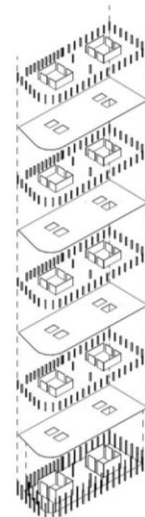
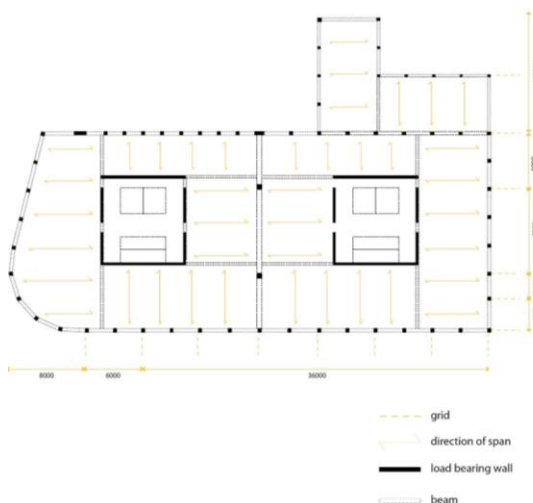
- Dimensions
- Relation et interdépendance
- Position des éléments les plus fix
- Anticiper différents scénarios

Inland Steel office Building
Skidmore, Owings & Merrill (1958)

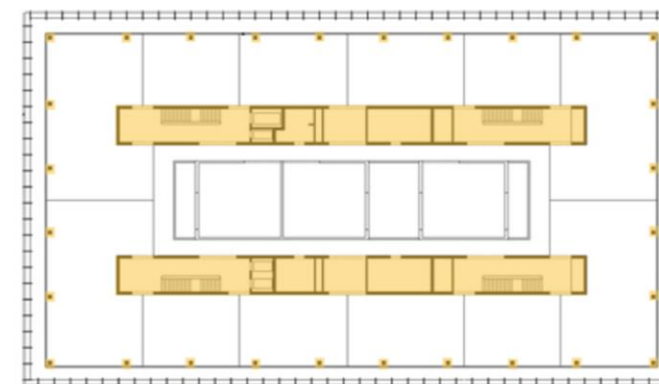


- Installations
- Restrooms
- Vertical transportation
- Structural elements

Solid 1 & 2, Amsterdam
Baumschlager-Eberle (2010)



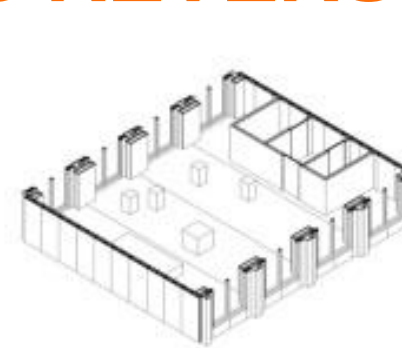
ETH E-sciencelab, Zurich
Baumschlager-Eberle (2008)



CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

RÉVERSIBILITÉ DE L'ESPACE

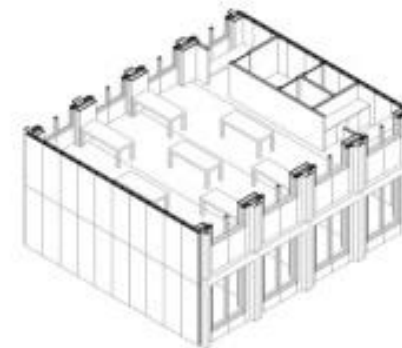
- Dimensions
- Relation et interdépendance
- Position des éléments les plus fix
- Anticiper différents scénarios



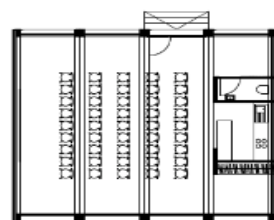
Dissemination Space – Lecture Café
Public



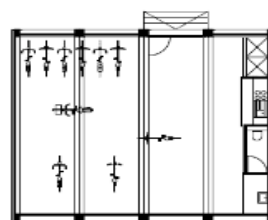
Eco Guesthouse
Residential



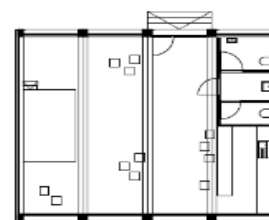
Temporary Plug-In Offices
Professional



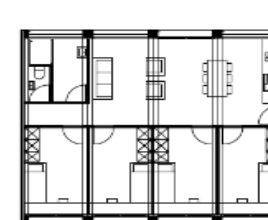
SEMINAR ROOM



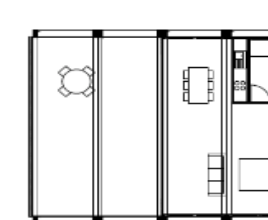
BICYCLE REPAIR SHOP



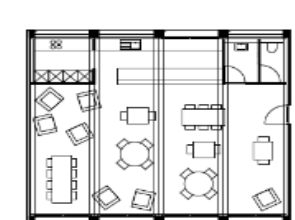
CONCERT SPACE



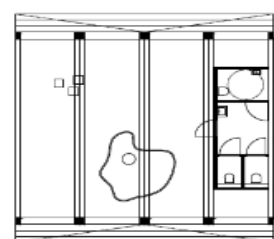
UPDATED STUDENT HOUSING



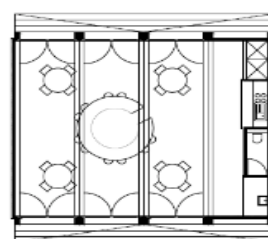
"KAVELKAMER"



