CRAVEzero

Towards the definition of a nZEB cost spreadsheet as a support tool for the design

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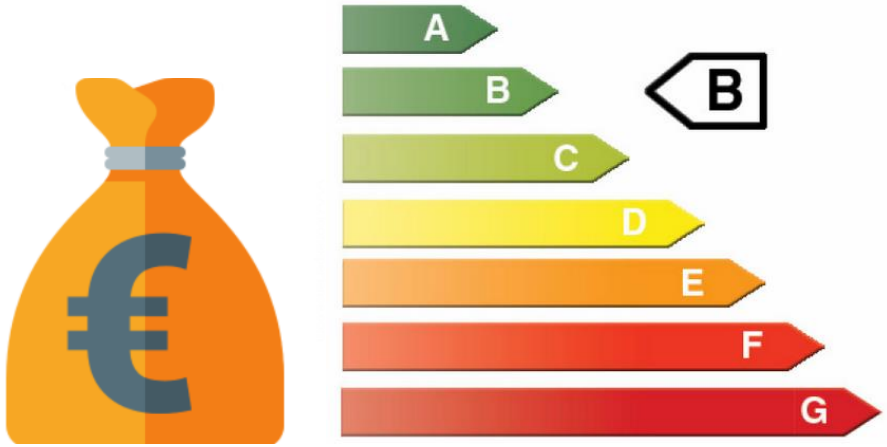
CRAVEzero

