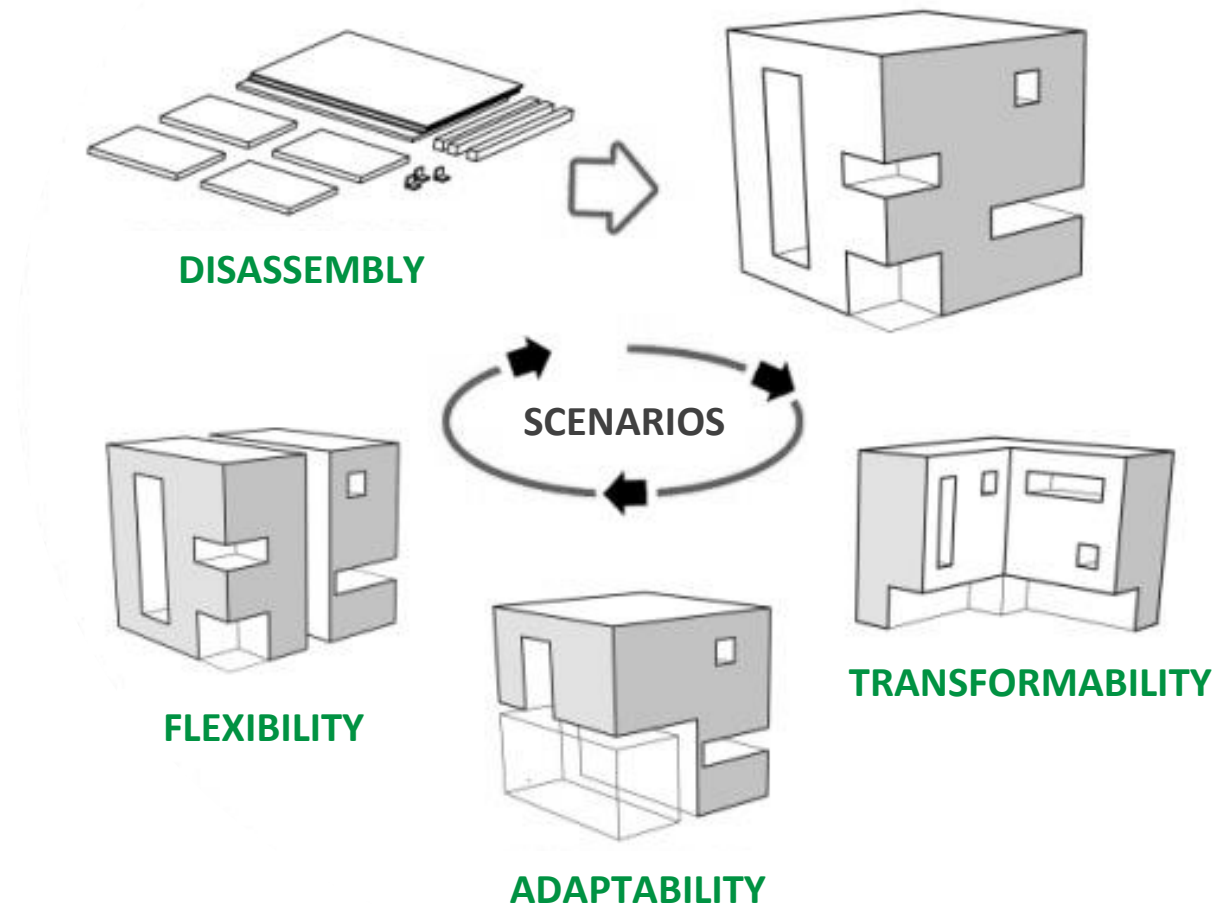


# LCC and LCA of dynamic construction in the context of social housing



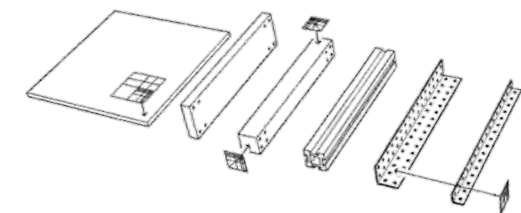
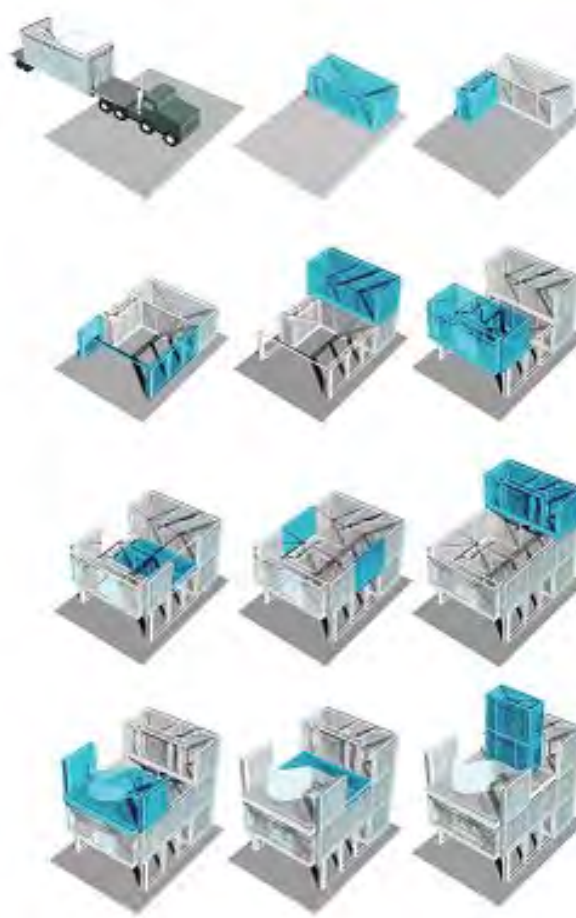
**SUSTAINABLE BUILDING CONFERENCE 2013**  
*27 September 2013, TU Graz, Austria*