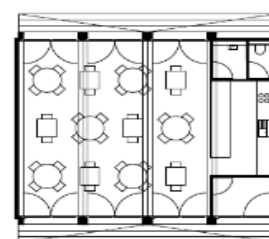
SANDWICH BAR / COFFEE SHOP



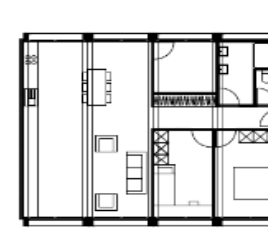
MULTIFUNCTIONAL OPEN AIR SPACE



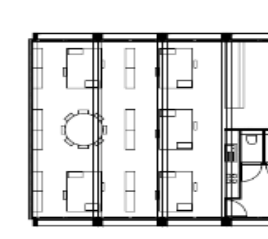
INFORMATION OFFICE



BISTRO / RESTO



APARTMENT TYPE 2/3



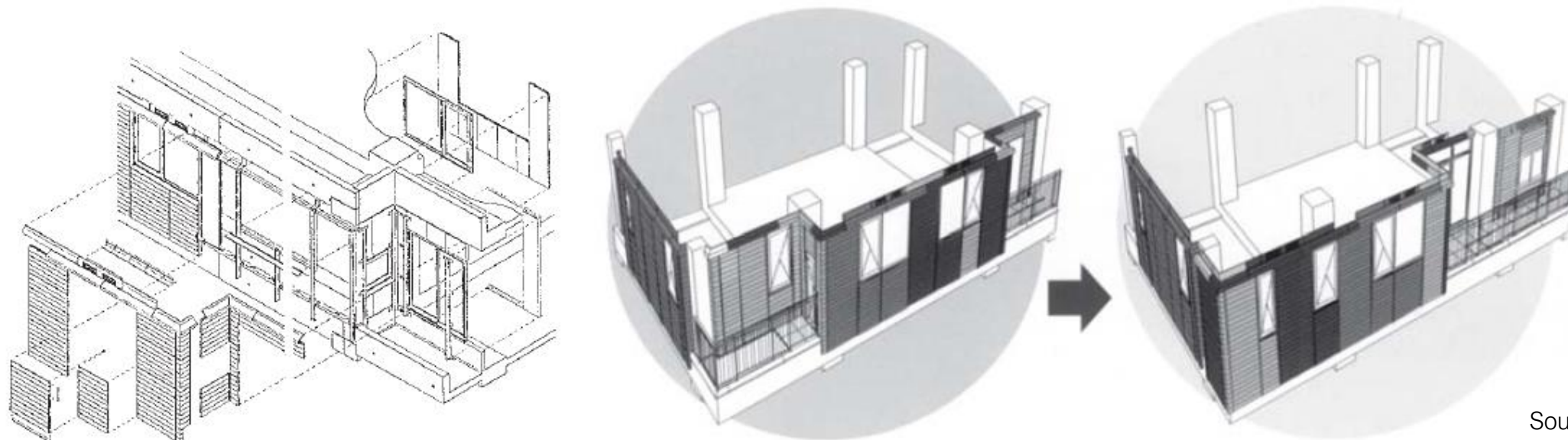
ADMINISTRATION OFFICE



2 INDIVIDUAL STUDIO'S

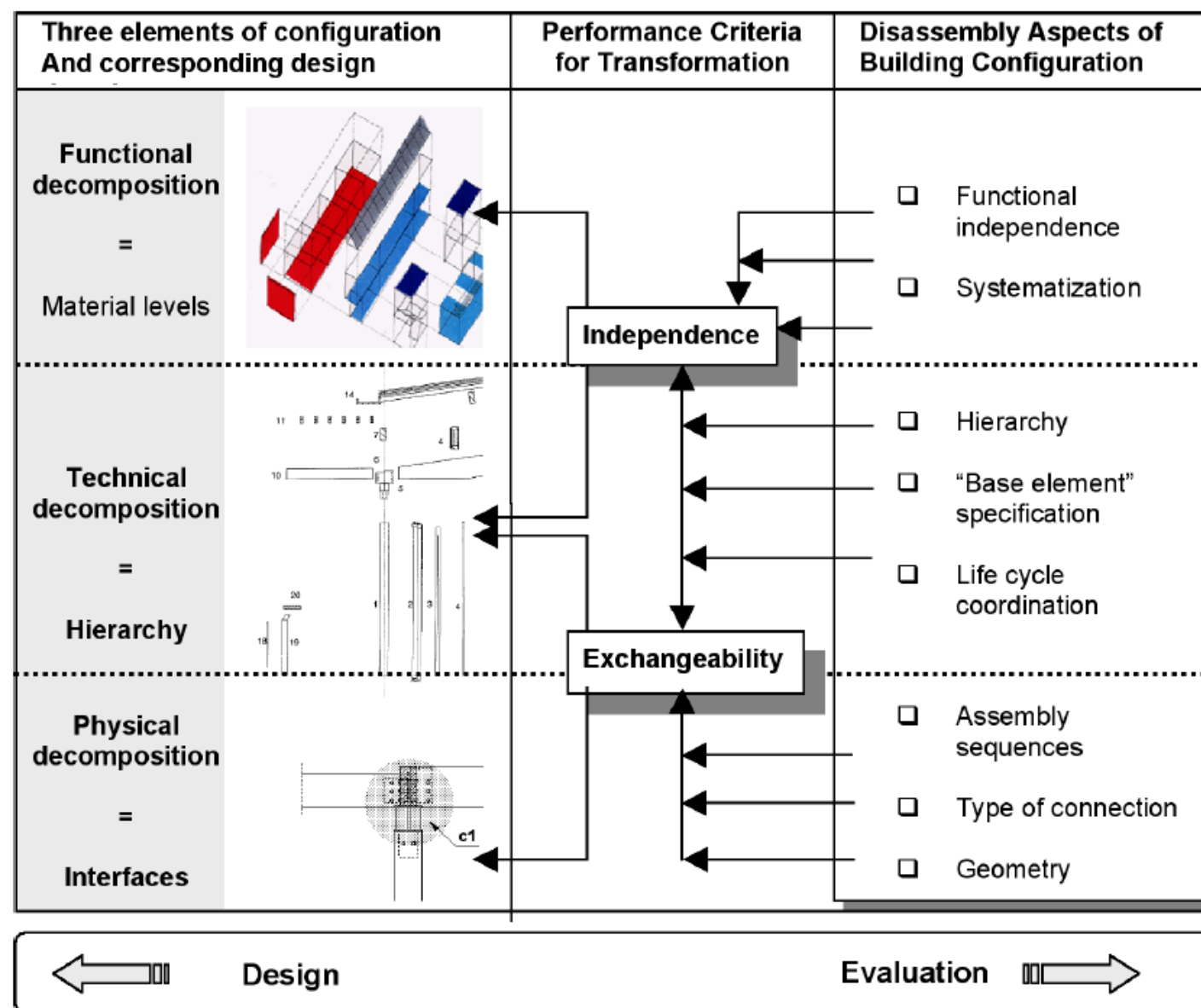
CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

RÉVERSIBILITÉ DES SYSTÈMES, PRODUITS & MATÉRIAUX



Source: Drees & Sommer
Dr. Elma Durmisevic

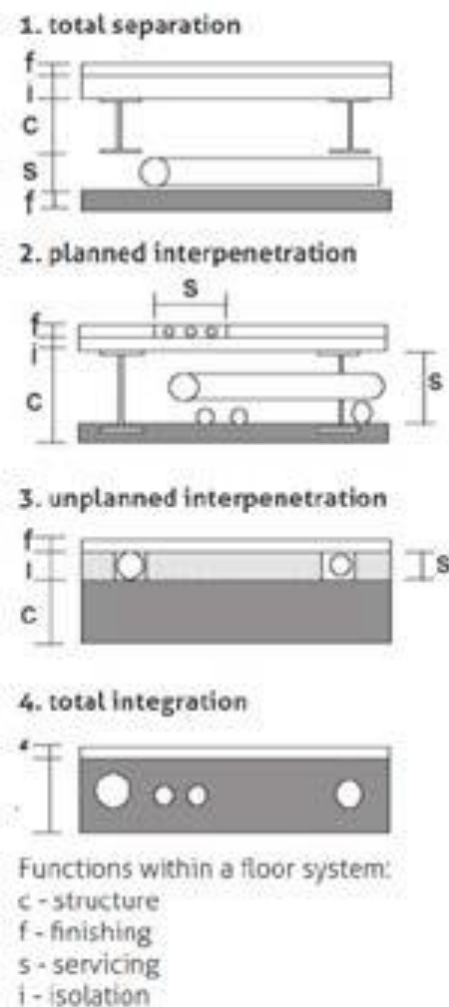
CONCEVOIR DES BÂTIMENTS RÉVERSIBLES



Durmisevic 2006 ©

CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

- Décomposition fonctionnelle – niveau d'intégration des fonctions dans un elements et l' (in)dépendance of fonctions ; Séparation fonctionnelle; Autonomie fonctionnelle

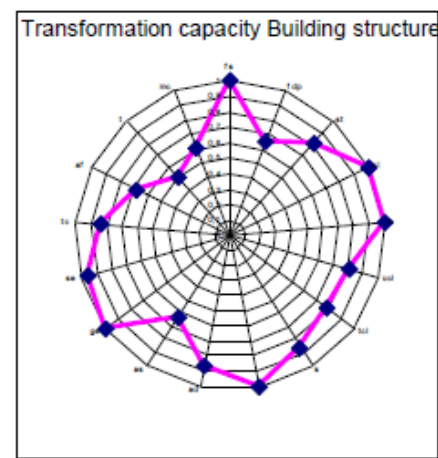
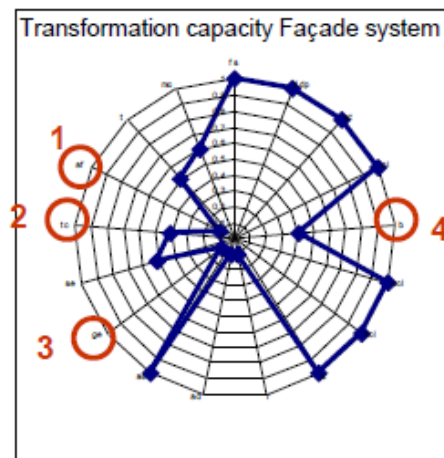
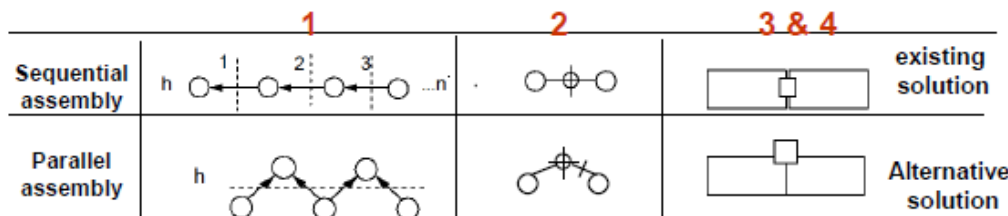
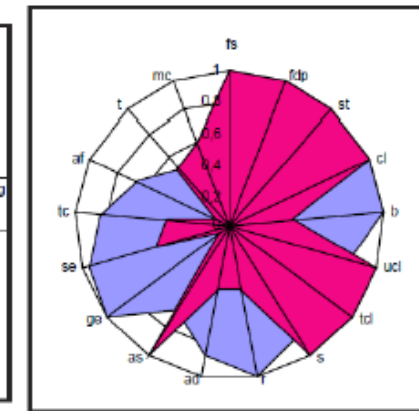
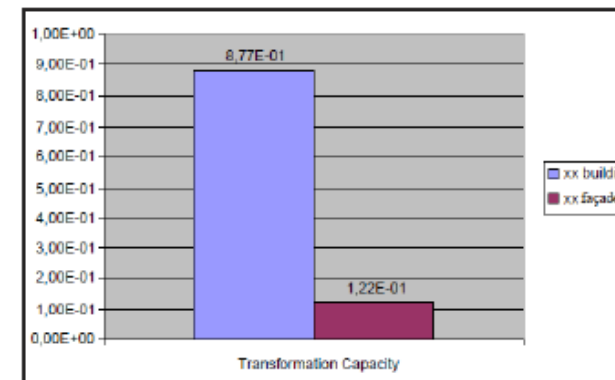
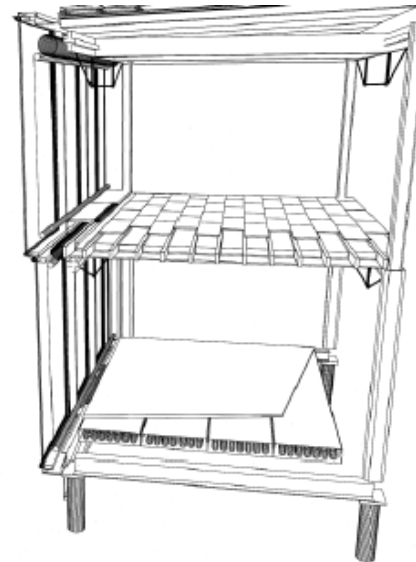
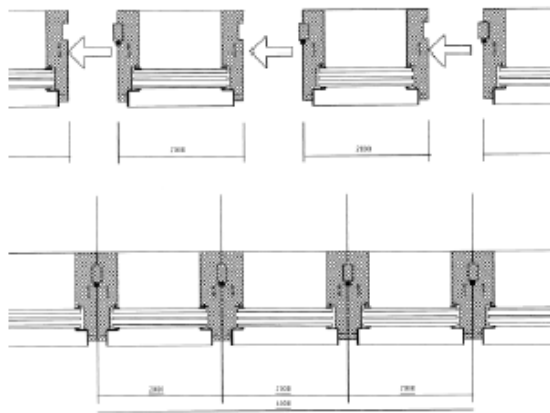


