Vrije Universiteit Brussel

Environmental impact assessment of adaptive reuse of existing social high-rise dwellings

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Copromotor:
Prof. H. Hendrickx

iwt

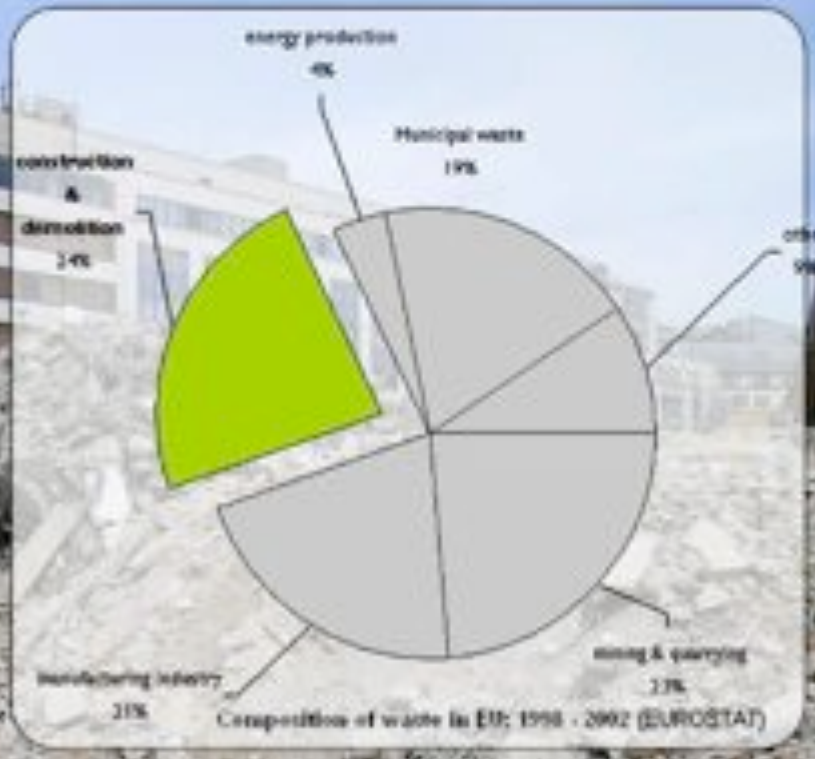
PROBLEM STATEMENT

PROBLEM STATEMENT

Construction &
demolition waste
25% of total composition of waste in EU

+

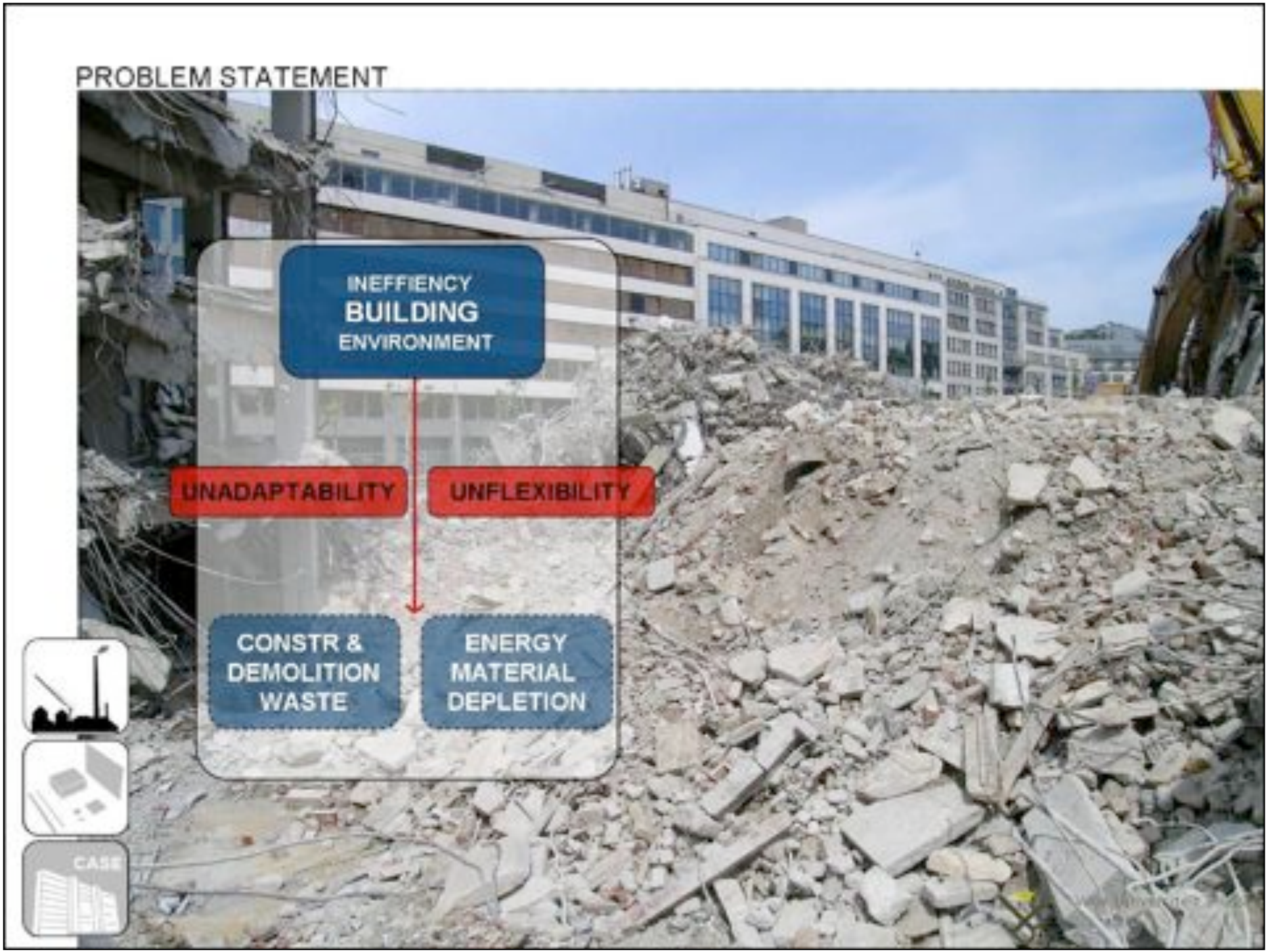
Amount of CD&W
grows year by year



Composition of waste in EU; 1998 - 2002 (EUROSTAT)