## Dynamic construction

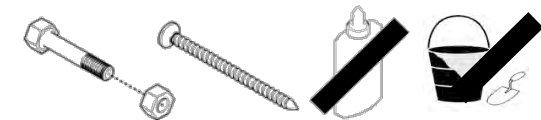


## 1. Introduction

### Dynamic construction



*Reversible connections*



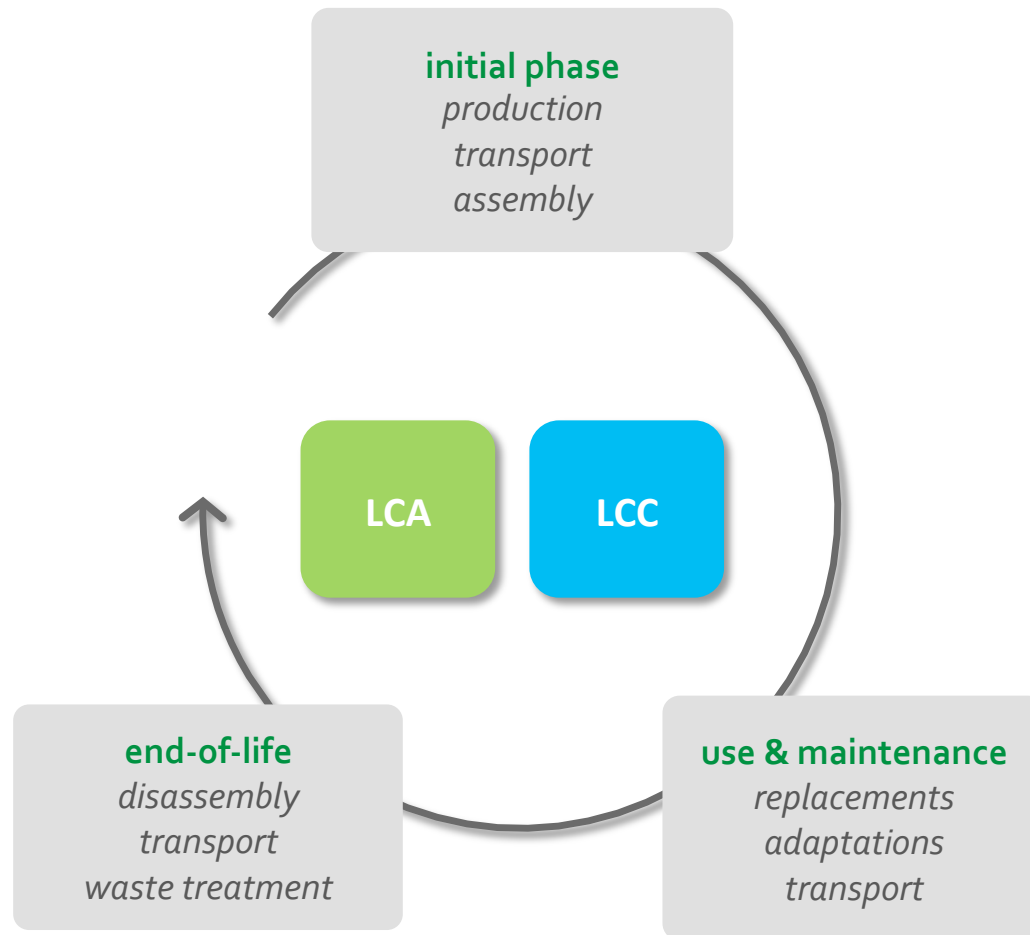
## 1. Introduction

### Objectives

- Case study: **social housing neighbourhood** Mahatma Ghandi (Mechelen, Belgium)
- **Renovation scenarios** considering dynamic alternatives for **internal walls**
- Evaluation of financial and environmental benefits and drawbacks based on a **life cycle approach**