Assessment functional autonomy

1. total separation (modular zoning)	1,0
2. planned interpenetration for different solutions	0,8
3. planned interpenetration for one solution	0,4
4. unplanned interpenetration	0,2
5. total integration	0,1

CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

System level assessment



nr.	Design for Disassembly Aspects	nr.	Determining Factors
1	FD (Functional decomposition)	1.1.	fs (functional separation)
		1.2.	fdp (functional dependence)
2	SY (Systematisation)	2.1	st (structure of material levels)
		2.2	c (type of clustering)
3	BE (Base elements)	3.1	b (type of base element)
4	LCC (Life cycle coordination)	4.1	ucl (use life cycle coordination)
			tcl (technical life cycle coordination)
			s (coordination of life cycle and size)
5	RP (Relational pattern)	5.1	r (type pf relational pattern)
6	A (Assembly process)	6.1	ad (assembly direction)
			as (assembly sequences)
7	G (Geometry)	7.1	gp (geometry of product edge)
		7.2	spe (standardisation of product edge)
8	C (Connections)	8.1	tc (type of connections)
		8.2	af (accessability to fixings)
		8.3	t (tolerance)
		8.4	mj (morfology of joints)

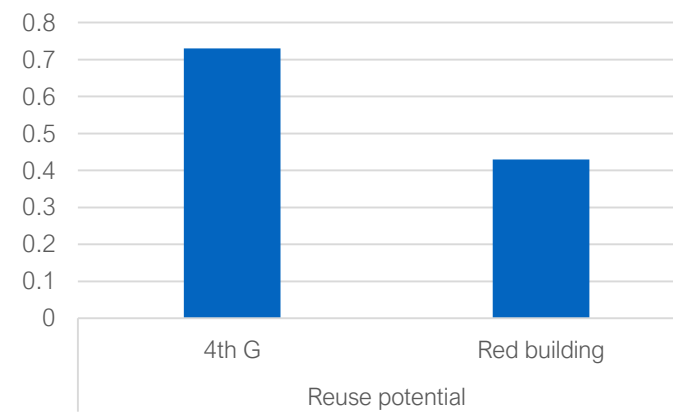
CONCEVOIR DES BÂTIMENTS RÉVERSIBLES

3 catégories de réversibilité

-  **Irréversible**
PR indique que le système a un $PR < 0,3$.
Option de fin de vie : Recyclage / sous-cyclage

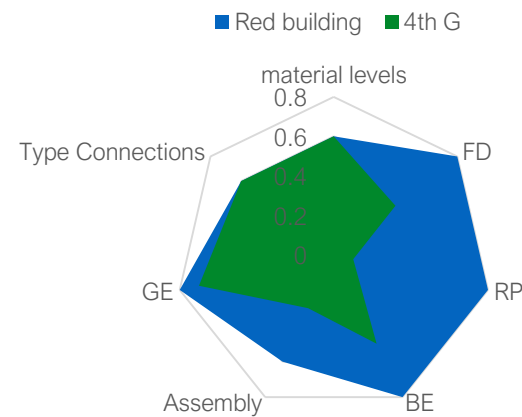
-  **Partiellement réversible**
PR indique que le système a un $PR > 0,3$ et $PR < 0,6$.
Option de fin de vie : réemploi direct ou après réparation

-  **Réversible**
PR indique que le système a un $PR > 0,6$.
Option de fin de vie : réemploi direct ou après réparation,
reconfiguration et upgrading



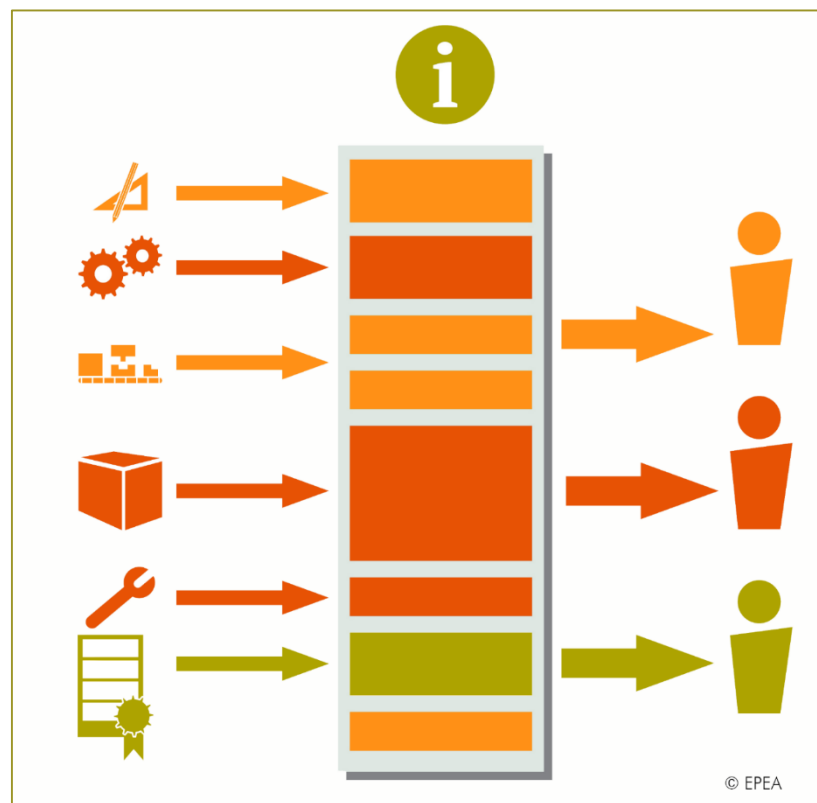
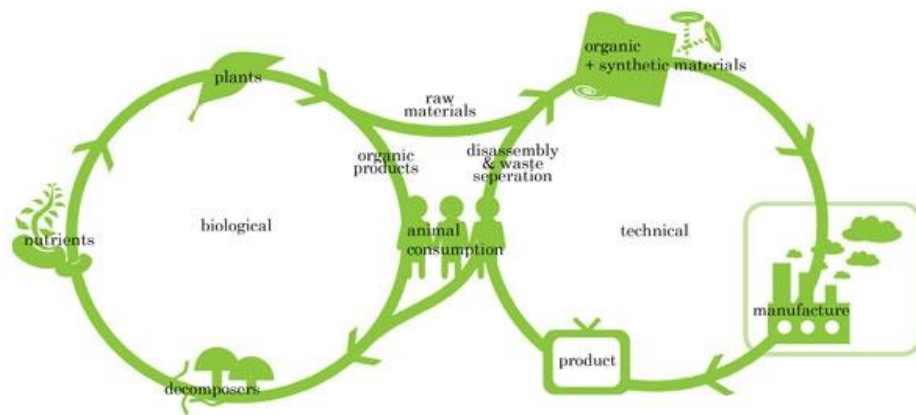
RP= 0,73 –
reuse, reconfiguration