Cost Reduction and market Acceleration for Viable nearly zero-Energy buildings

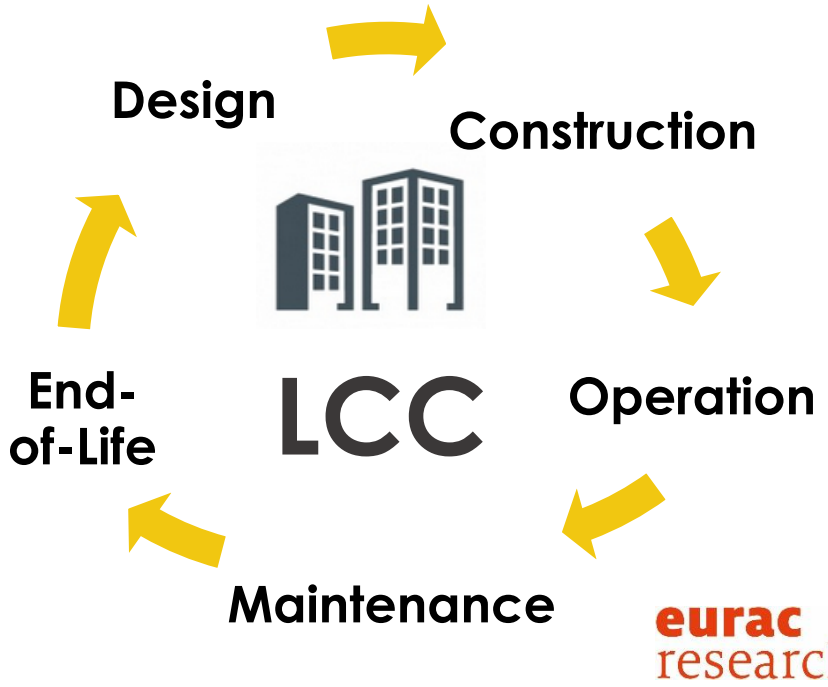
Initial investment

Calculated yearly energy demand



Time dimension

Life Cycle Cost



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CRAVEzero

Cost Reduction and market Acceleration for Viable nearly zero-Energy buildings

01 **Data collection**
Case studies

02 **Life Cycle Cost**
Methodology

03 **Normalisation**

04 **Spreadsheet**

05 **Comparative analysis**
Results

06 **Sensitivity analysis**

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01

Data Collection

Case studies

CRAVEzero nZEB Frontrunner Buildings

Residential

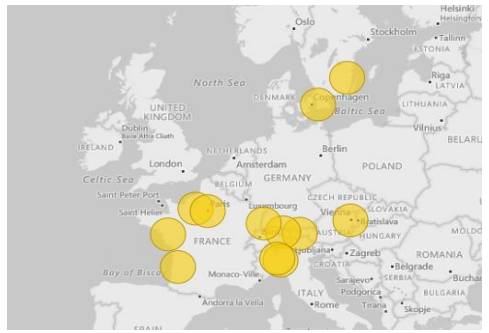







Office



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02

Life Cycle Cost

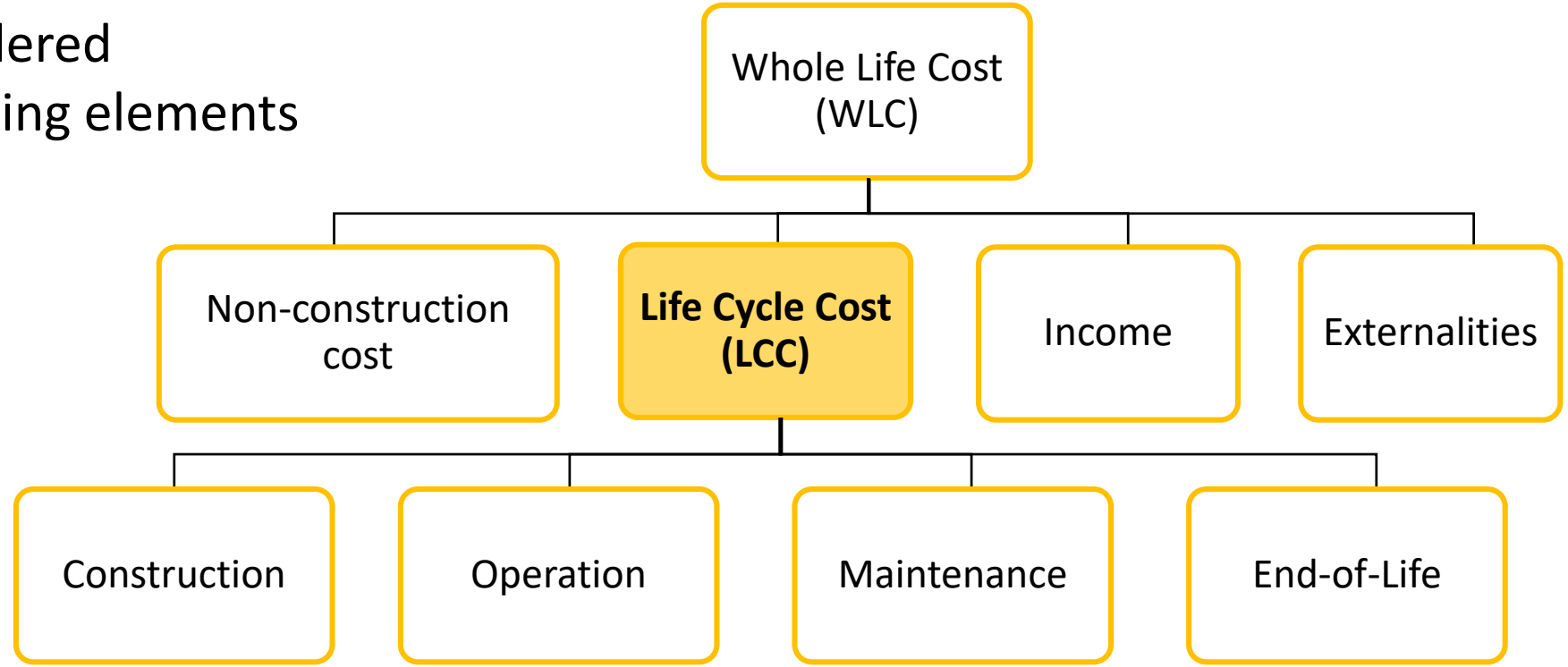
Methodology

Main references: ISO 15686-5:2008 + Code of measurement for cost planning

- Phases to be considered
- Brakedown of building elements

$$LCC = \sum_{n=1}^{p} \frac{C_n}{(1+d)^n}$$

LCC = NPV (40 years) for the costs associated to each phase



REF: ISO 15686 - Buildings and constructed assets -- Service life planning -- Part 5: Life-cycle costing
EEC Code of Measurement for Cost Planning. https://www.ceecorg.eu/

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Life Cycle Cost

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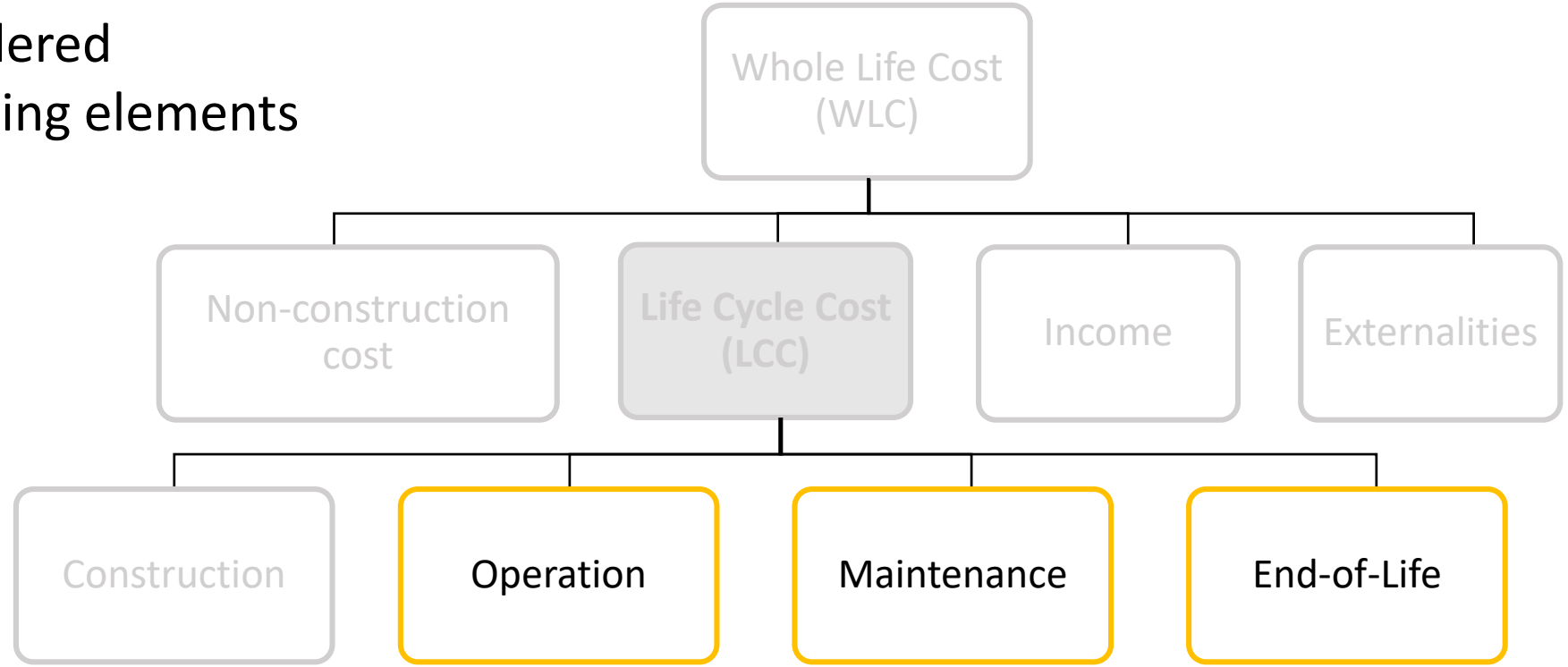