## Integrated life cycle evaluation



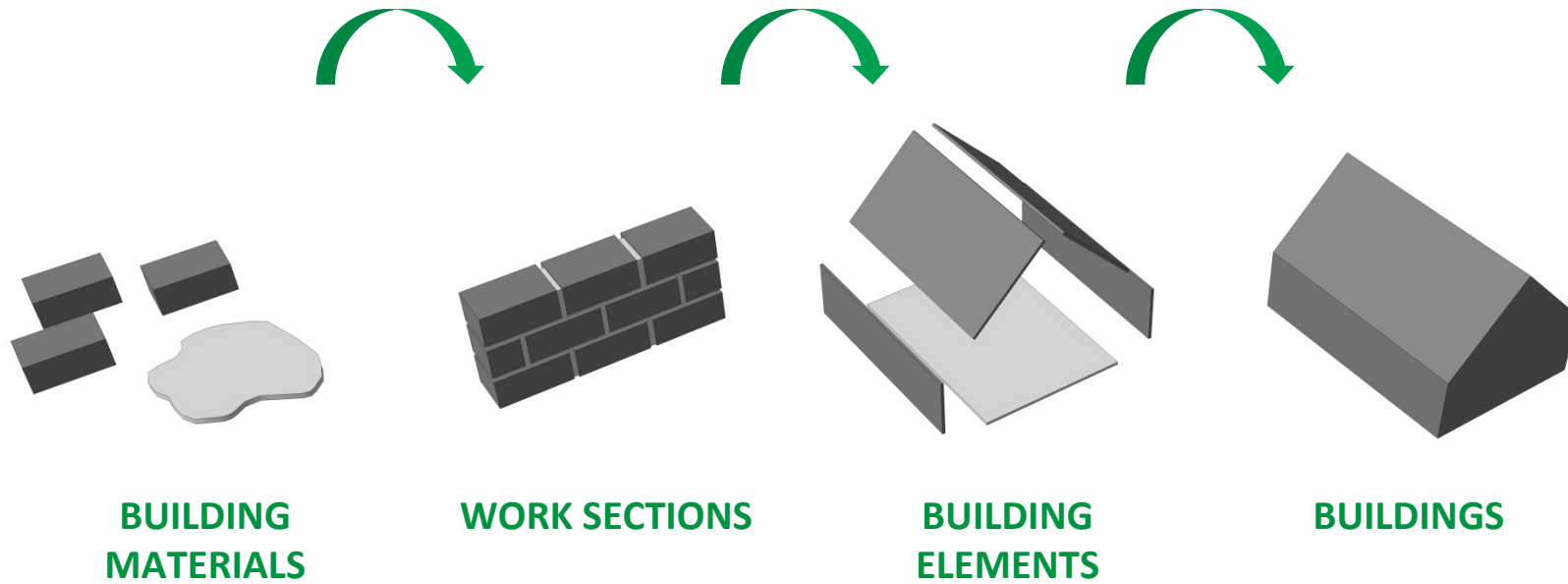
### Environmental impact

Environmental costs =  
valuation of environmental impacts

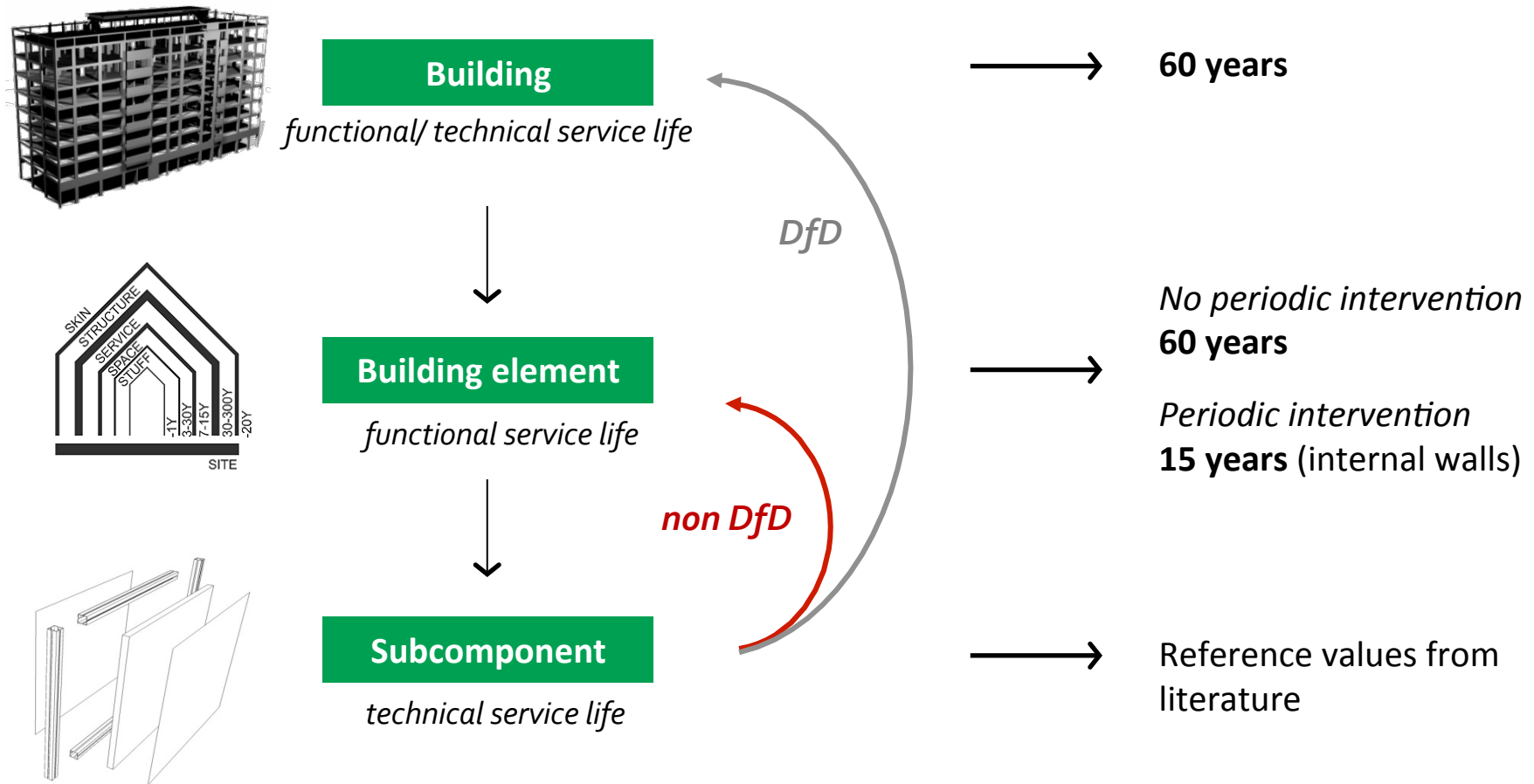
### Financial costs

Total Present Value =  
initial costs + discounting of future costs

