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Barcelona, 4 October 2024

ICAEN – Catalan Institute for Energy

Towards Sustainable Construction for Deep Renovation: a comprehensive analysis of the transition from cost-optimal methodology to multi-objective methodology

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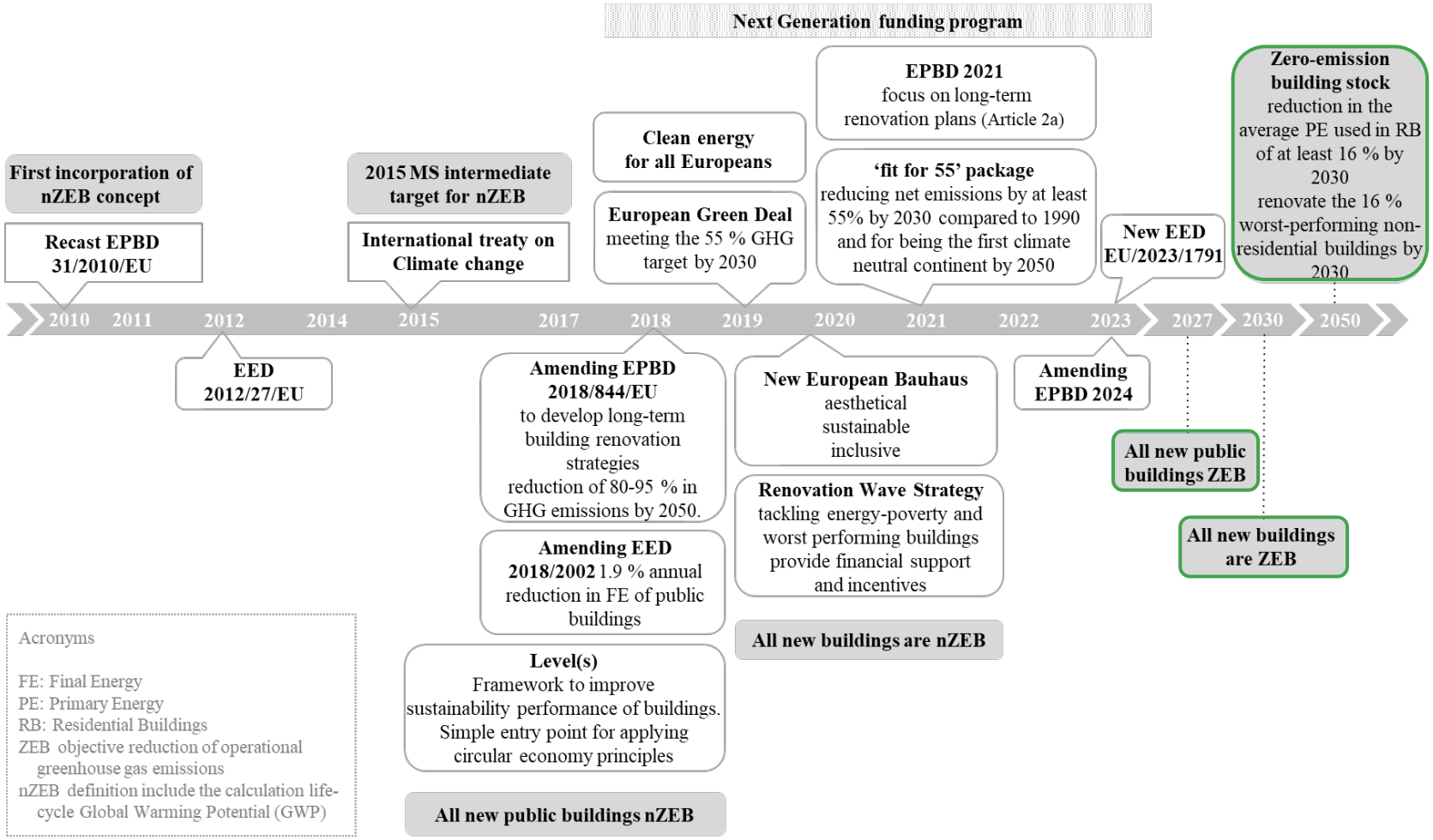
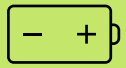
Introduction



Introduction - Concept clarification

Confusion among the sector between different concepts:



Energy

- Demand
- Consume
- CO2 emissions

Methodologies for renovation

- Cost-optimal
- Cost-effectiveness

Building classification

- nZEB
- ZEB
- LC-Nzeb
- Deep retrofit
- Deep renovation
- PEB

Methodology

PHASE 1

PHASE 2

1.1. Opportunity identification

Current building stock evaluation according its energy performance:

- Demand - Envelope
- Consume - Facilities
- CO_2 emissions – energy source

1.2. Action and assessment

Optimisation of the renovation strategies thorough:

- Energy in operational phase
- CO_2 Impacts in the whole Lifecycle
- Efficient use of resources and les waste

3. New paradigms

Literature review

More sustainable construction demand through:

- More society commitment
- Economical and Social impact

LCA - LCC - SLCA

4. Conclusions

Las tendencias de la literatura review muestran diferentes csos de incorporación de estos tres conceptos en la toma de decisiones

Como clave para reactivar la rehabilitación a nivel masivo

COST OPTIMAL - EBPD → **MULTI OBJECTIVE**

Reference: Architectural and Environmental Strategies Towards a Cost-Optimal Deep Energy Retrofit for Mediterranean Public High Schools. Authors: Eva Crespo, Cossima Cornadó, Oriol París

Case study and results

Severity of climate +

WINTER A B C D E

SUMMER 1 2 3 4

Buildings with higher potential for replicability

LLEIDA'S INSTITUTES

D3 I. Ribera de Sió AGRAMUNT

D3 I. La Pobla de Segur POBLA

D3 I. Joan Oró LLEIDA

D3 I. Josep Vallverdú BORGES

GIRONA'S INSTITUTES

I. Narcís Xifrà GIRONA C2

I. Alexandre Deulofeu FIGUERES C2

I. Montsacopa OLOT D2

I. Pere Borrell PUIGCERDÀ E1

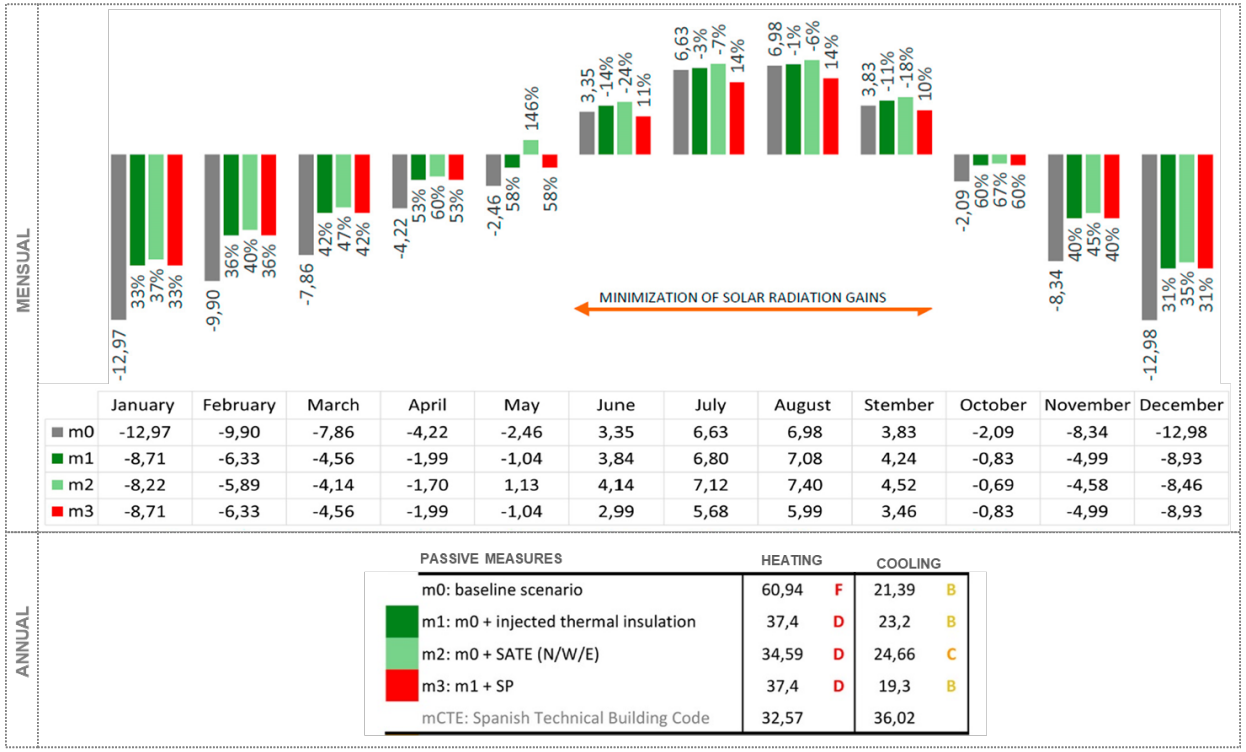
Case study and results

	DEMAND		FINAL ENERGY		NON-RENEWABLE PRIMARY ENERGY	CO_2 EMISSIONS	ΣTOTAL	ENERGY AWARENESS	BUILDING DETERIORATION LEVEL	ΣTOTAL
	heating	cooling	electricity	GLP/DIESEL						
1. Agramunt				1			1	1	1	3
2. Pobla de Segur	3			1	1		**5**	1	1	**7**
3. Lleida			0,5			2,5	3	1	1	5
4. Borges Blanques		0,5					0,5	1	1	2,5
5. Girona			0,5				0,5	1	1	2,5
6. Figueres	3			1	1	2,5	**7,5**	1	1	**9,5**
7. Olot							0	1	1	2
8. Puigcerdà		0,5					0,5	1	1	2,5
	3,5		2,5			2,5	8,5	1	1	10,5

Case study and results - Hypothesis

CO_2 IMPACT OPERATIONAL PHASE

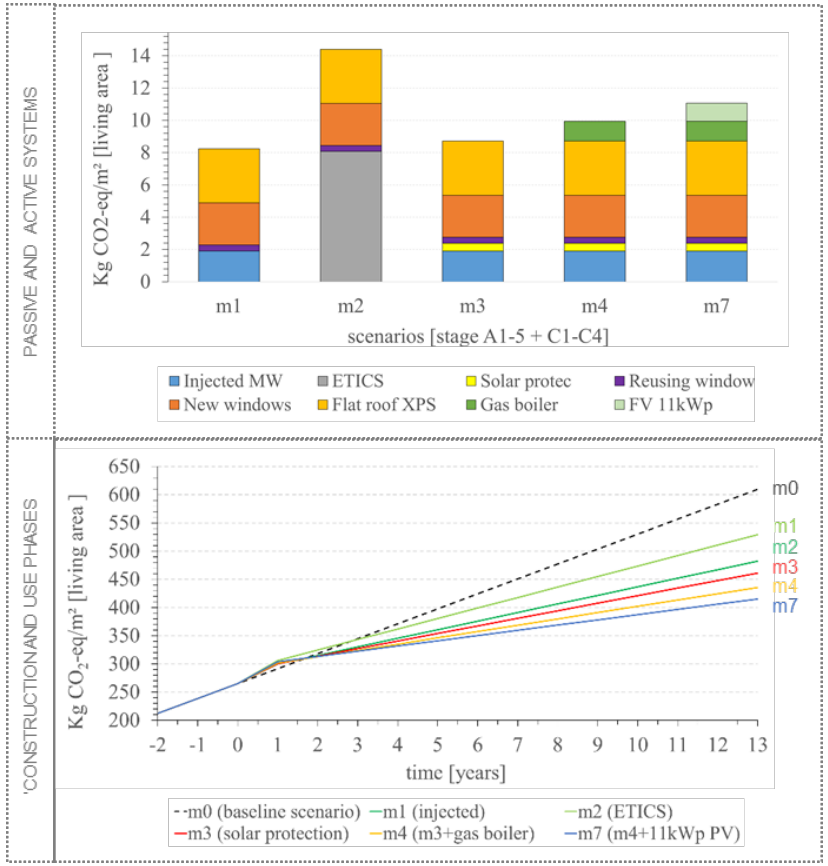
ENERGY DEMAND COMPARISION (kWh/m²y)