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03 Normalisation

Construction costs: Cost index from http://constructioncosts.eu	**Energy costs:** Average prices from Eurostat
Climate conditions: Heating degree days	**Building surface:** Gross floor area

03 Normalisation

Construction Cost Index	
France	103.87%
Austria	100.67%
Germany	96,62 %
Italy	91,63 %
Sweden	134,19 %

Energy costs:
Average prices from Eurostat

Climate conditions:
Heating degree days

Building surface:
Gross floor area

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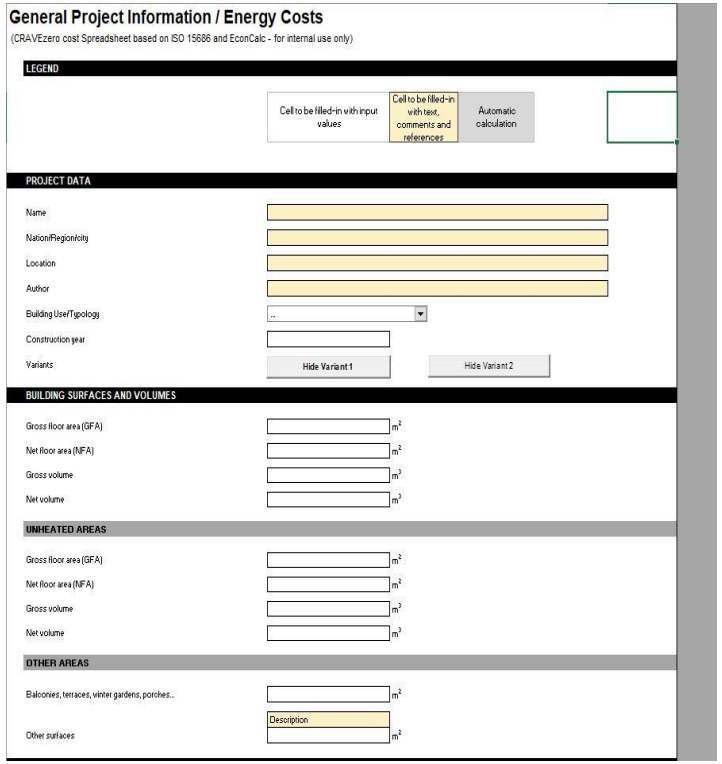
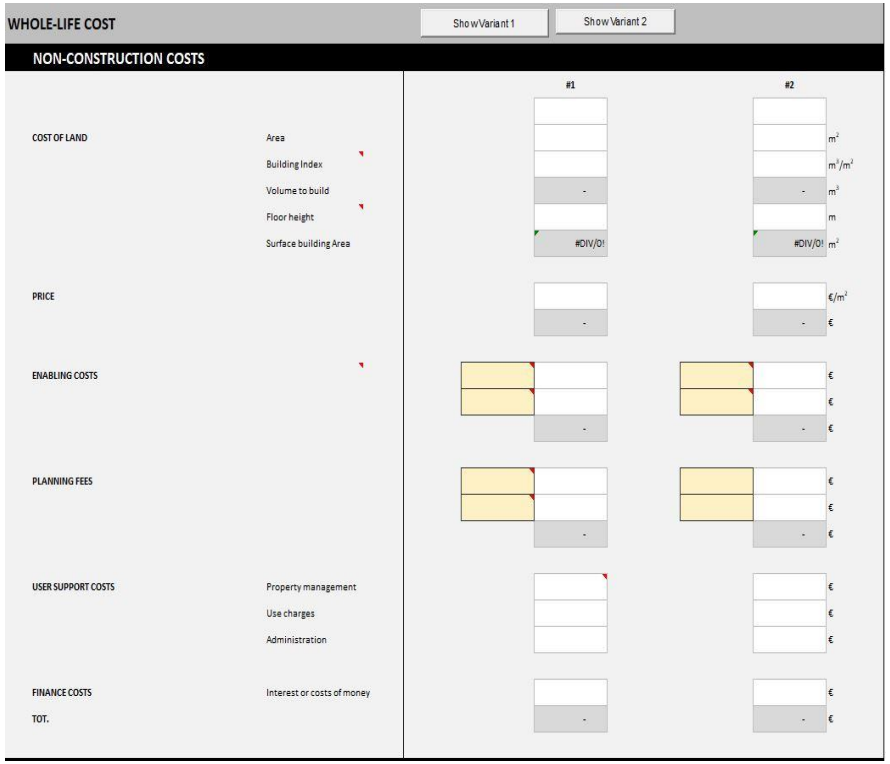
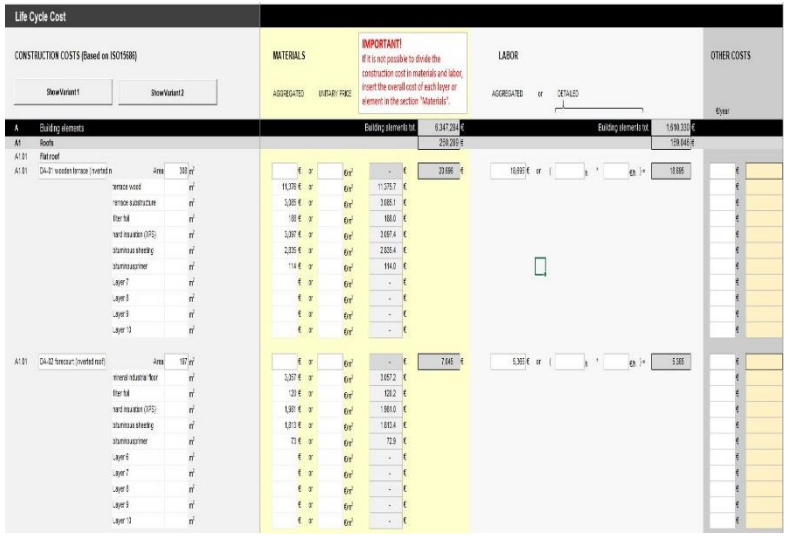
LCC Spreadsheet