## Evaluation structure



## Service life scenarios

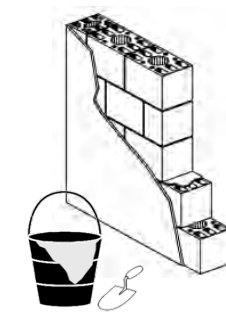
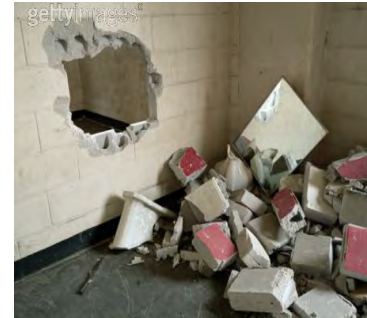




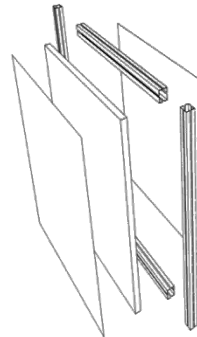
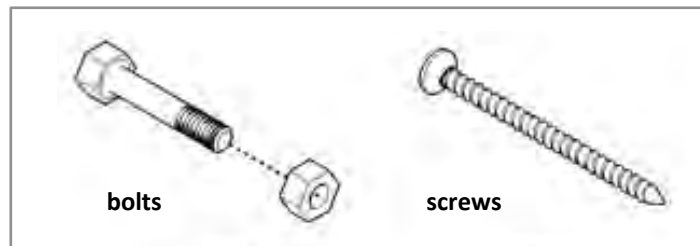
## Qualitative assessment : construction method