Chart Title

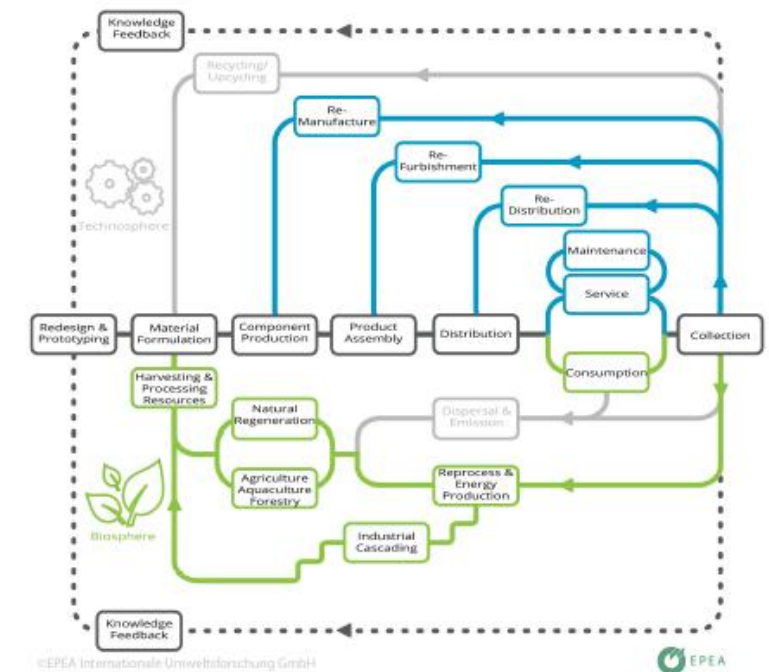


RP= 0,43 –
repair, recycle

PASSEPORTS MATÉRIAUX



Product features
+ solid construction
+ no glues or metals



Reuse potentials

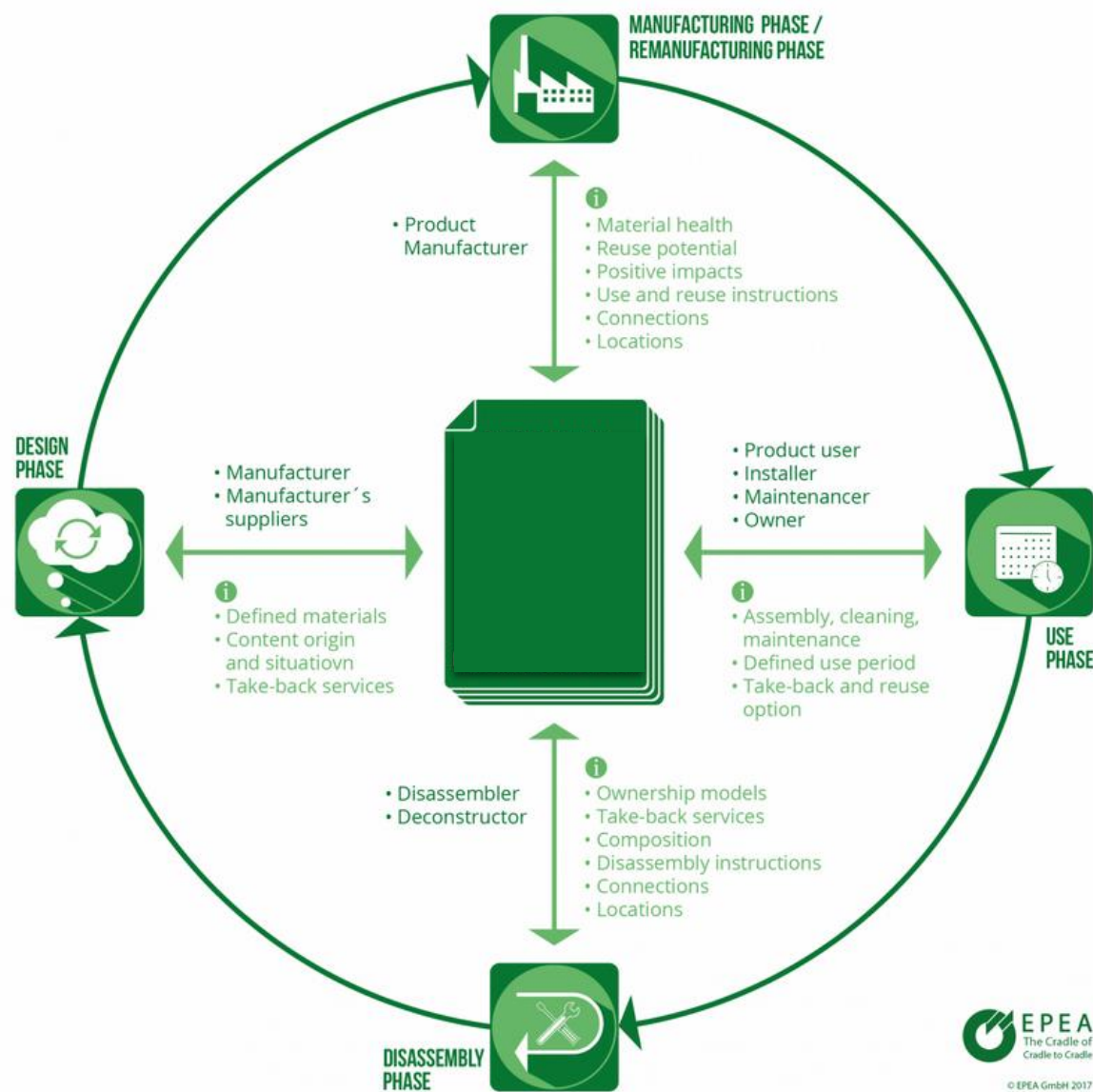
The Holz100 construction system can be disassembled and reused in new applications, recycled and finally composted in a bio-cascade, returning nutrients to the biosphere. Holz100 wood is FSC certified.

Product story

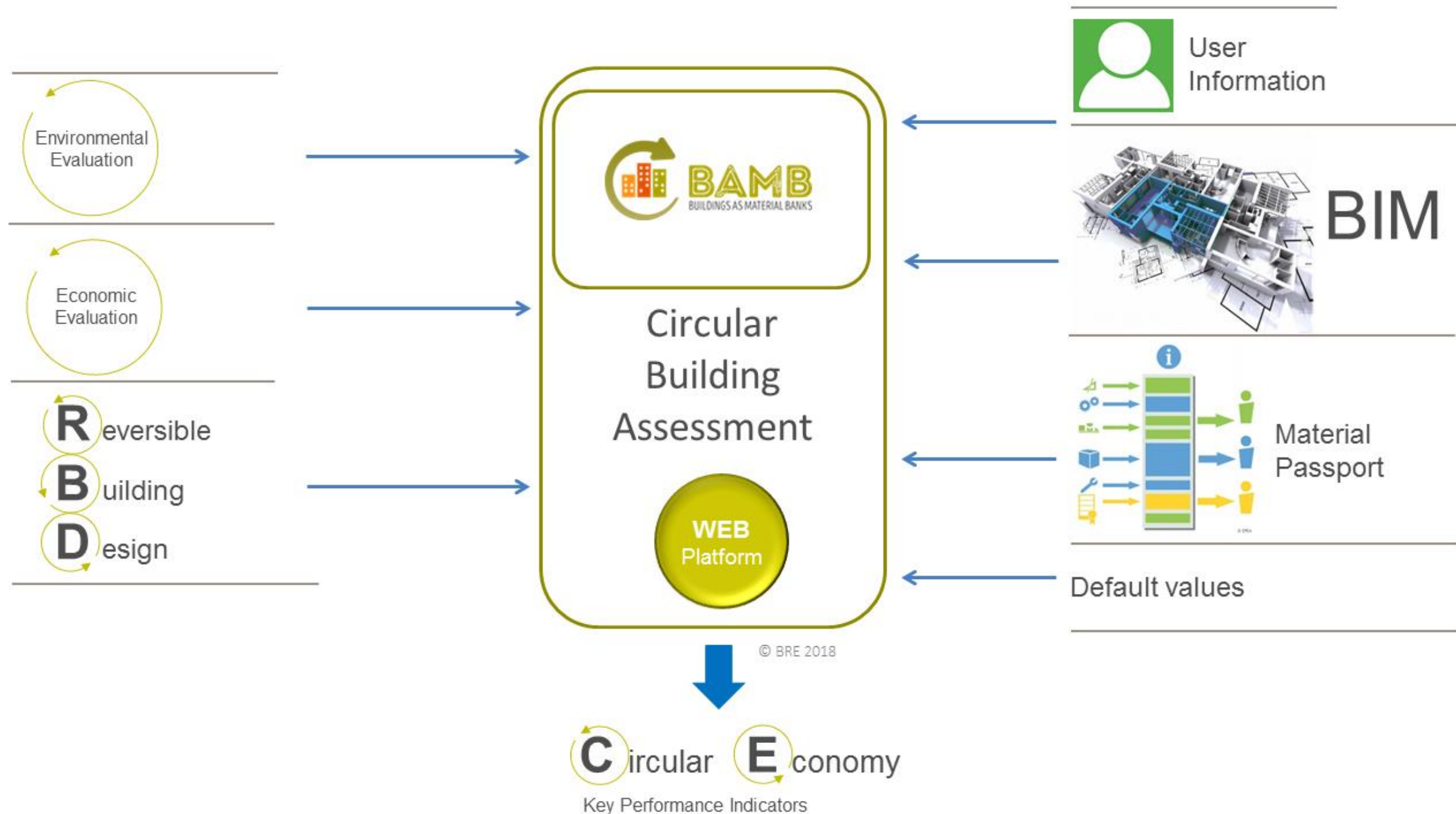
Layers of wood connected with wooden pegs are assembled into solid wood panels designed for interior walls, floors and ceilings, roof structures and exterior walls. The resulting indestructible solid wooden blocks are highly water resistant and perform better than other construction methods in heat insulation, fire security, radiation shielding, earthquake safety and have 100% protection against condensation and mould growth.