CASE

PROBLEM STATEMENT



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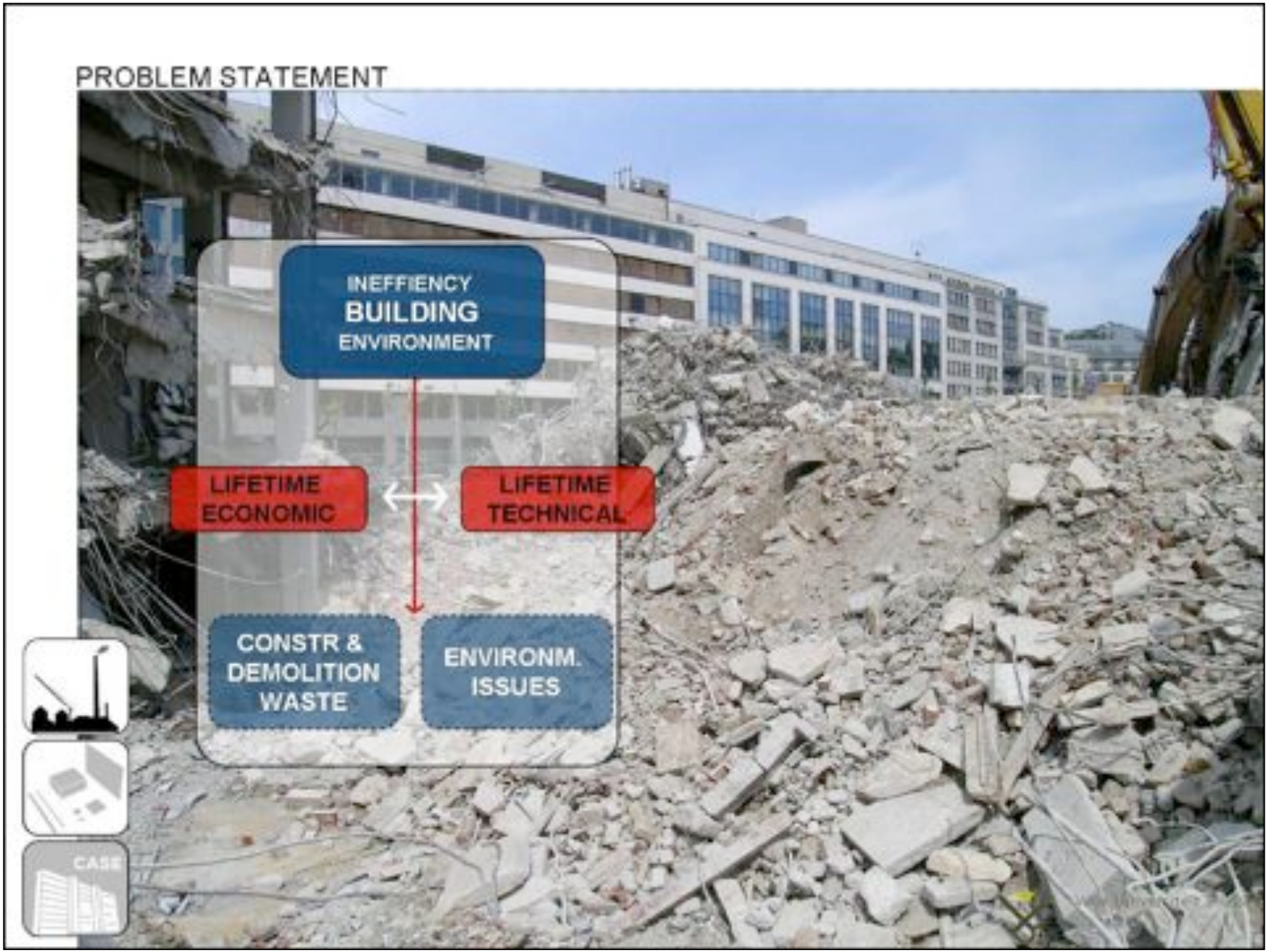

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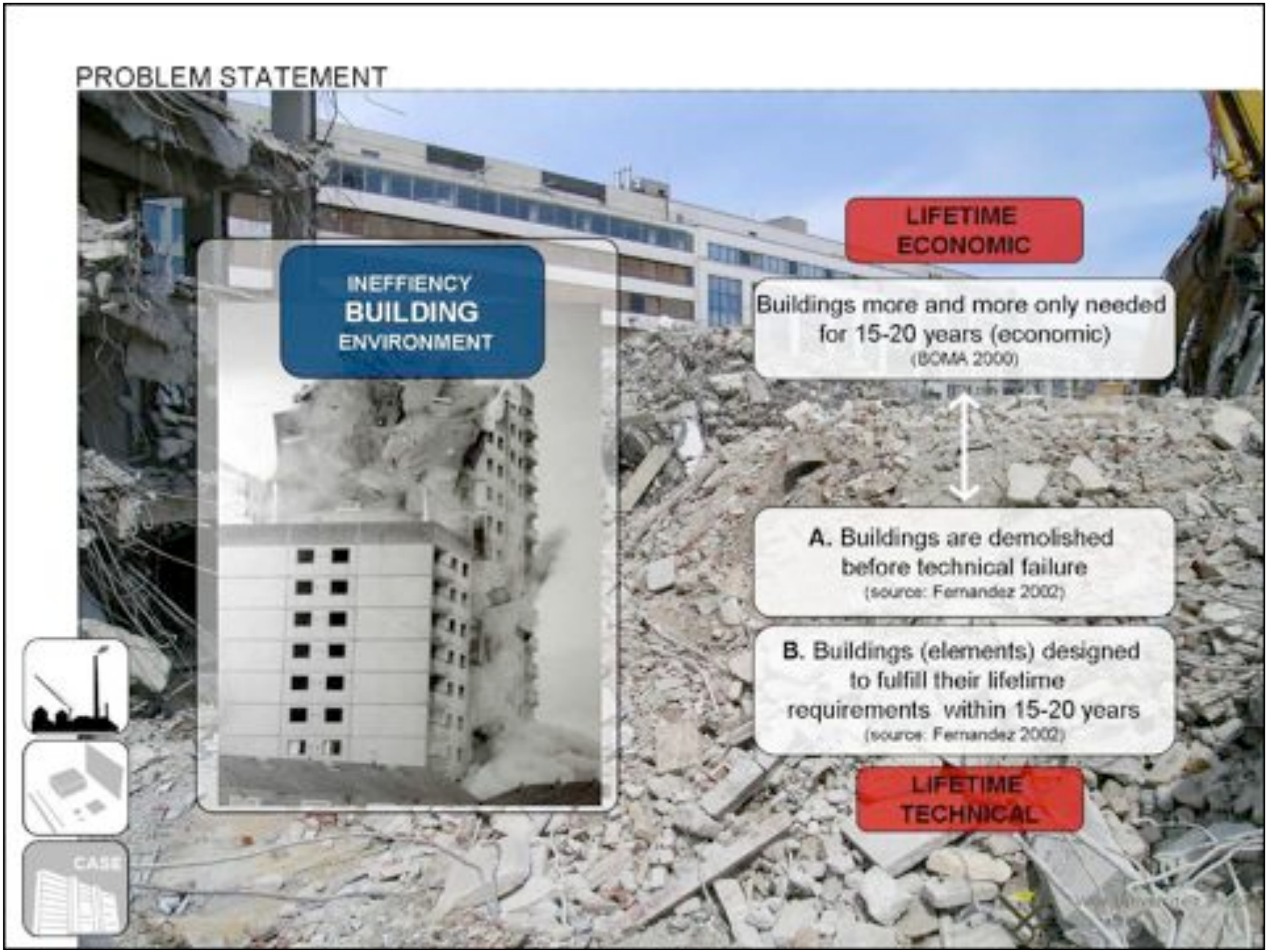