CRAVEzero nZEB spreadsheet

General project information	Whole Life Cost	Construction cost







05

LCC Spreadsheet

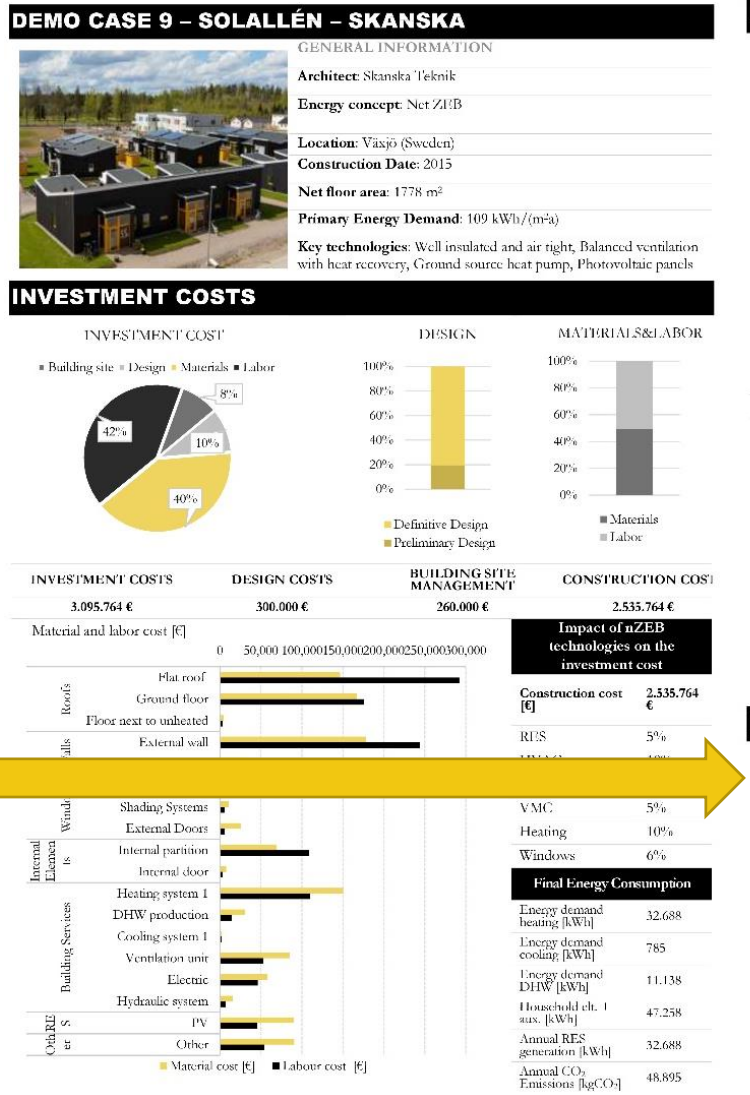
CRAVEzero nZEB spreadsheet

Section 1: Investment cost

- Share for design/materials/labour
- Design cost (preliminary, etc.)
- Cost for materials and labour
- Brakedown for building elements