PASSEPORTS MATÉRIAUX

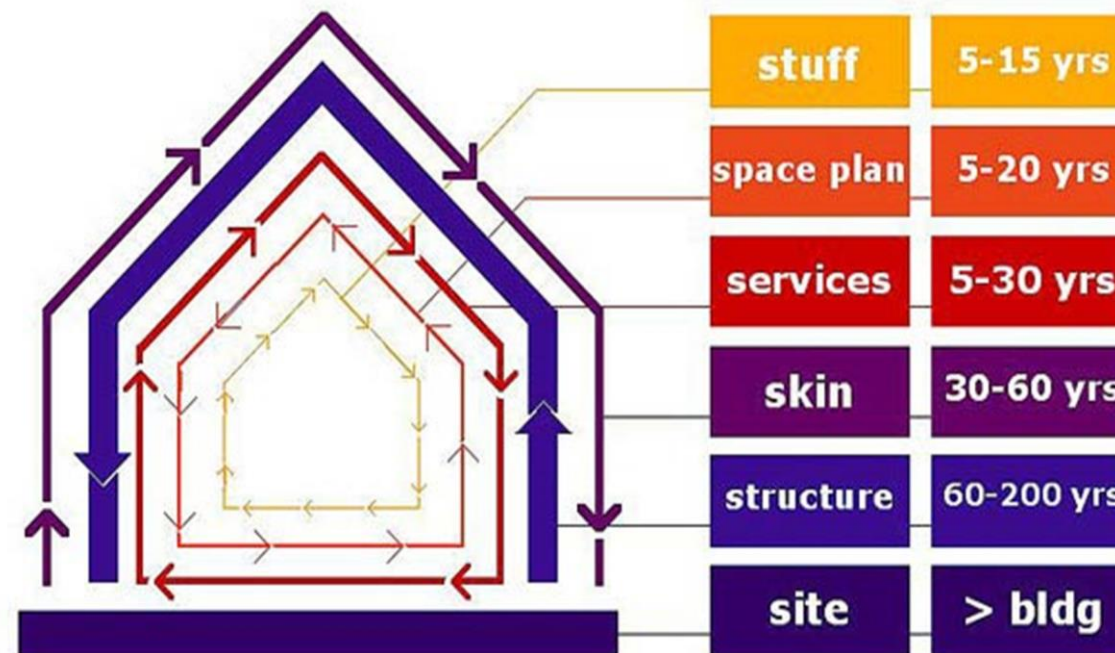


OUTIL D'ÉVALUATION DE LA CIRCULARITÉ DES BÂTIMENTS



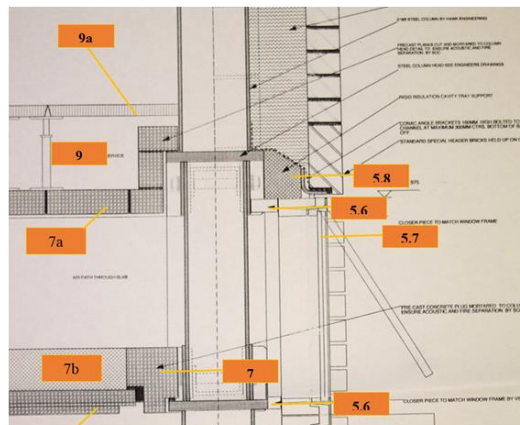
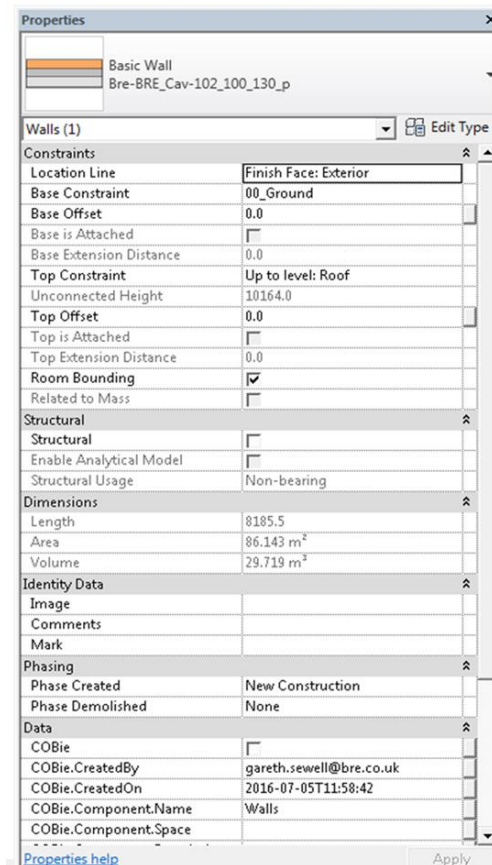
OUTIL D'ÉVALUATION DE LA CIRCULARITÉ DES BÂTIMENTS

Evaluation évolutive et flexible



OUTIL D'ÉVALUATION DE LA CIRCULARITÉ DES BÂTIMENTS

Circularity Indicators



Roof Structure

1,570.00

Cost

Roof Tiles

External Walls

52%

Reclaimed Content

Windows

41%

Virgin/primary resource indicator

Upper Floor Types

67%

Recycled Content

Internal Partitions

7.24

Reuse Potential/ RBD score

Ground Floors

60

Life cycle co-ordination

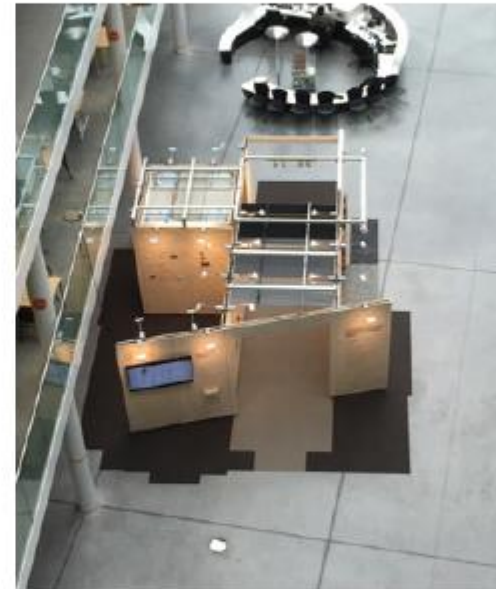
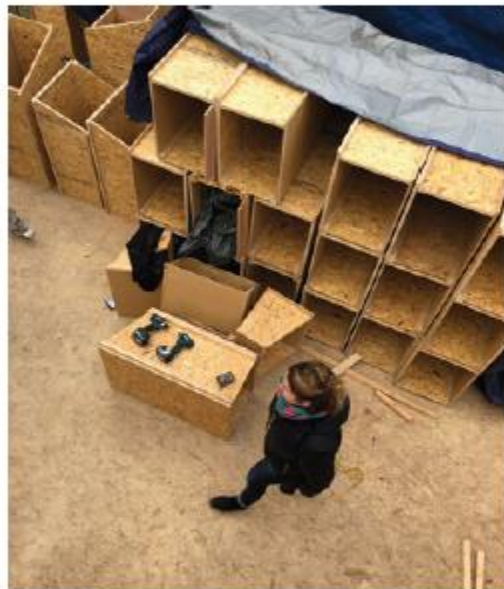
5.75