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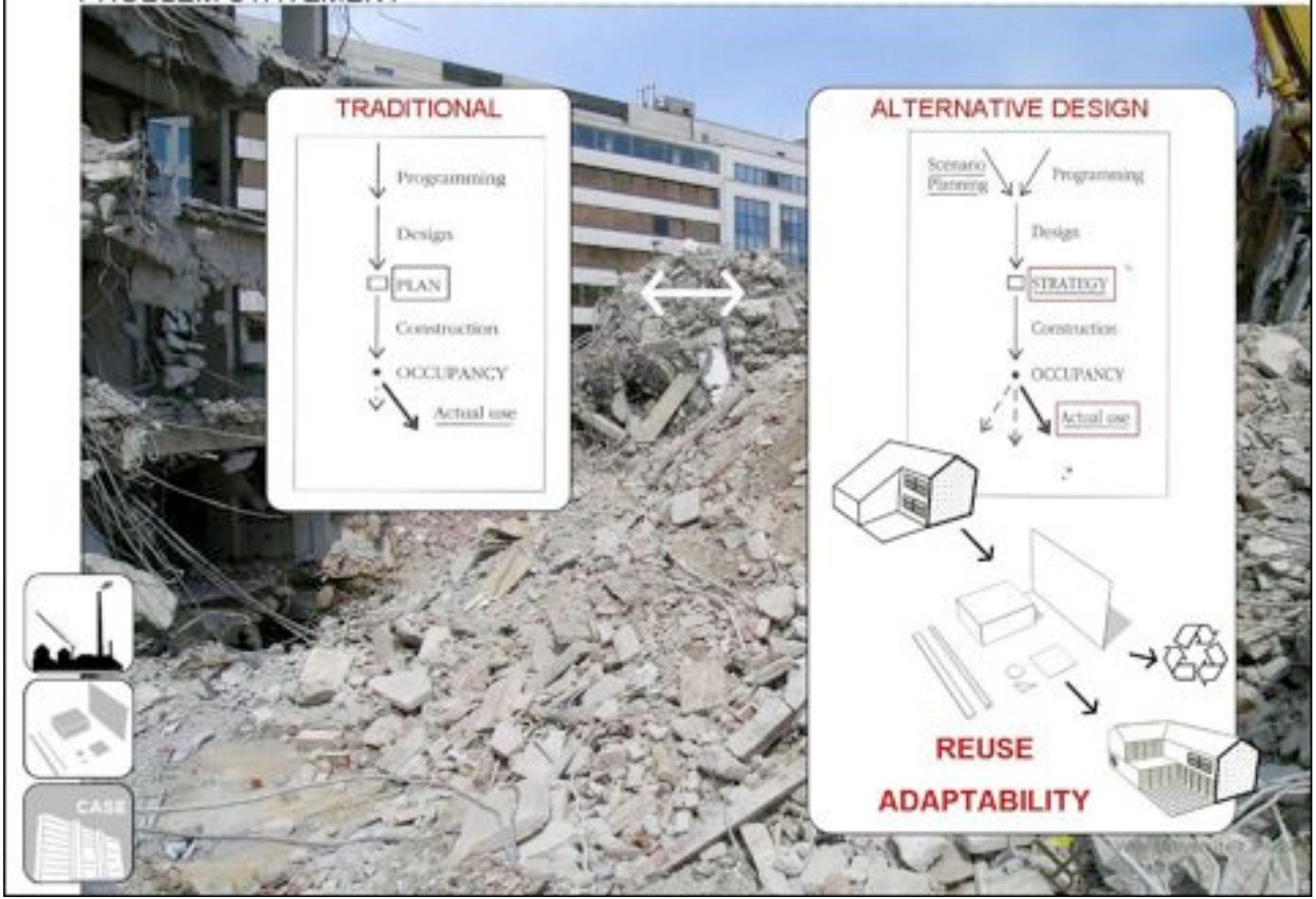


ALTERNATIVE DESIGN STRATEGIES

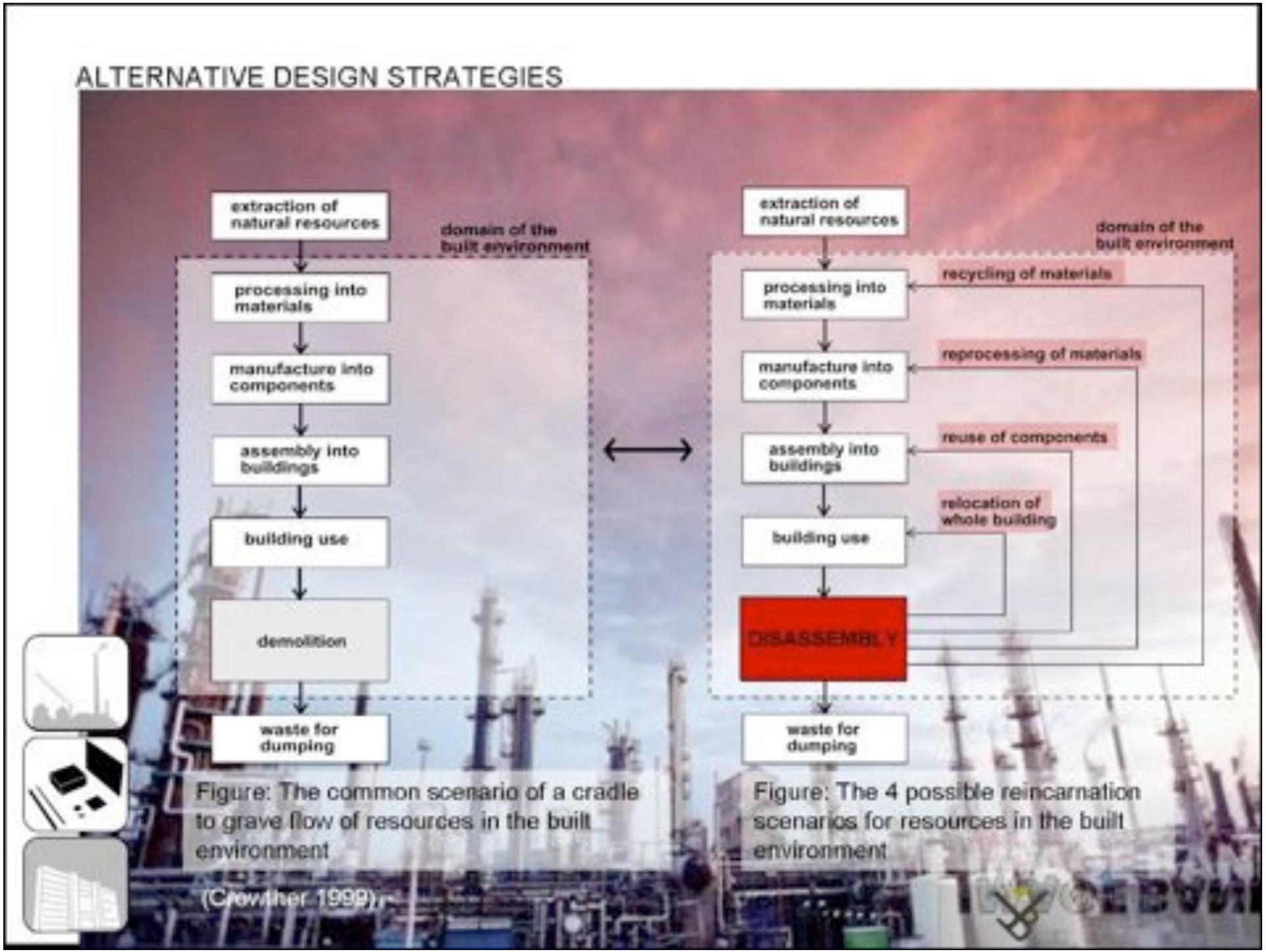


Figure: The common scenario of a cradle to grave flow of resources in the built environment

(Crowther 1999)

Figure: The 4 possible reincarnation scenarios for resources in the built environment