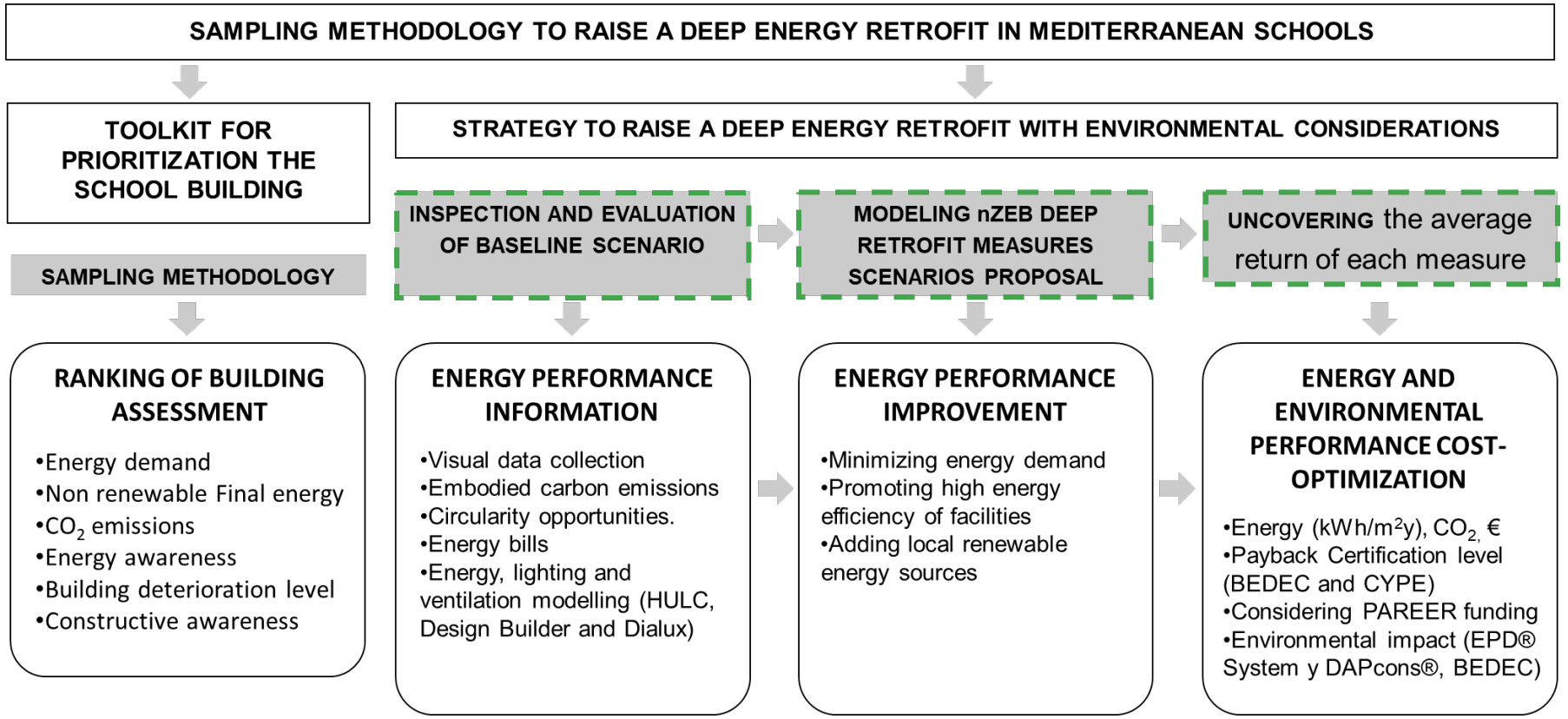
	January	February	March	April	May	June	July	August	Stember	October	November	December
m0	-12,97	-9,90	-7,86	-4,22	-2,46	3,35	6,63	6,98	3,83	-2,09	-8,34	-12,98
m1	-8,71	-6,33	-4,56	-1,99	-1,04	3,84	6,80	7,08	4,24	-0,83	-4,99	-8,93
m2	-8,22	-5,89	-4,14	-1,70	1,13	4,14	7,12	7,40	4,52	-0,69	-4,58	-8,46
m3	-8,71	-6,33	-4,56	-1,99	-1,04	2,99	5,68	5,99	3,46	-0,83	-4,99	-8,93

PASSIVE MEASURES	HEATING		COOLING	
m0: baseline scenario	60,94	F	21,39	B
m1: m0 + injected thermal insulation	37,4	D	23,2	B
m2: m0 + SATE (N/W/E)	34,59	D	24,66	C
m3: m1 + SP	37,4	D	19,3	B
mCTE: Spanish Technical Building Code	32,57		36,02	