Transformation capacity

6.24

Recyclability

PROJETS PILOTES



PROJETS PILOTES



Circular Retrofit Lab – Vrije Universiteit Brussel

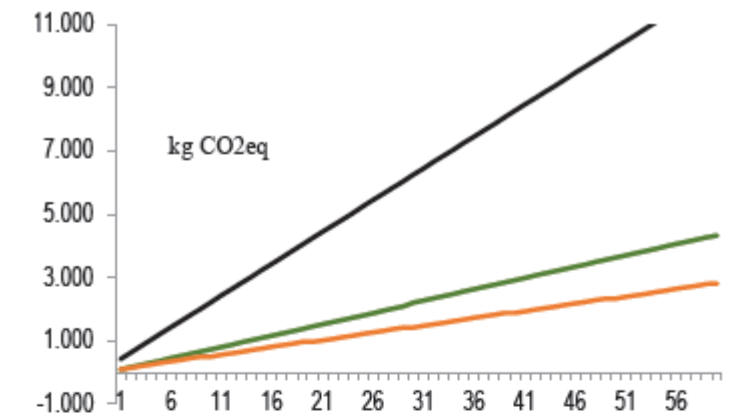
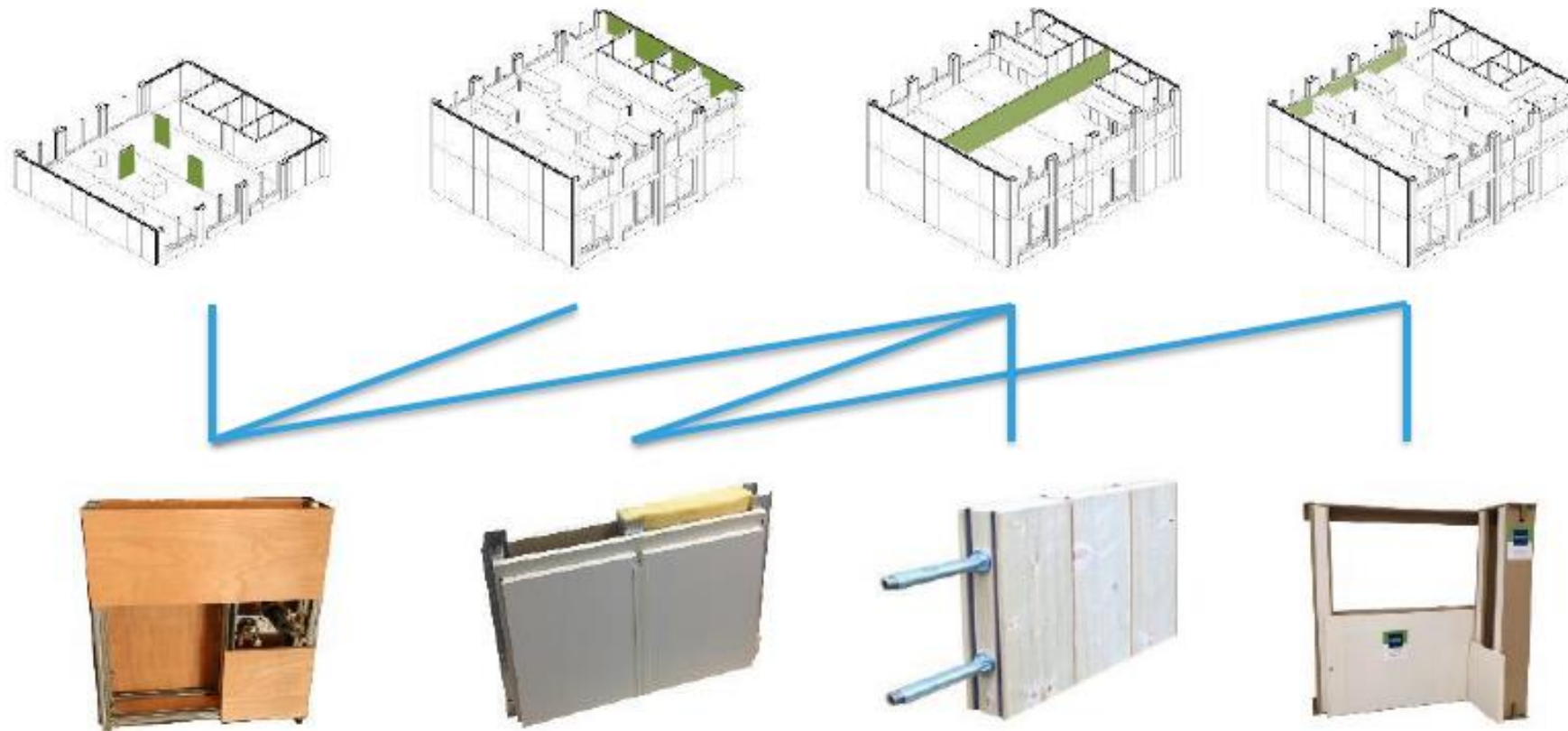


Figure 75: Environmental impacts per m², yearly transformation

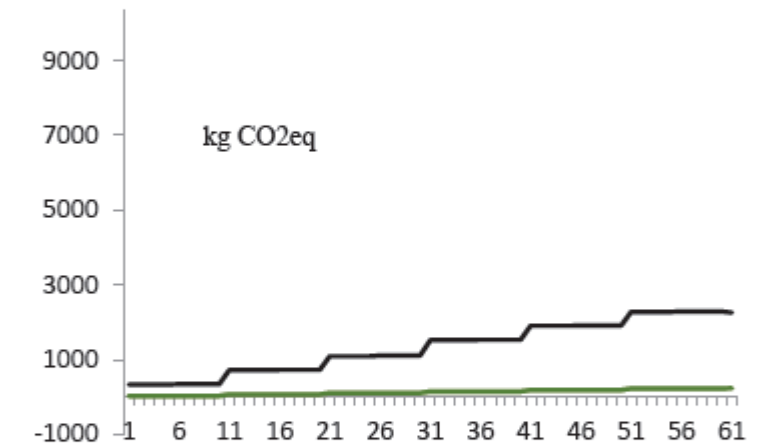
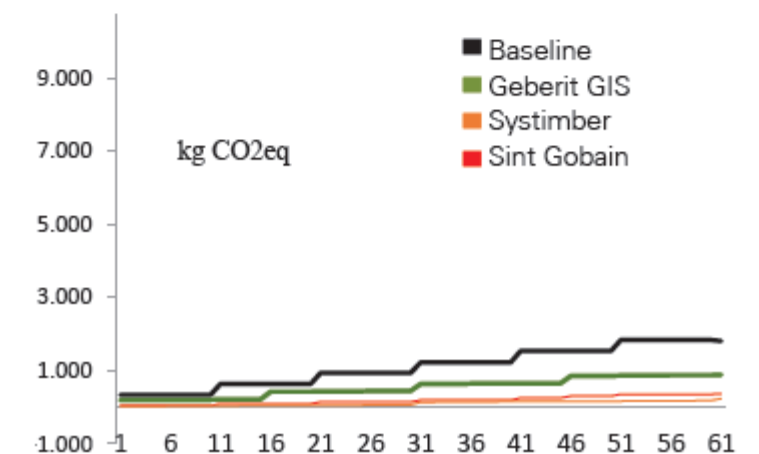
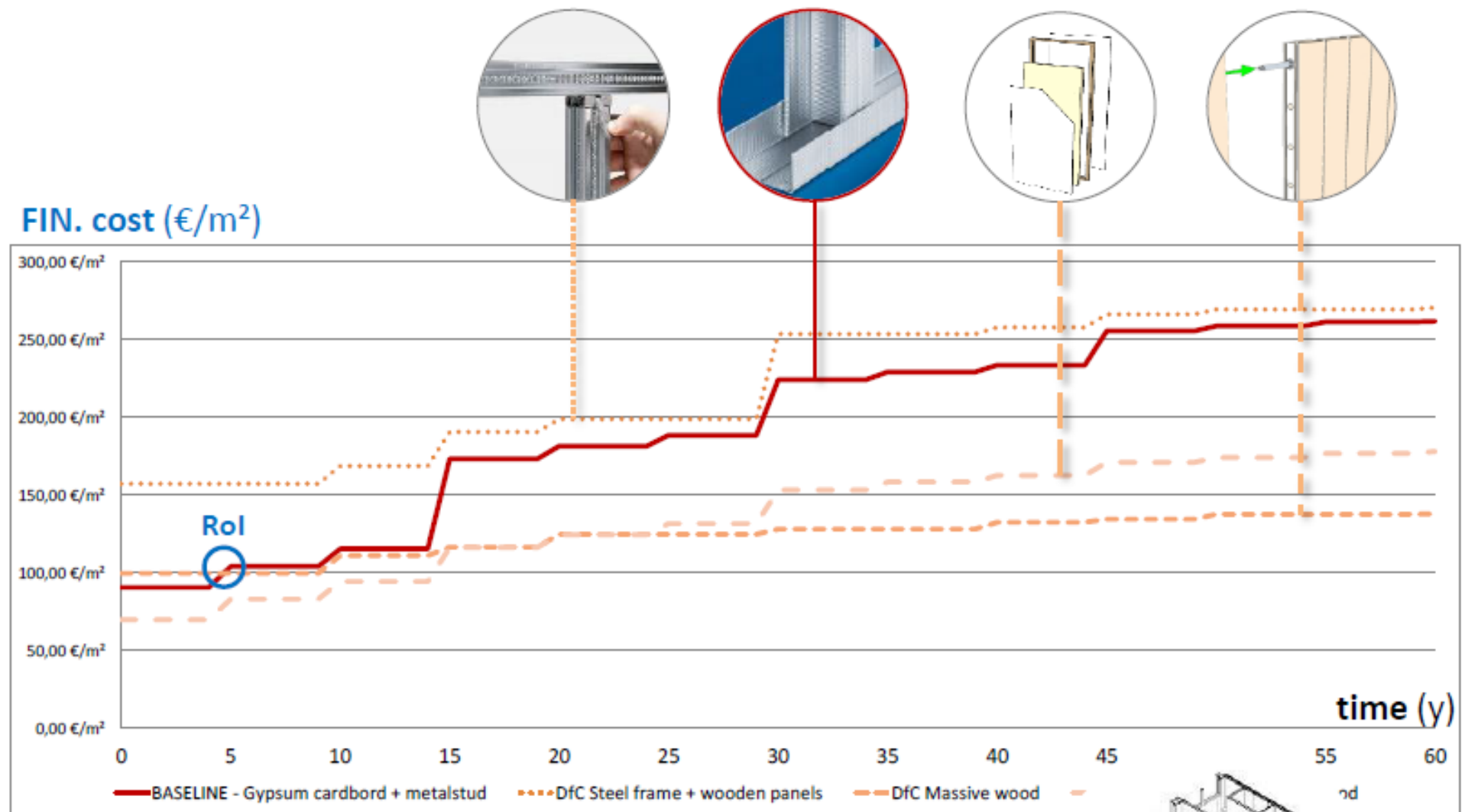