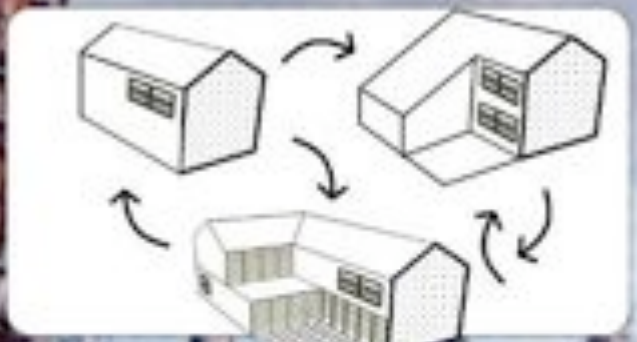
ALTERNATIVE DESIGN STRATEGIES

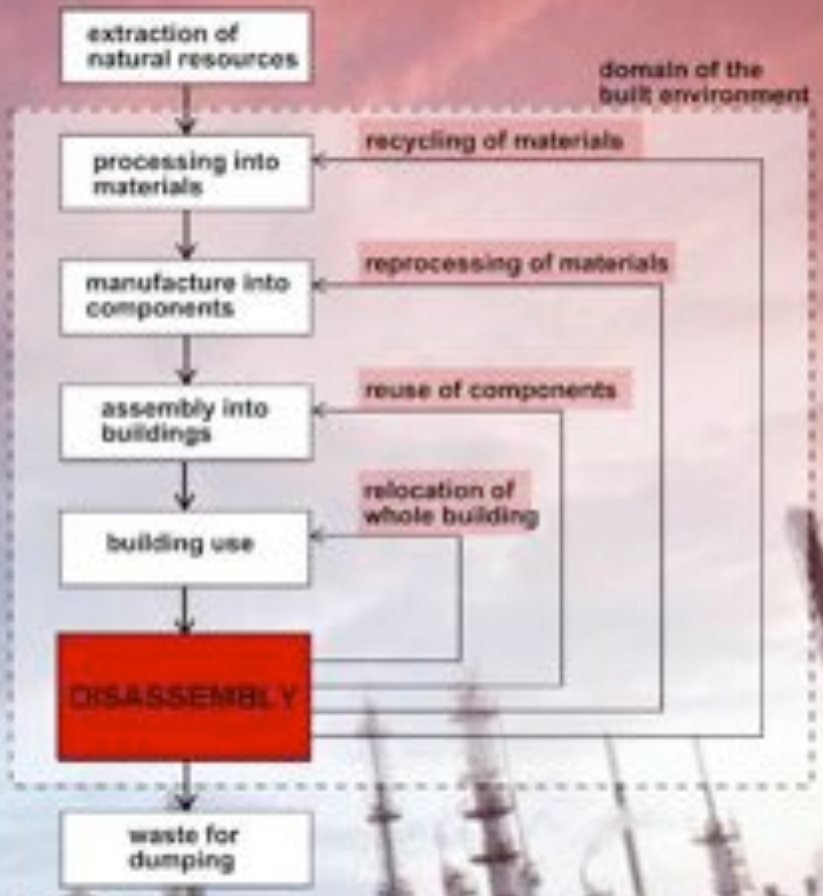
STRATEGIES

Design for DISMANTLING
(material reuse)

Design for DECONSTRUCTION
(component reuse)

Design for ADAPTABILITY
(building reuse)





ALTERNATIVE DESIGN STRATEGIES

4 DIMENSIONAL DESIGN

ONTWERPREGELS 4D

CONSTRUCTIESYSTEEM=
constructie-elementen + combinatieregels

DEMONTEERBAARHEID

PROBLEM STATEMENT: WHY RENOVATION?