Section 2: Life Cycle Cost

- Yearly LCC
- Brakedown for life cycle phases
- Energy and maintenance



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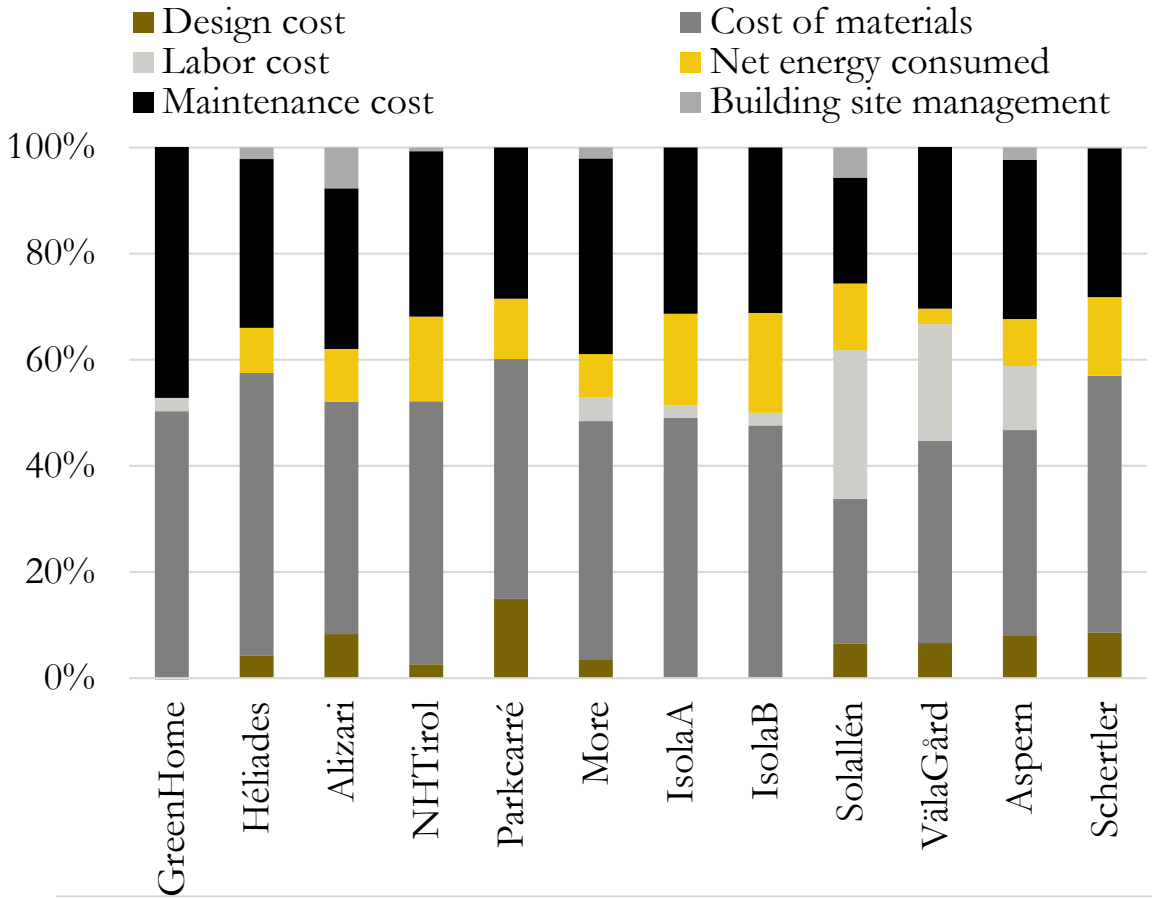
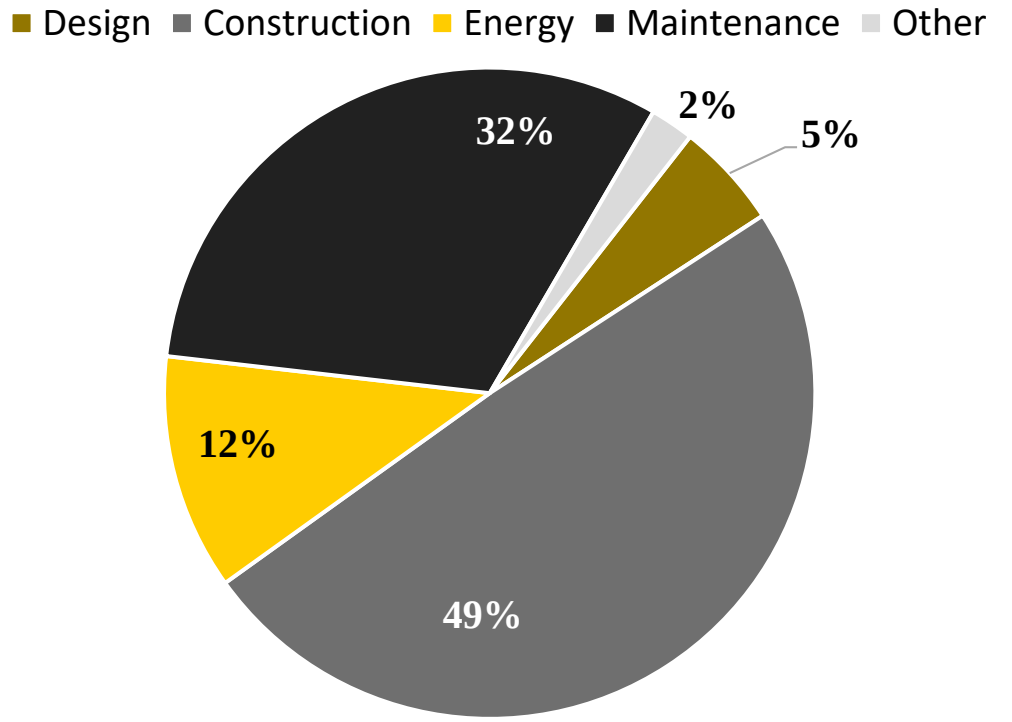
06 Comparative Analysis