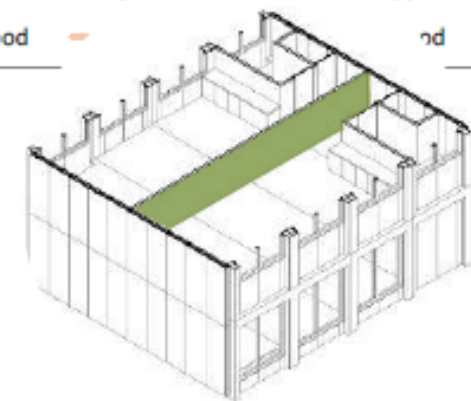
Figure 76: Environmental impact per m² Decennial transformation



PROJETS PILOTES

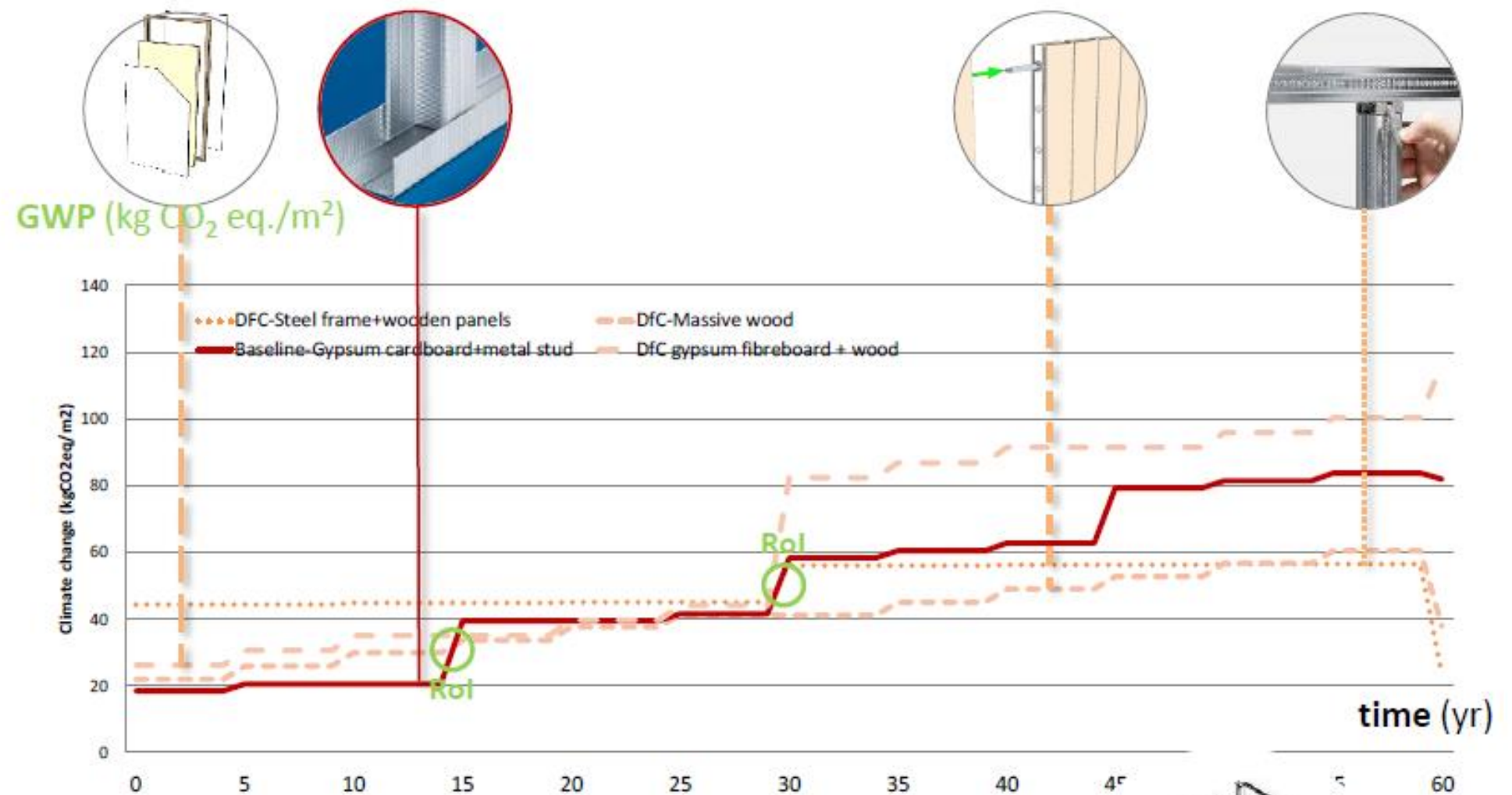


separating wall between dwelling units

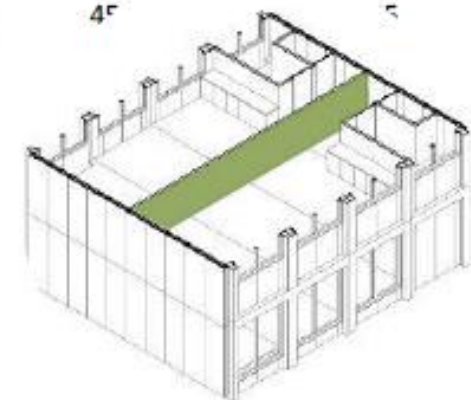


Paduart & Debacker, Circulair Bouwen (2018)

PROJETS PILOTES



separating wall between dwelling units



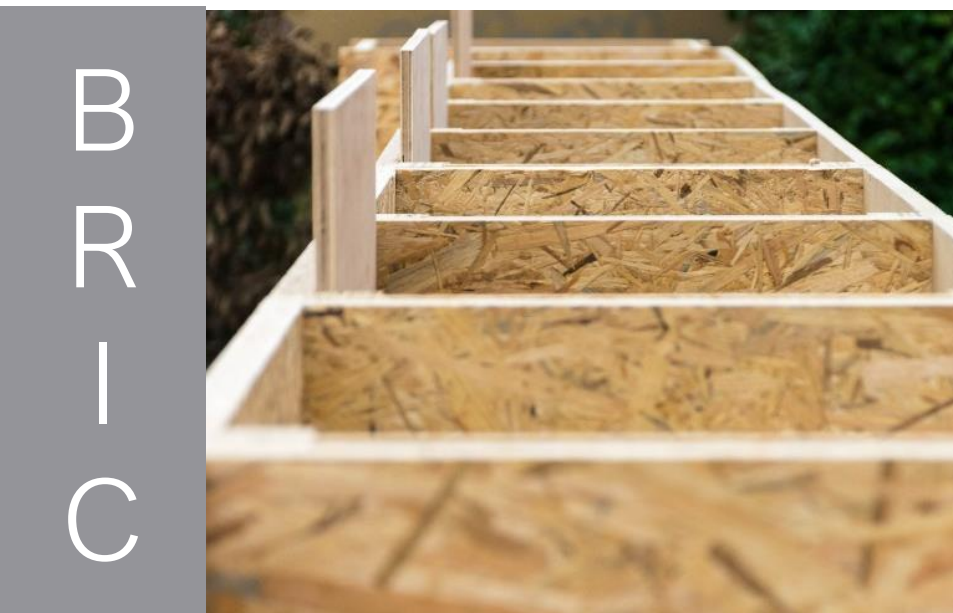
Paduart & Debacker, Circulair Bouwen (2018)