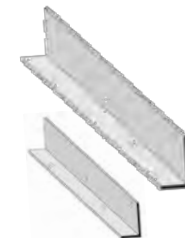
IRreversible



reversible



+



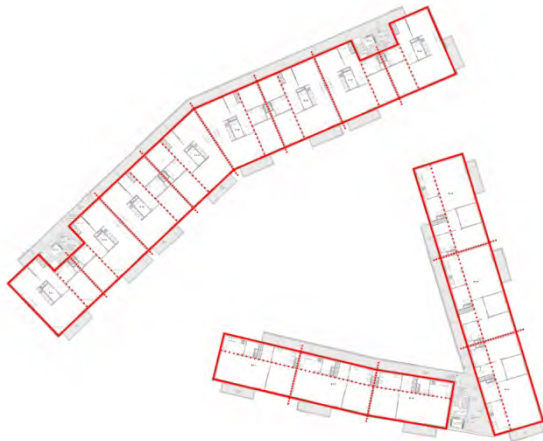
+



reuse ↗  
recycling ↗

## Qualitative assessment : building layers

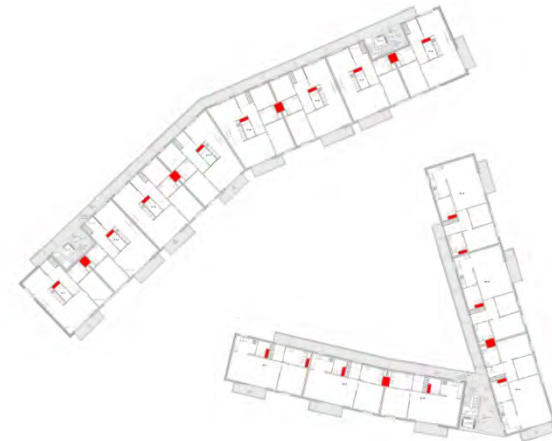
- Loadbearing walls
- External circulation
- Clustering of technical services



**STRUCTURE**



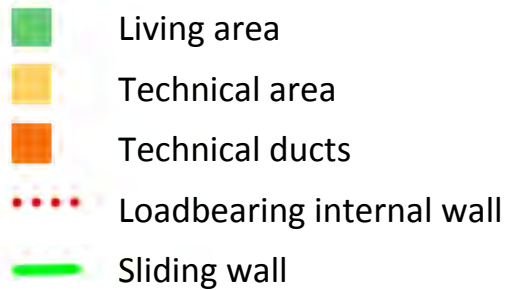
**CIRCULATION**





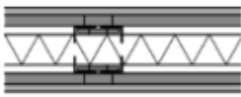
**SERVICES**

### Qualitative assessment : plan layout housing unit

- **Grouping of rooms**
- **Clustering of technical ducts**



## Quantitative assessment : variants for internal walls

Category	Composition	Thickness
 <b>Masonry wall</b>	- brickwork:	
	a) perforated clay bricks (case study)	140 mm
	b) cellular concrete blocks	150 mm
	c) hollow concrete blocks	140 mm
	- plaster + painting	12 mm
 <b>Dry wall</b>	- metal studs	50 mm
	- mineral wool	40 mm
	- gypsum plasterboard	12.5 + 12.5 mm
	- painting	
 <b>DfD wall</b>	- metal framework	50 mm
	- glass wool	40 mm
	- OSB boarding+	15 mm
	a) MDF boarding	12.5 mm
	b) gypsum fibreboard	12.5 mm
	c) gypsum plasterboard	12.5 mm
	- painting	