NEW BUILDINGS

EXISTING BUILDINGS

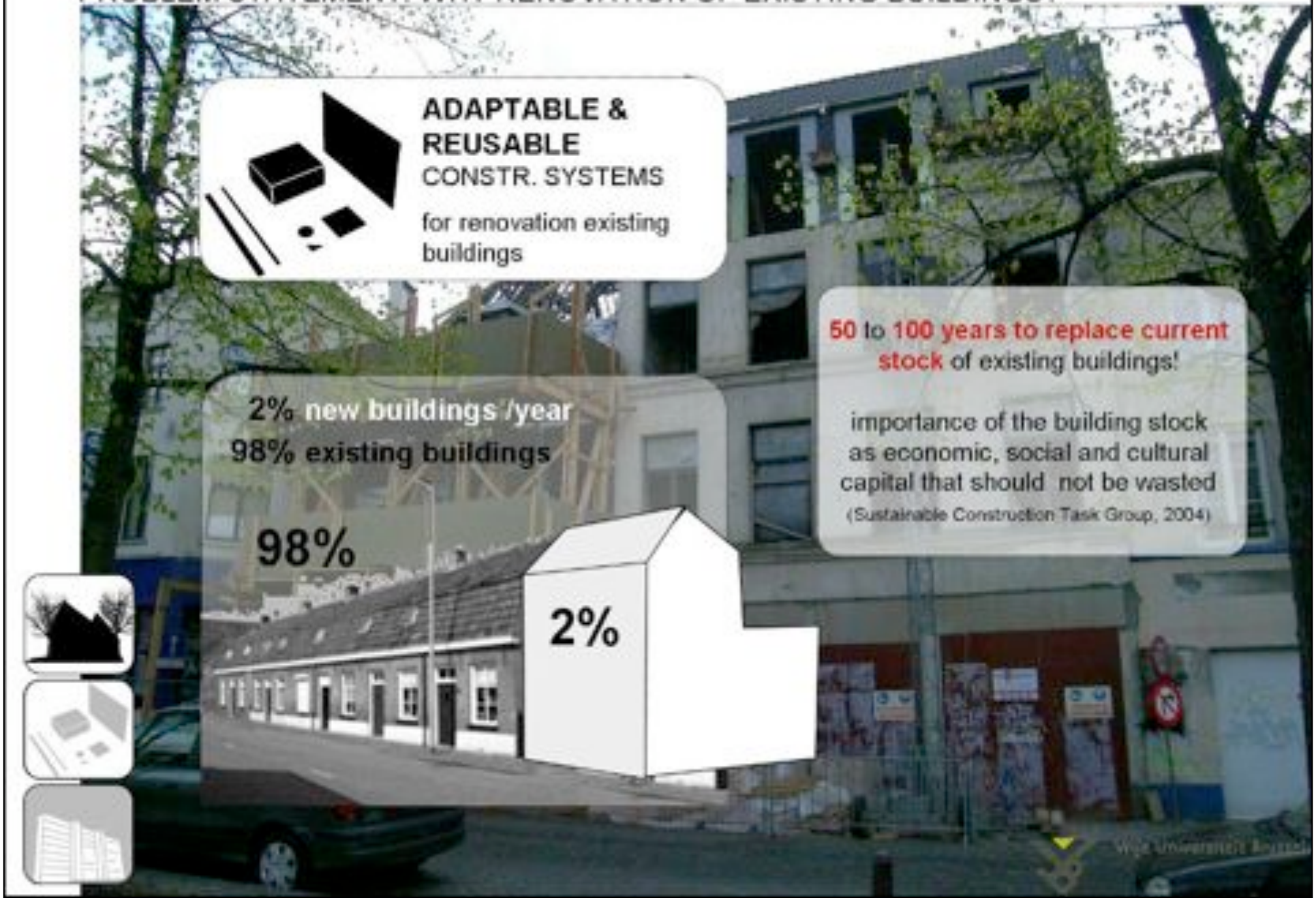
ALTERNATIVE DESIGN

REUSE

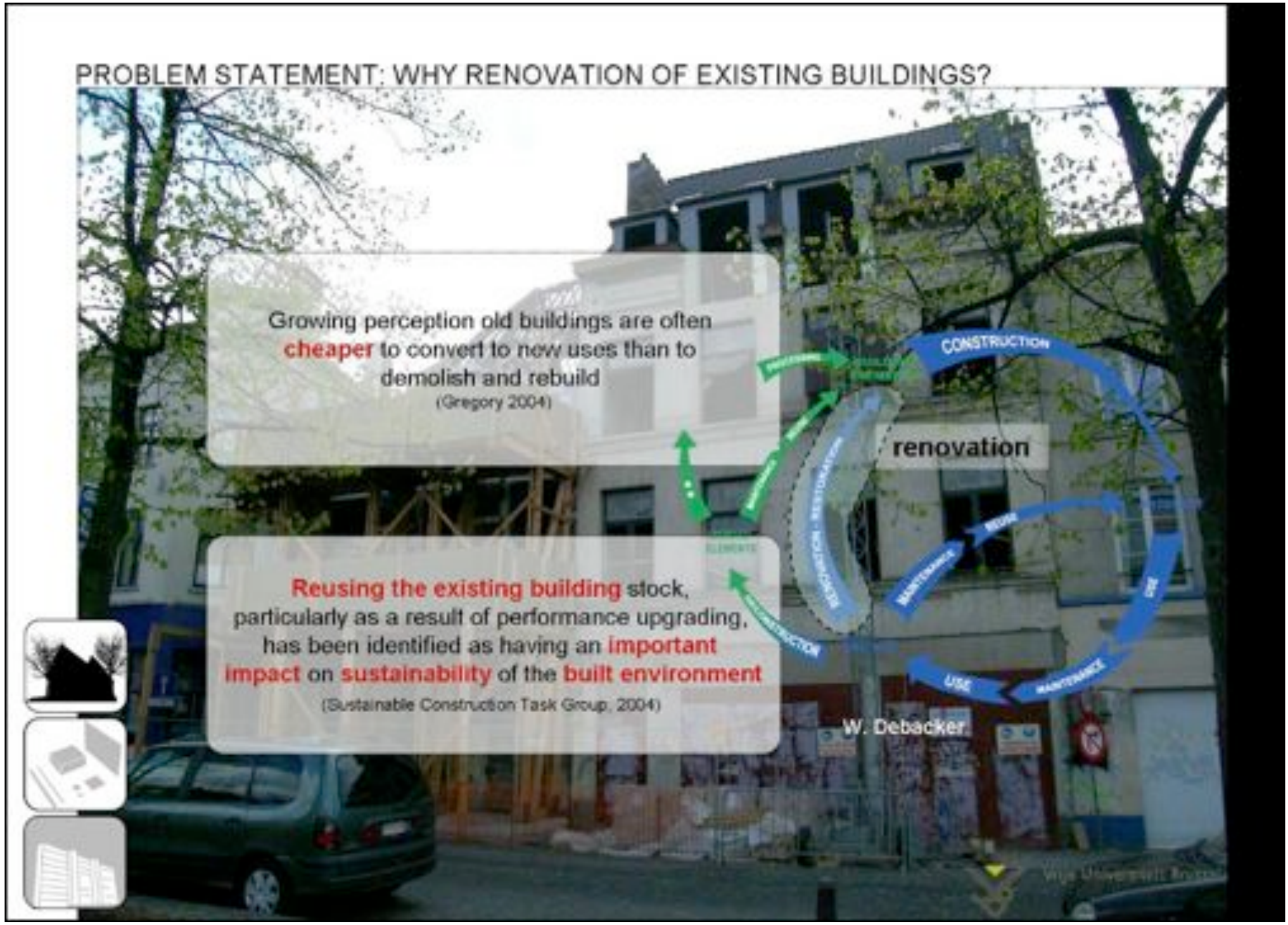
ADAPTABILITY

CASE

PROBLEM STATEMENT: WHY RENOVATION OF EXISTING BUILDINGS?



PROBLEM STATEMENT: WHY RENOVATION OF EXISTING BUILDINGS?



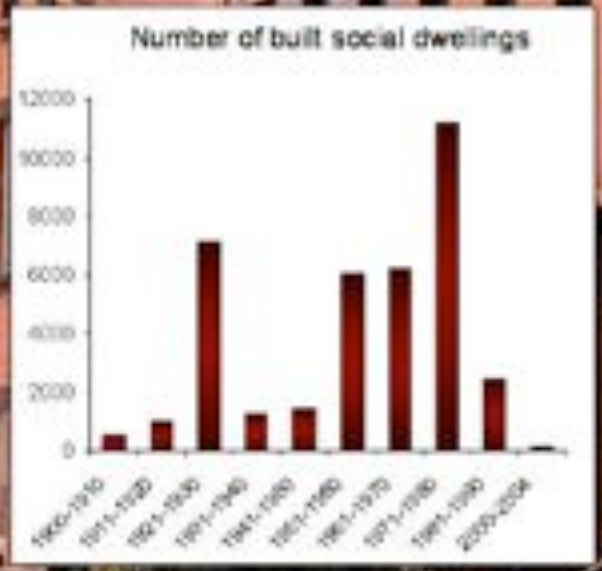
PROBLEM STATEMENT: WHY SOCIAL HOUSING?

SOCIAL HOUSING FLANDRES

Flanders:
Increasing demand:
OFFER <<< DEMAND
+
Lack **qualitive** social housing
→ 12% serious deficiencies

Need for investment new social habitats + **renovation of existing social housing**

Urgent need for efficient **construction & renovation approach**



PROBLEM STATEMENT: WHY SOCIAL HOUSING?

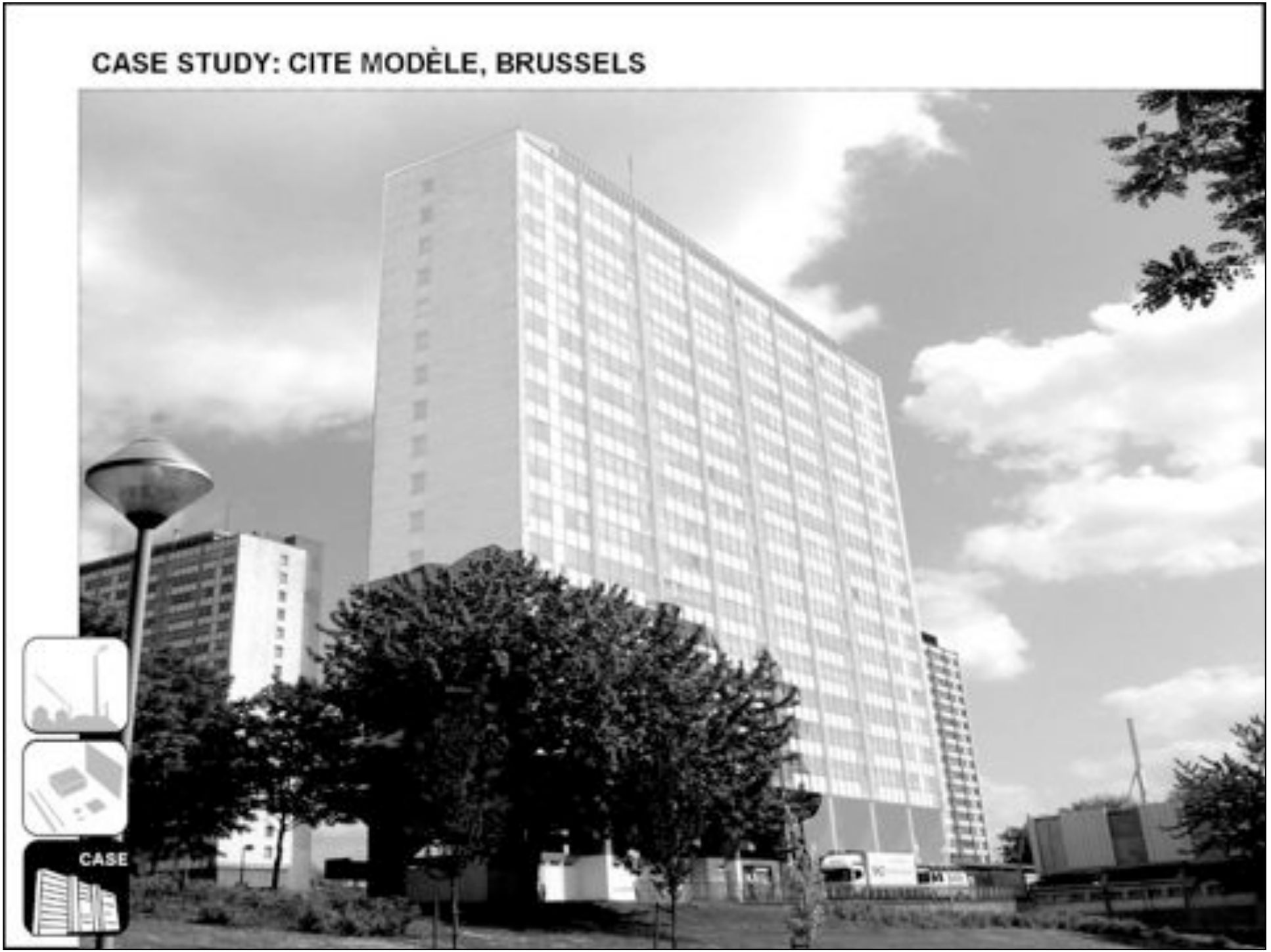
SOCIAL HOUSING FLANDRES

A. HIGH ENERGY CONSUMPTION (EPB 2006)

→ reaction to energy crisis '70
→introduction building regulations with requirements for thermal insulation
→28% (EU) built after '75
→ group older buildings priority for reduction of energy comsumption (heating)

PROBLEM STATEMENT: WHY SOCIAL HOUSING?