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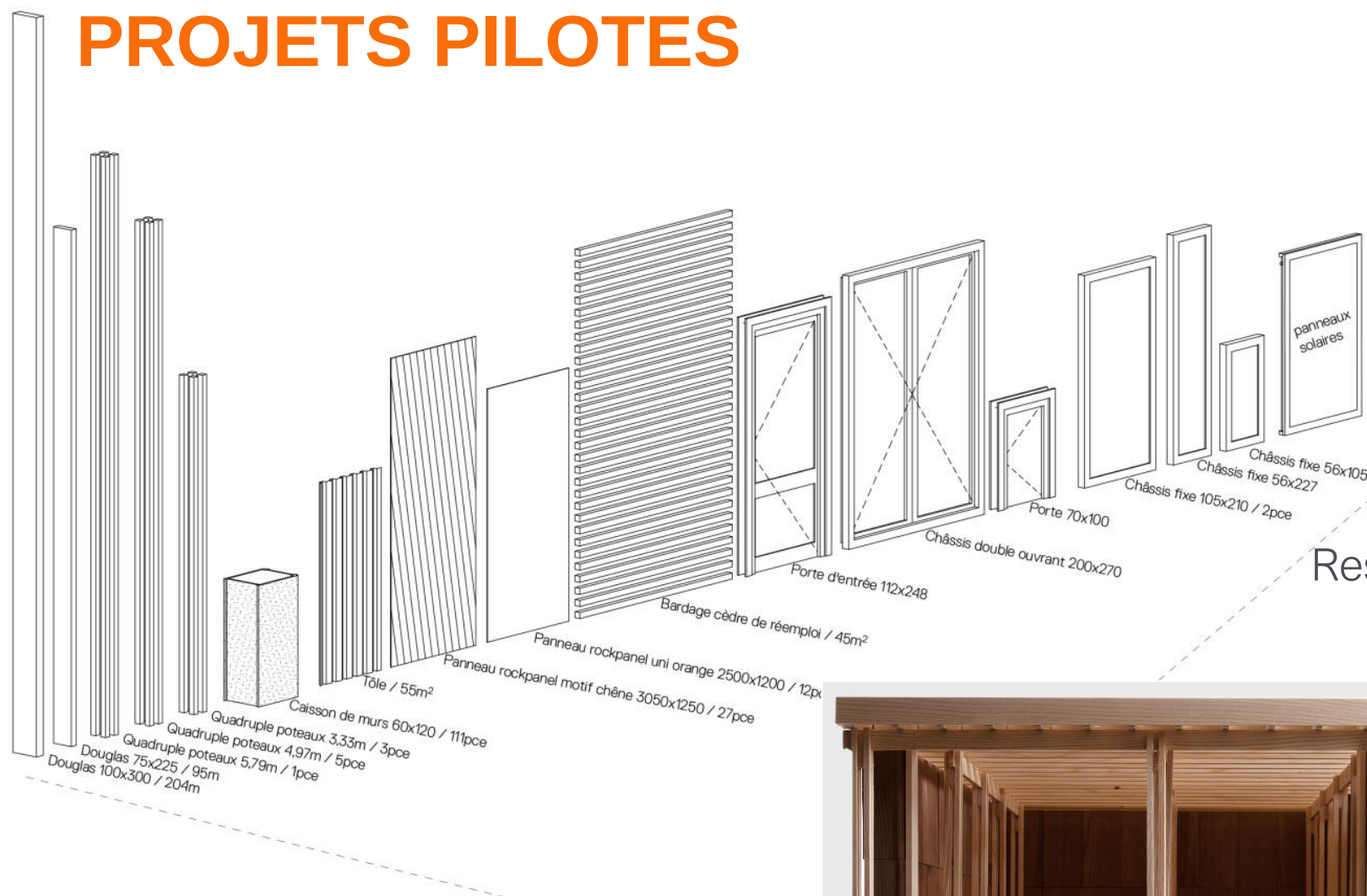
PROJETS PILOTES



B
R
I
C



PROJETS PILOTES



Ressources BRIC 1

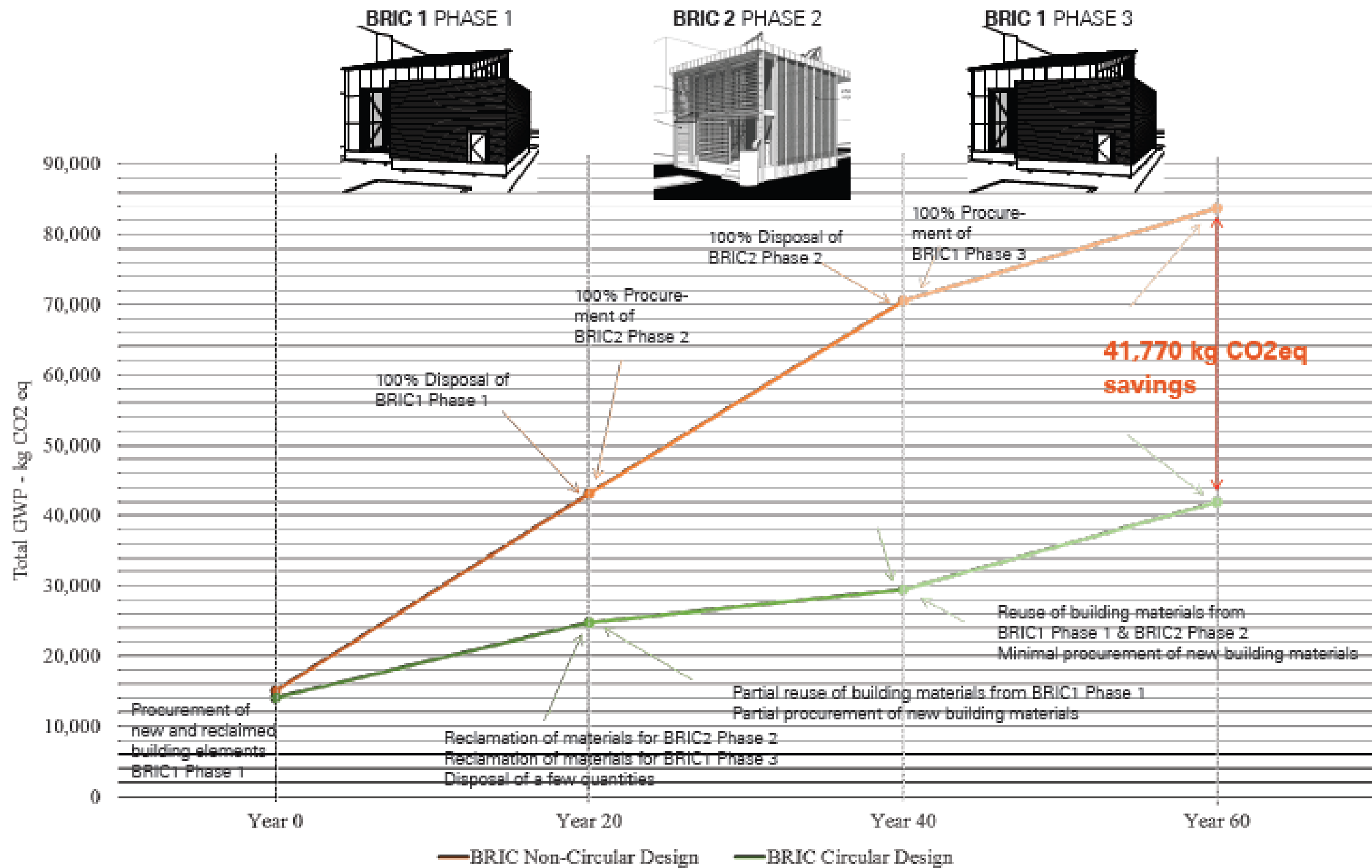


Déchets : 3,5 m3



BRIC 2

PROJETS PILOTES



CONCLUSIONS

- L'engagement de la Région de changer de modèle économique avec une volonté de soutenir une transition vers une économie circulaire
 - ✓ **Le bâtiment, vu comme une banque de matériaux**
ressources à maintenir sur le territoire
 - ✓ **Une conception circulaire**
adaptabilité et réversibilité
 - ✓ **Les projets pilotes ont prouvé qu'un réemploi et une réduction des déchets jusqu' 75 à 90 % sont possible**
 - ✓ **Réduction des émission de GES jusqu' 50%**
 - ✓ **Développement d'outil pour soutenir les professionnels de la construction**



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of the European Union



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