## Quantitative assessment : renovation scenario



## Quantitative assessment : wall scenarios



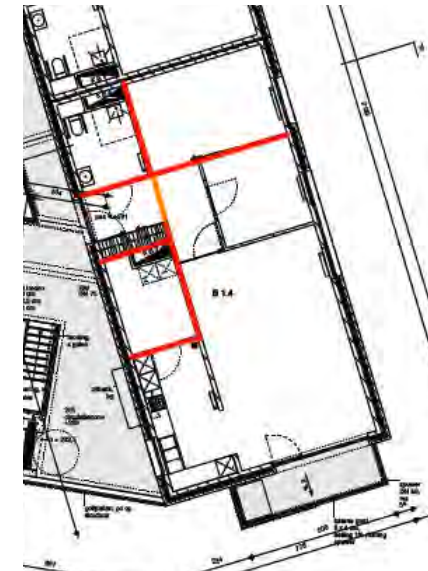
0-15 year



15-30 year



30-45 year



45-60 year



Use period: year 0 to 60, no periodic turnover



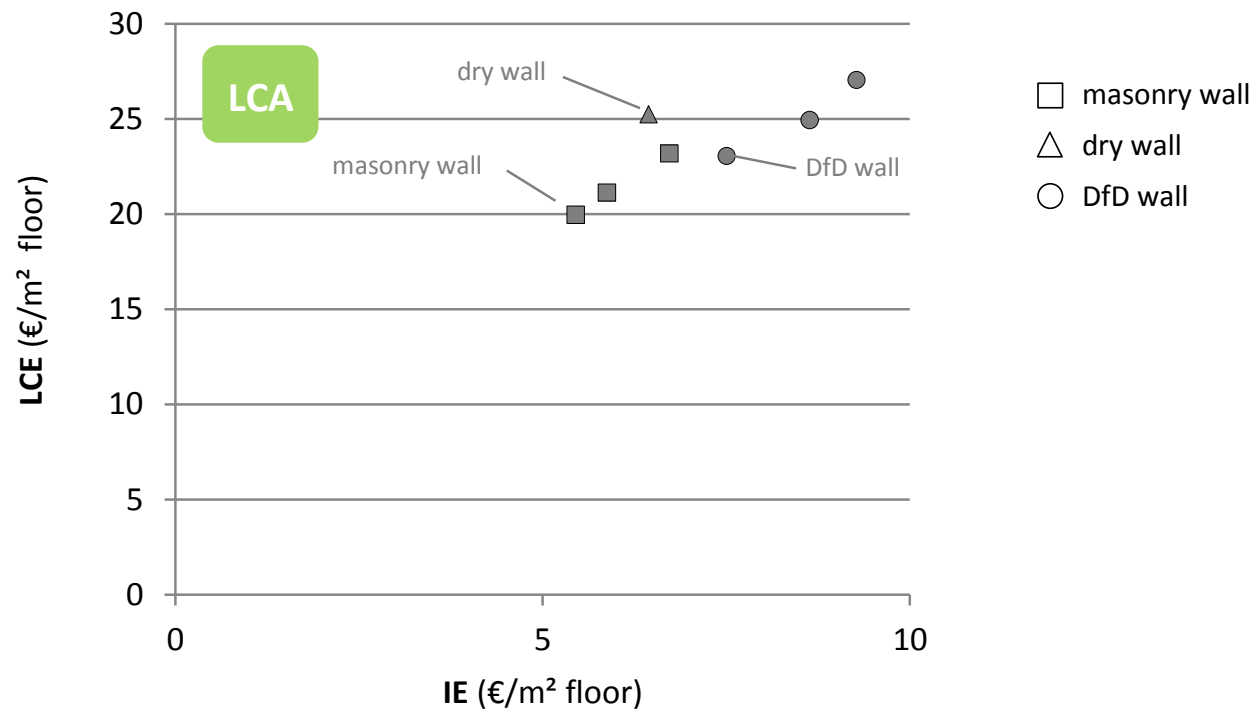
Use period: year 0 to 60, periodic turnover: 15 years