CASE STUDY: CITE MODÈLE, BRUSSELS



CASE STUDY: CITE MODÈLE, BRUSSELS

Social high-rise Flanders (Belgium)

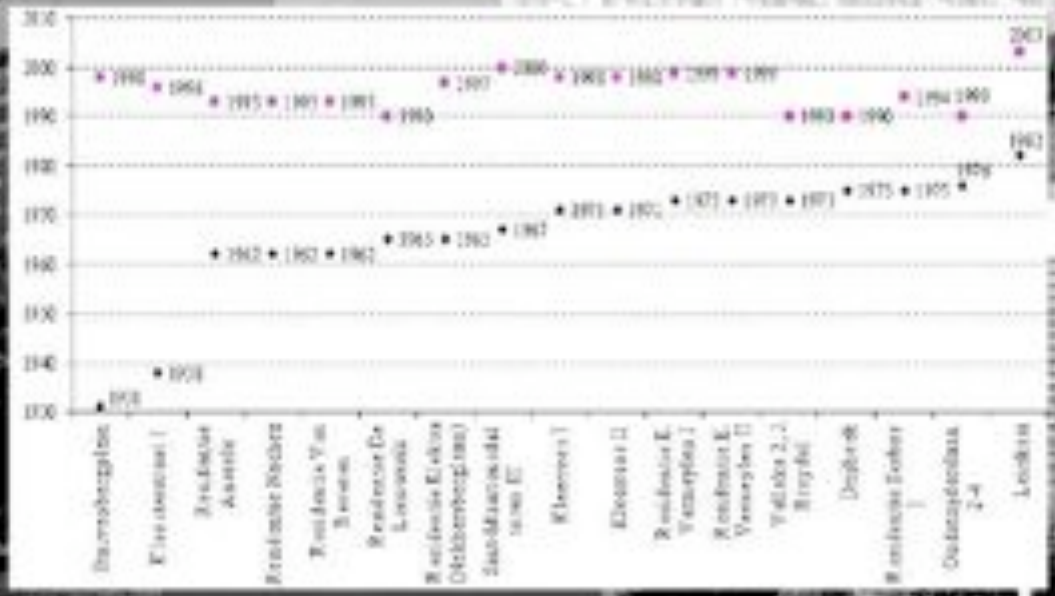
→ 1970's

→ answer to rising prices of building plots

→ rigid construction design

→ unadapted housing

→ low quality housing <<<



CASE STUDY: CITE MODÈLE, BRUSSELS

Cité Modèle, Brussels (Belgium)

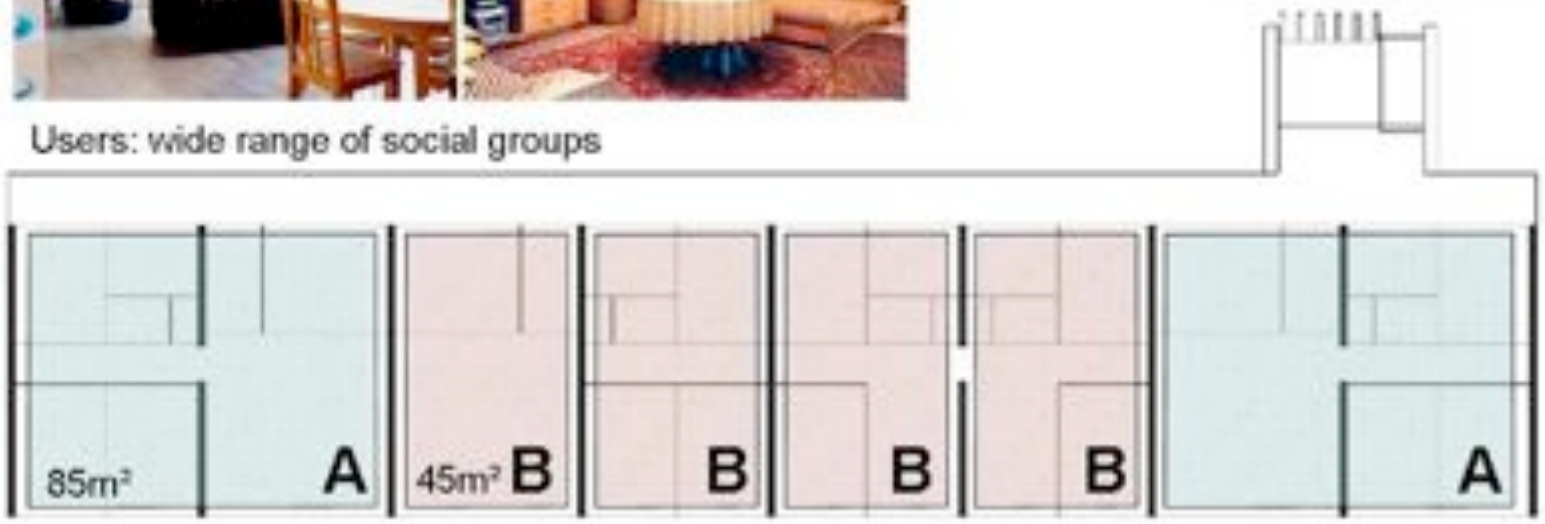
- 6490 m²
- 16 floors
- 64 dwellings
- 2 dwelling typologies

CASE

CASE STUDY: CITE MODÈLE, BRUSSELS

Cité Modèle, Brussels (Belgium)

Users: wide range of social groups



CASE STUDY: CITE MODÈLE, BRUSSELS

	VMSW		CITE MODELE	
TYPE *	MIN WO	MAX WO	Type A	Type B
0/1	30 m²	44 m²		
0/2 of 1/1	44 m²	52 m²		X
1/2	52 m²	62 m²		
2/3	62 m²	76 m²		
2/4	70 m²	86 m²	X	
3/4	76 m²	94 m²	X	
3/5	86 m²	105 m²		
3/6	94 m²	114 m²		
4/5	94 m²	114 m²		
4/6	100 m²	122 m²		
4/7	106 m²	130 m²		
4/8	112 m²	138 m²		
5/7	114 m²	140 m²		
5/8	122 m²	148 m²		
5/9	128 m²	154 m²		
5/10	132 m²	160 m²		

TYPE: # sleeping rooms/ # inhabitants
WO: Dwelling surface

2 typologies

→ Maxima (1958) have become minima (2007)