LCC breakdown

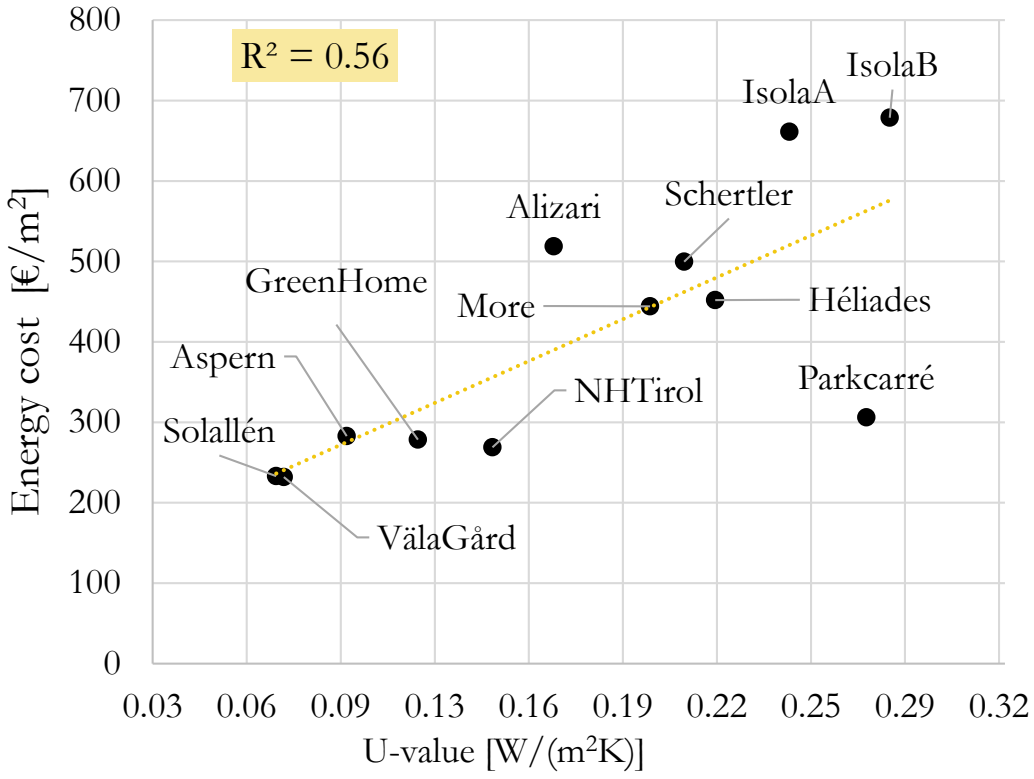


LCC breakdown – average

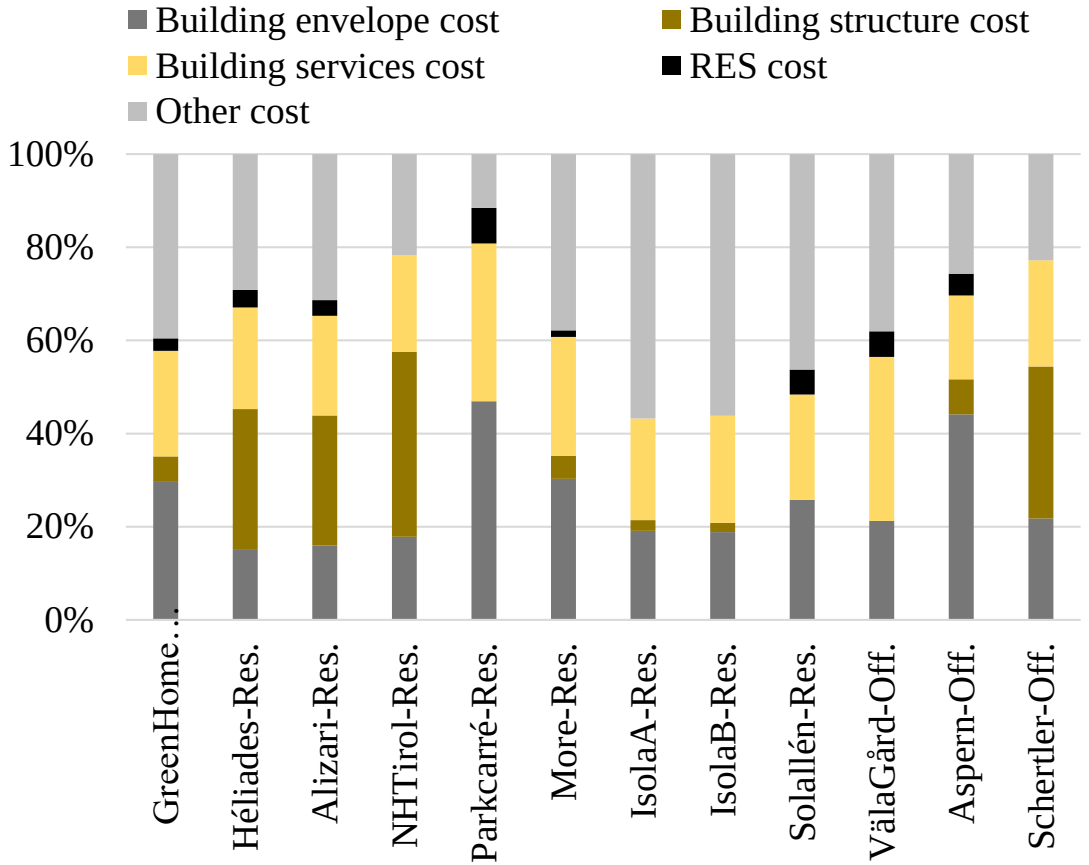


06 Comparative Analysis

Correlation between energy cost and U-value



Construction cost breakdown



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04 Sensitivity Analysis

Case study: Résidence Alizari

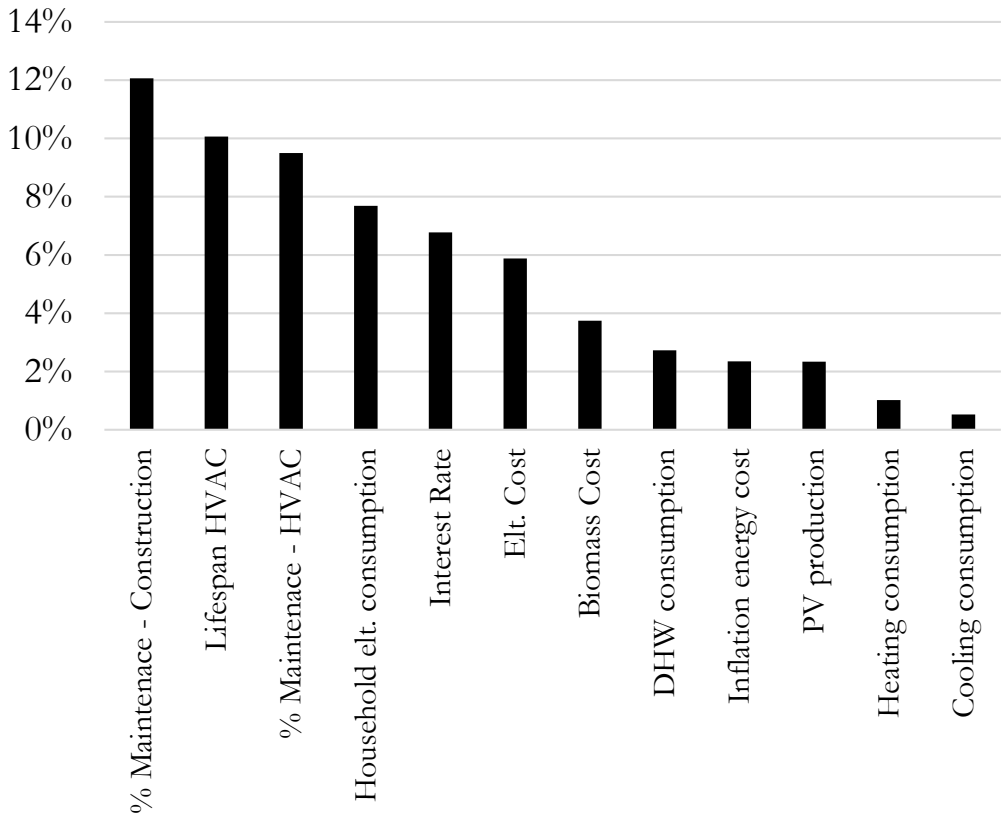

Figure 1. Sensitivity index (s%) of boundary and assumptions – Résidence Alizari.

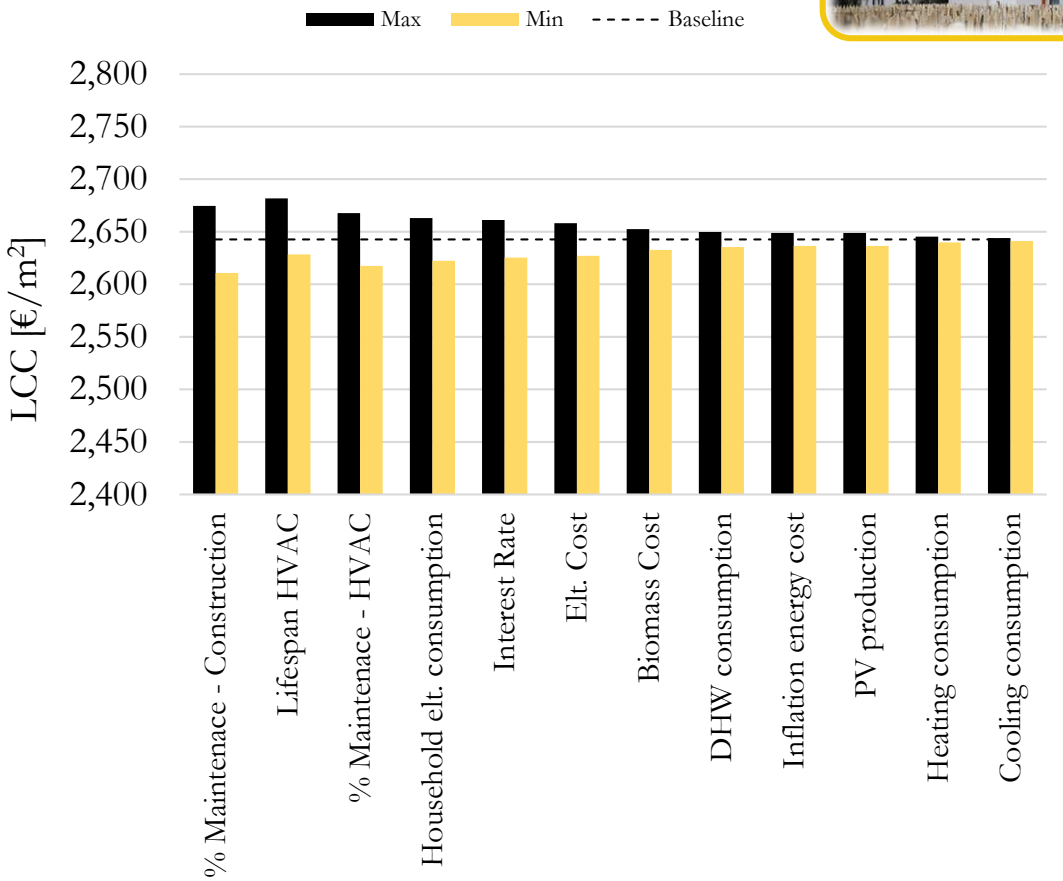

Figure 2. LCC variability according to the variations of boundaries and assumptions – Résidence Alizari.

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Conclusions and Further Development

- An **operative methodology** for an EU-wide evaluation of life cycle cost.
- Overview of the main results for **11 exemplary case studies** was reported…
- …providing useful **benchmarks** for nZEB comparison and increasing the reliability of LCC.

- Starting point for the development of an effective **LCC tool** (beta version available at cravezero.eu).
- The broad application of the LCC analysis can foster the market uptake of nZEBs, highlighting the **cost-effectiveness and benefits during the life cycle**.

Thank you!