Use period: year 0 to 15 and year 30 to 45; periodic turnover: 15 years

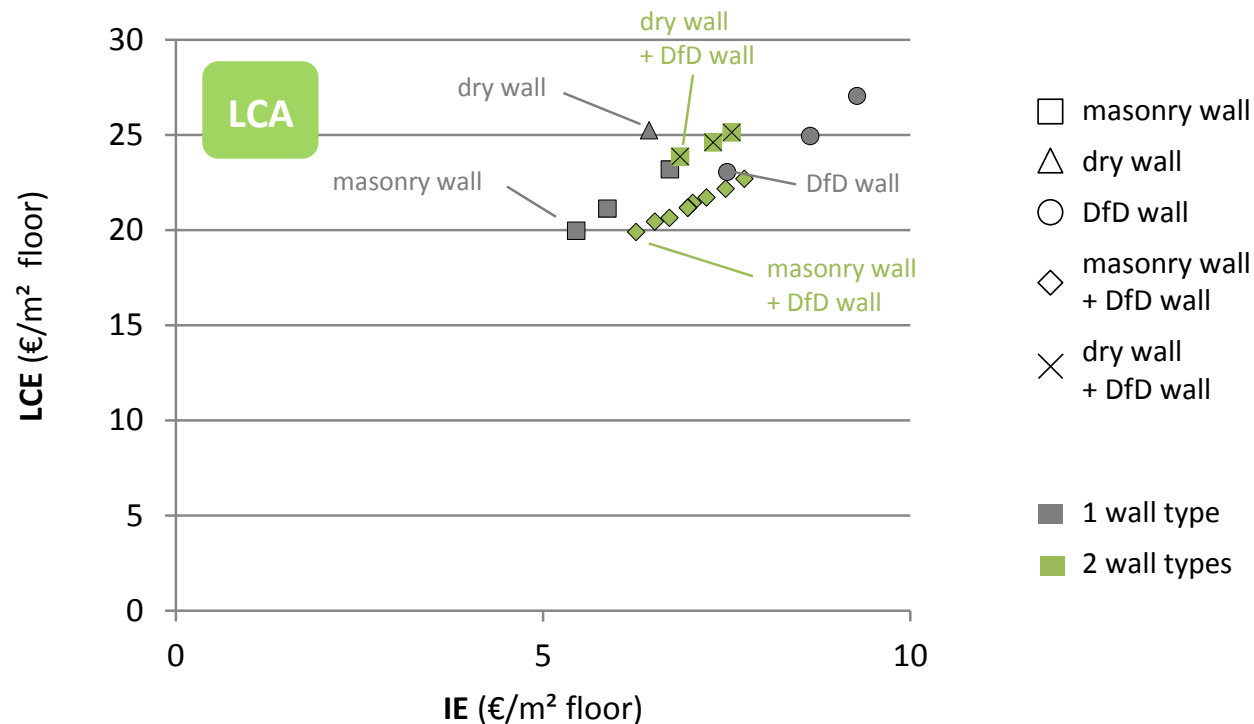
## Quantitative assessment : LCA results

- Dynamic assemblies for all internal walls are **not beneficial** (limited required interventions)



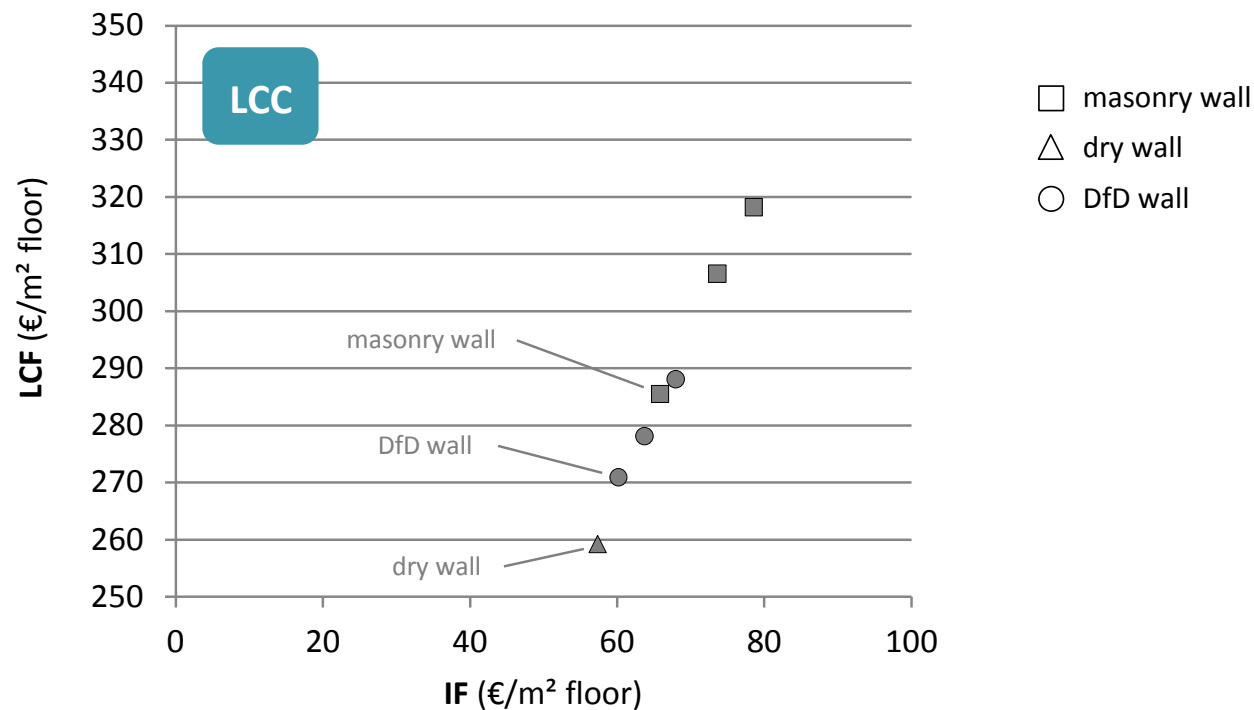
## Quantitative assessment : LCA results