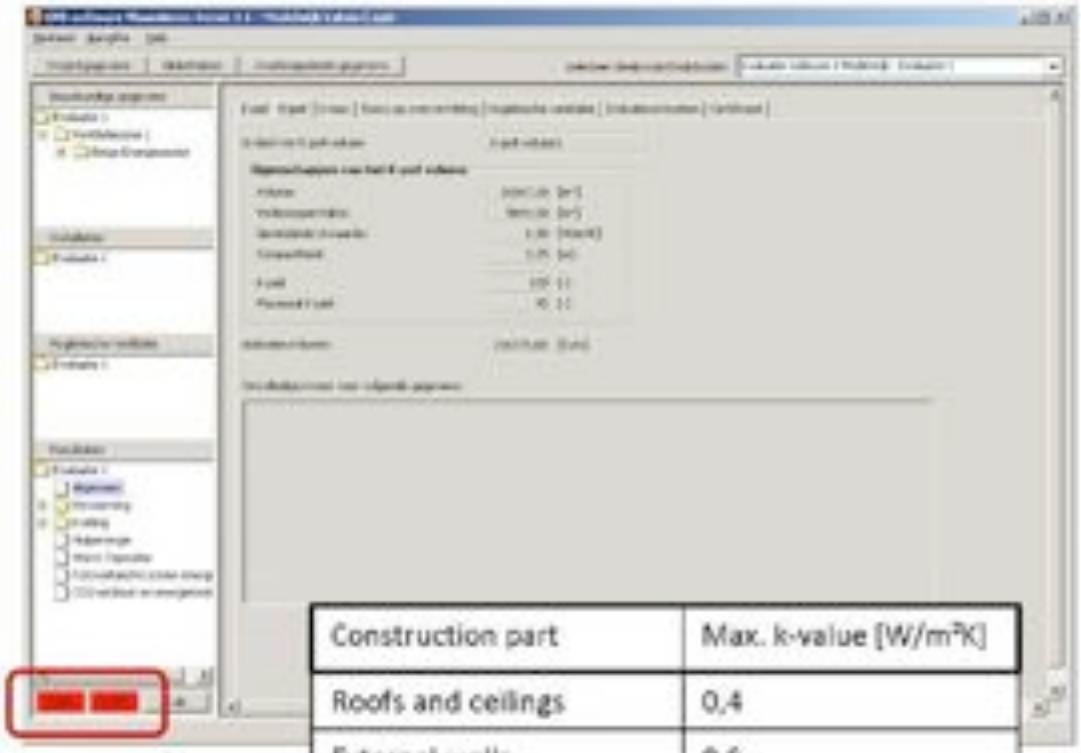
→ Restricted offer for different family typologies

→ Rigid structure

→ Unadapted living

CASE

CASE STUDY: CITE MODÈLE, BRUSSELS



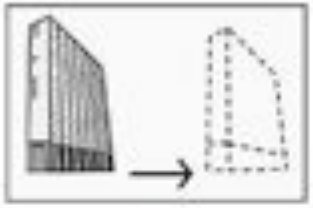
K-level

E-level

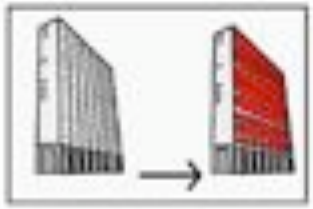
Construction part	Max. k-value [W/m²K]
Roofs and ceilings	0,4
External walls	0,6
External floor	0,6
Other floors	0,4
Windows	1,6
Internal Walls	1,0
Doors	2,9

Current requirements in terms of insulation and energy use are not anymore being achieved !

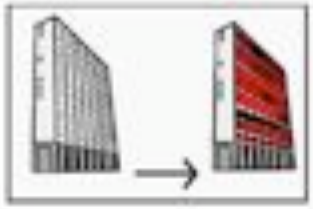
CASE STUDY: CITE MODÈLE, BRUSSELS



DEMOLITION



TRADITIONAL RENOVATION



RENOVATION REUSE

NEW BUILDING

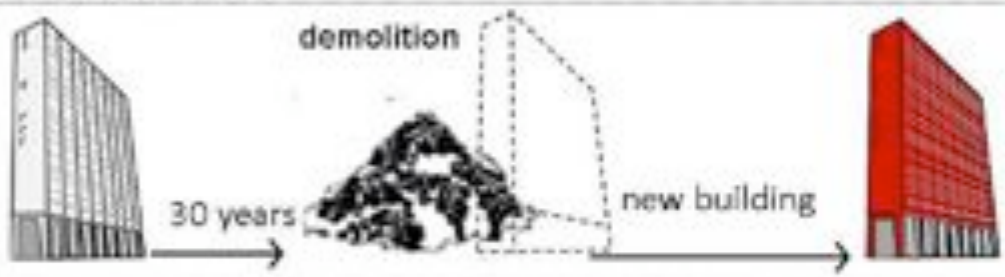
Energy impact assessment of

4 SCENARIOS for END-OF-LIFE building

CASE STUDY: CITE MODÈLE, BRUSSELS

NEW BUILDING

NEW BUILDING



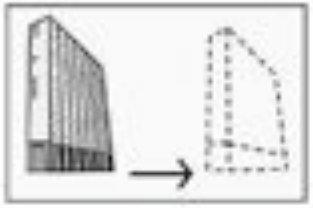
→ Entire demolition of existing building

→ New building according to current energy legislation

30 years

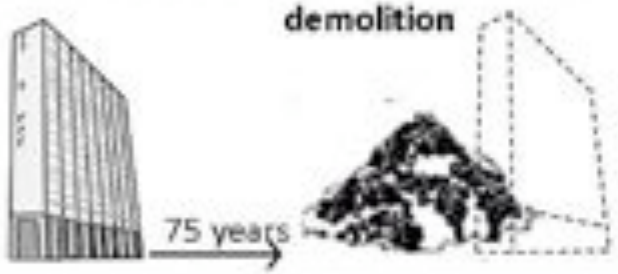
CASE

CASE STUDY: CITE MODÈLE, BRUSSELS



DEMOLITION

REFERENCE SCENARIO

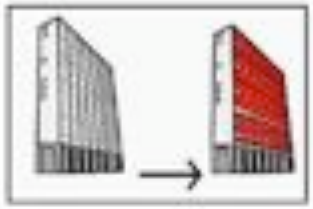


→ No renovation interventions

→ Lifespan 75 years

CASE

CASE STUDY: CITE MODÈLE, BRUSSELS



TRADITIONAL RENOVATION

TRADITIONAL RENOVATION

→ Stripping of the building and new infill current energy legislation

→ NO introduction of adaptability and/ or reuse

30 years

CASE

CASE STUDY: CITE MODÈLE, BRUSSELS

RENOVATION ADAPTIVE REUSE

RENOVATION INTRODUCING ADAPTABILITY & REUSE

→ Stripping of the building and new infill current energy legislation

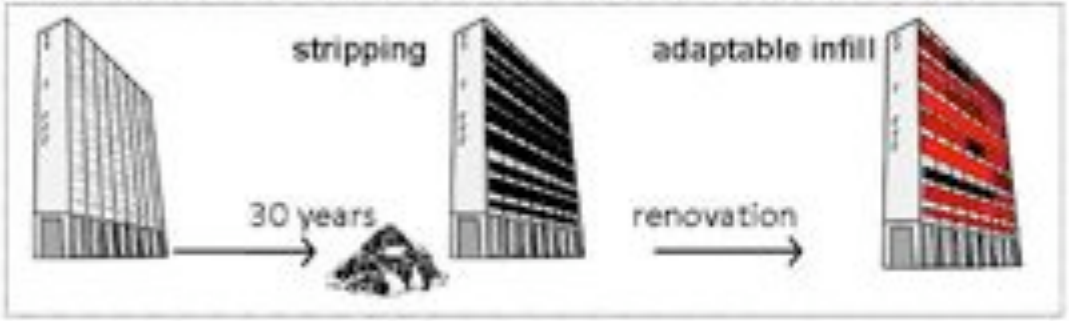
→ Introduction of adaptability or reuse (4D DESIGN)

S.Elsen

CASE STUDY: CITE MODÈLE, BRUSSELS

RENOVATION REUSE

RENOVATION INTRODUCING ADAPTABILITY & REUSE



→Building in layers

Space Plan	3 years
Services	7-15 years
Skin	20 years
Structure	> 50 years
Site	eternal