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05 LCC spreadsheet

CRAVEZero nZEB spreadsheet

LCC (40) 1285€/m²	**Investment** 773 €/m²	**Design** 192 €/m²	Preliminary	10 €/m²	
			Definitive	- €/m²	
			Executive	182 €/m²	
		Construction 581 €/m²	Materials 581 €/m²	Building Elements	340€/m²
				Building Services	197€/m²
				RES	44 €/m²
				Other - €/m²	
			Labor - €/m²		
		Building site management	- €/m²		
	Operation 512 €/m²	**Energy** 146 €/m²	Consumed 313 €/m²	Heating	75 €/m²
				Cooling	11 €/m²
				DHW	57 €/m²
				Household el.+ aux.	188 €/m²
			Produced 167 €/m²		
		Maintenance 366 €/m²	Envelope	152 €/m²	
			HVAC	201 €/m²	
			RES	13 €/m²	
		Other 0 €/m²			

Example Case Study Parkcarré (K&M)

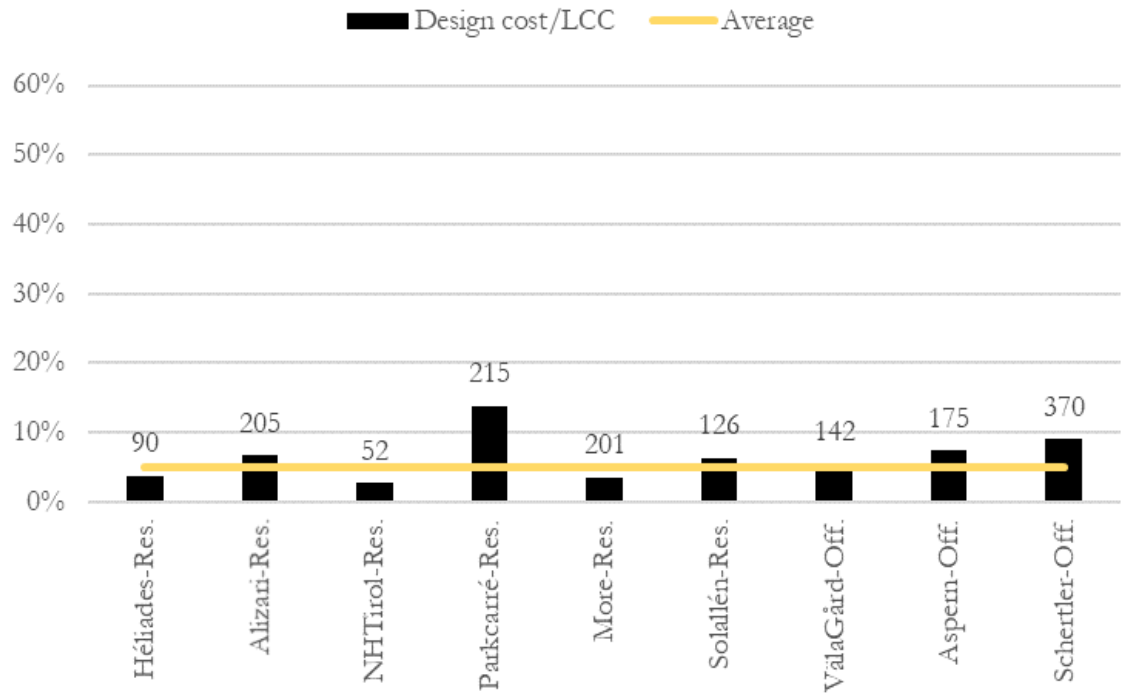
Normalised gross surface

04

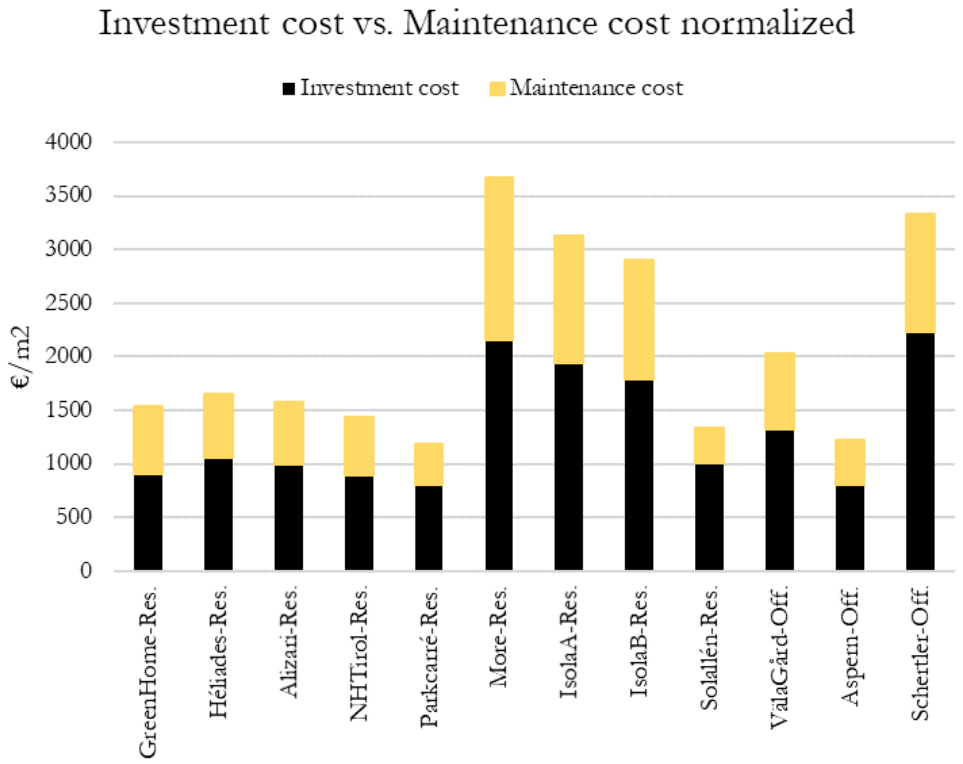
LCC Case Study analysis

Comparative analysis – case studies

Design cost (% - €/m²)



Investment/maintenance €/m²



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LCC Case Study analysis

Comparative analysis – case studies

Breakdown of investment cost for construction element