- Dynamic assemblies for all internal walls are **not beneficial** (limited required interventions)
- A **selective application** of dynamic assemblies results in (limited) environmental costs reduction



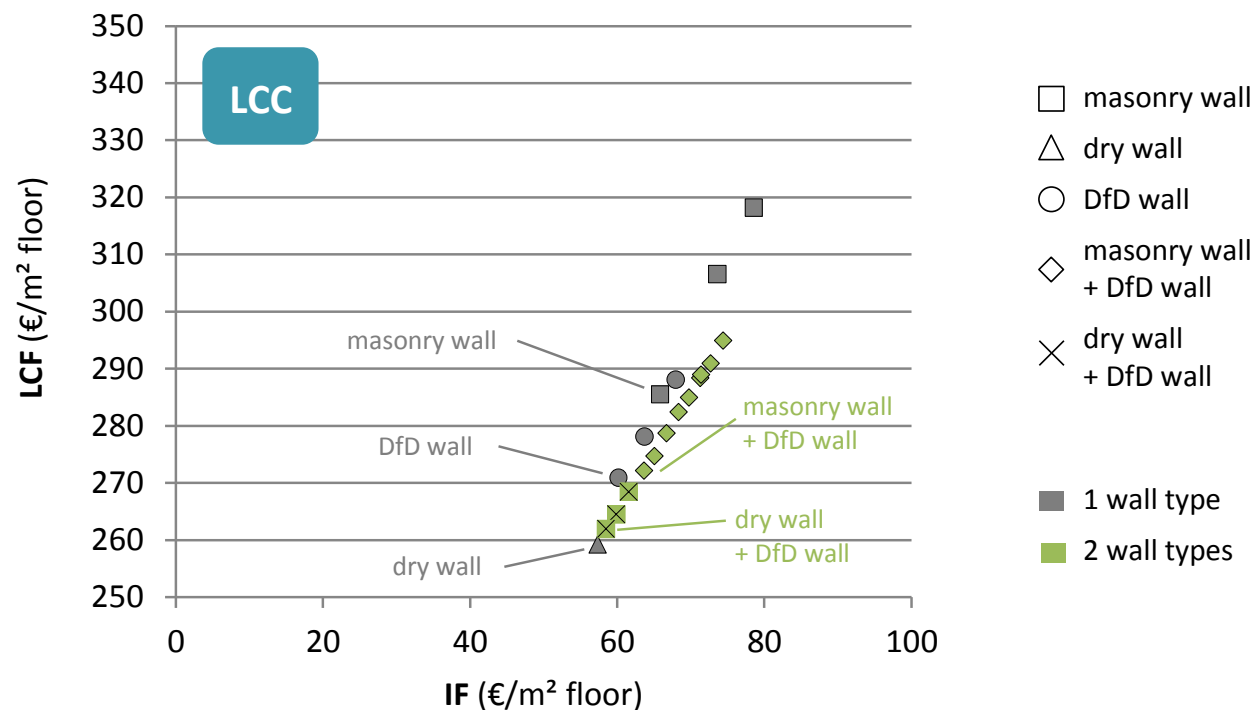
## Quantitative assessment : LCC results

- Dynamic assemblies can **compete with masonry walls** (pre-assembly of DfD walls) but are **more expensive than dry walls** (labour costs for disassembly and reassembly of DfD walls)



## Quantitative assessment : LCC results

- Dynamic assemblies can **compete with masonry walls** (pre-assembly of DfD walls) but are **more expensive than dry walls** (labour costs for disassembly and reassembly of DfD walls)
- A **selective application** of dynamic assemblies can be interesting in combination with masonry walls and results in a limited additional cost in combination with dry walls



## Main conclusions

- Importance of the **building concept and layout** for future interventions
- A **selective approach** of dynamic assemblies should be preferred
- **Further research:** other case studies and impact of life span scenarios

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## Acknowledgements