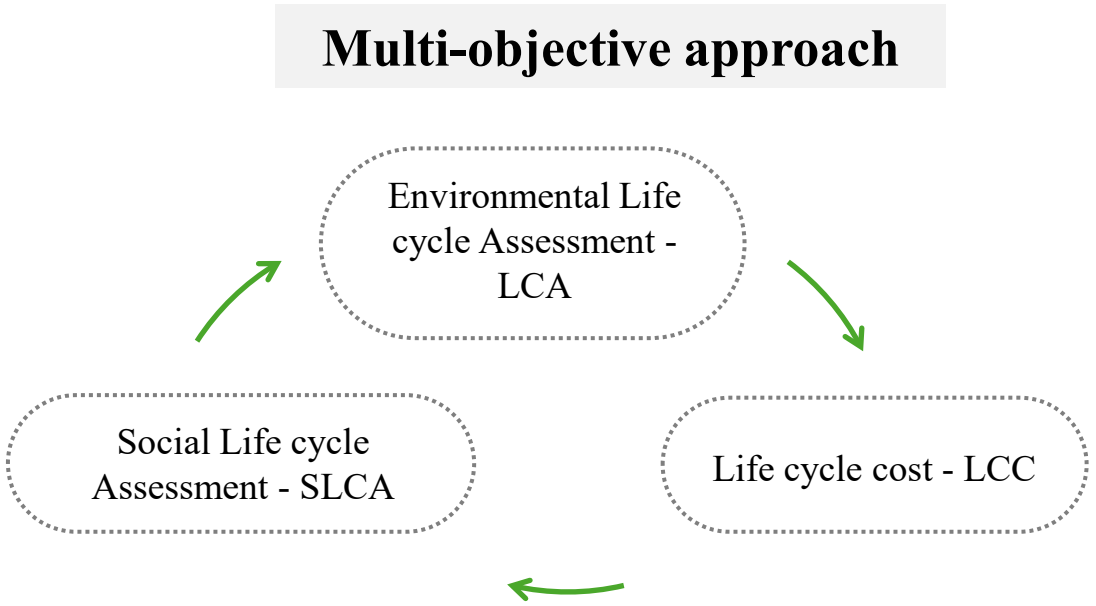
CO_2 IMPACTS OF THE WHOLE LIFE

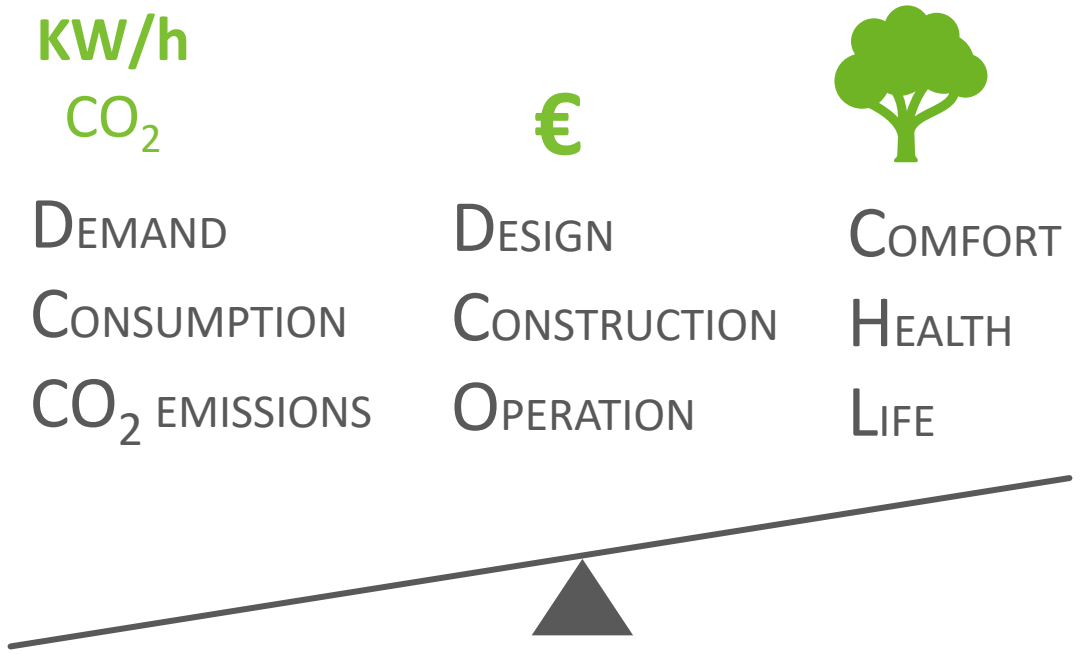


Case study and results - Actions



Demonstrative assessment of the multi-objective approach





Discussion and conclusion

1. Identifying and unifying the main guidelines, as well as established concepts and their scope, into a single framework is necessary
2. Going beyond the operational phase towards a whole life cycle. Enhanced EPC as with more data is required.
3. A transition towards a more sustainable Europe

''Initiatives like Zero Energy Renovation Kits are crucial for propelling the Renovation Wave. Thus, achieving decarbonization requires two interconnected strategies: rigorous analysis of passive strategies for zero operational emissions and adopting a circular economy to attain zero embodied carbon emissions and waste, supported by unified criteria and methodologies under a regulatory EU framework''

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