CASE STUDY: CITE MODÈLE, BRUSSELS

RENOVATION REUSE

RENOVATION INTRODUCING ADAPTABILITY & REUSE

CASE STUDY: CITE MODÈLE, BRUSSELS

DEMOLITION

TRADITIONAL RENOVATION

RENOVATION REUSE

NEW BUILDING

→ Renovation: influence on E(tot) life cycle

→ New building: influence on E(tot) life cycle + longer lifetime

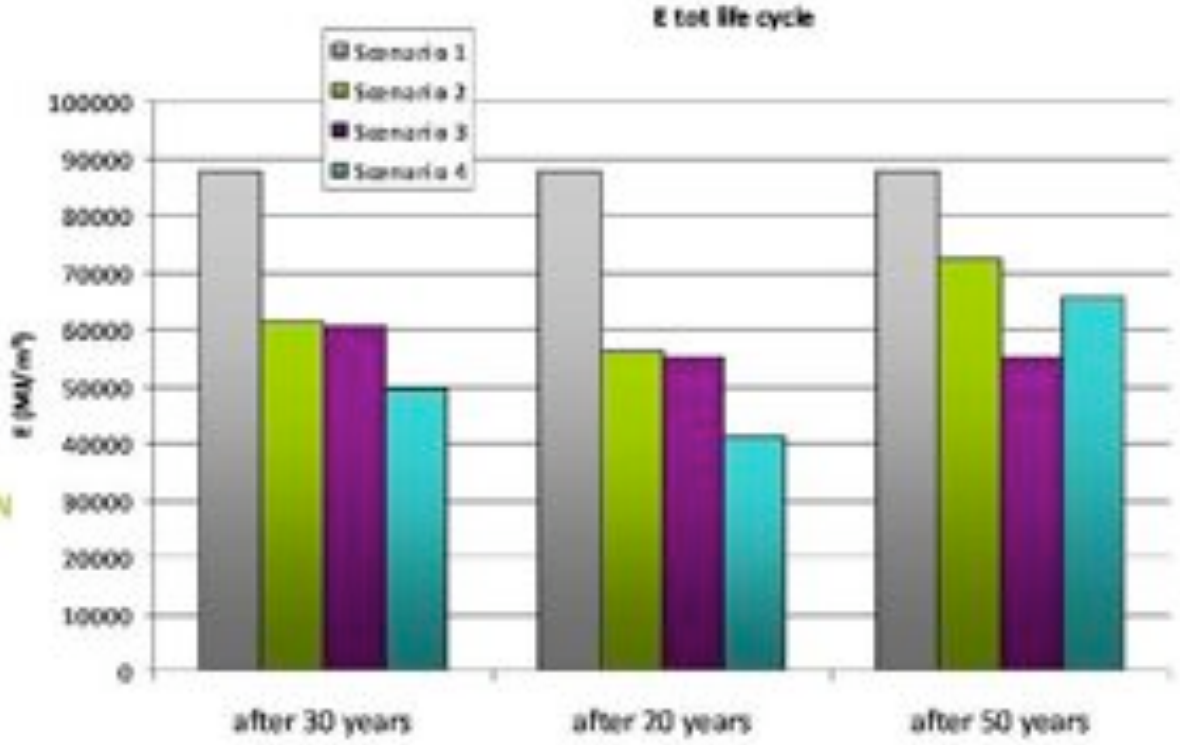
CASE STUDY: CITE MODÈLE, BRUSSELS

DEMOLITION

TRADITIONAL RENOVATION

RENOVATION REUSE

NEW BUILDING



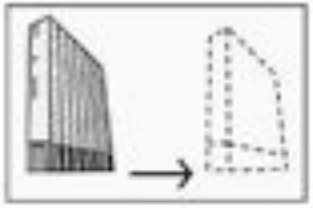
→ Interventions in existing building are necessary!

→ Existing building ↑↑↑ E tot (life cycle)

→ New building ↓↓ E tot (life cycle)

→ Influence of year of intervention

CASE STUDY: CITE MODÈLE, BRUSSELS



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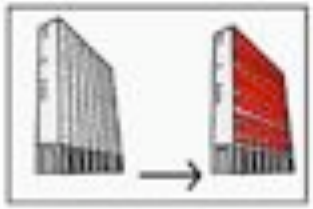

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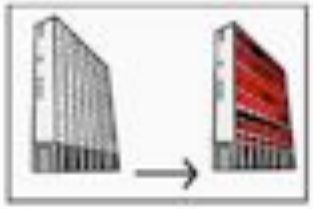

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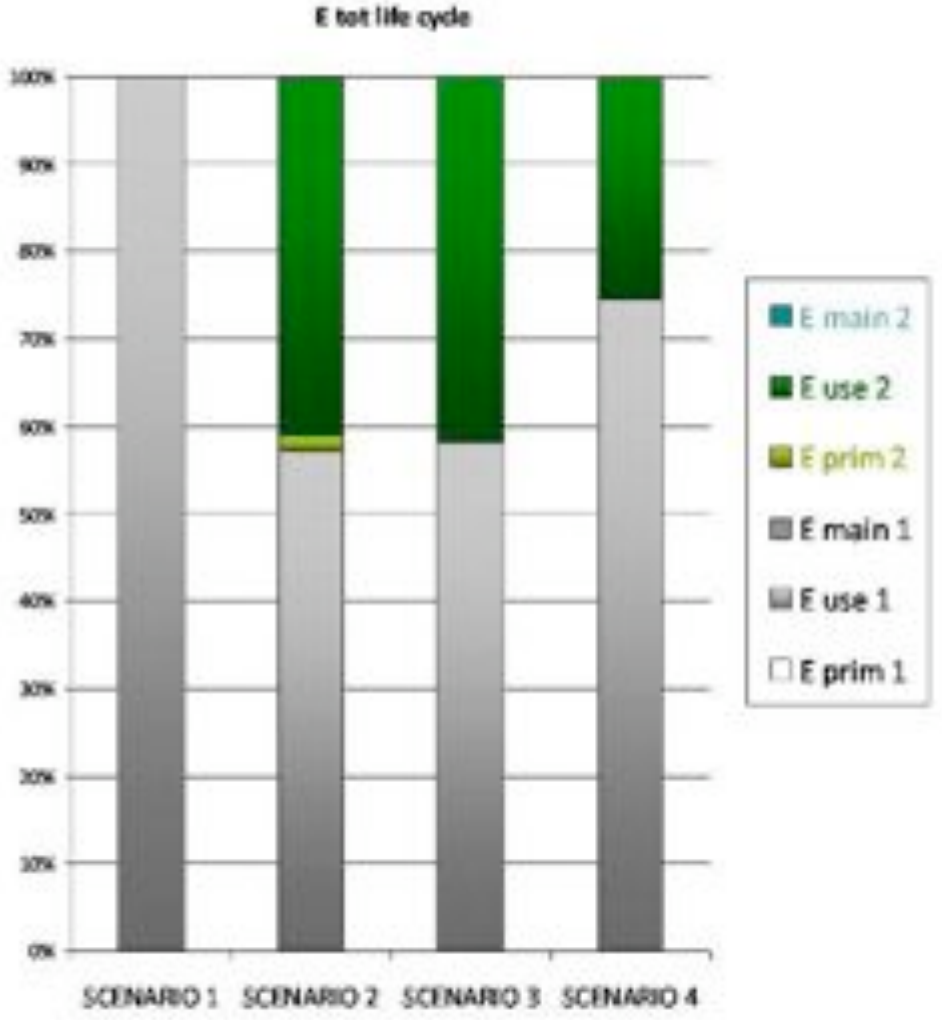
NEW BUILDING

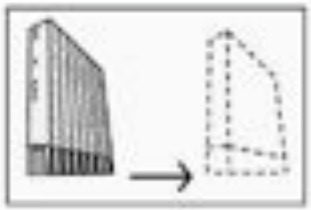


→ Importance of impact of E(use) in all scenarios

→ E(prim)/ E(main) is negigible

CASE STUDY: CITE MODÈLE, BRUSSELS

CONCLUSIONS + FURTHER RESEARCH



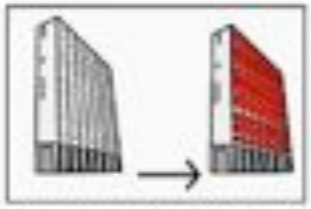
DEMOLITION

E impact

>>>

NEW BUILDING

MATERIALS ↕ ?



TRADITIONAL RENOVATION

E impact

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RENOVATION REUSE

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