



Cost-Effective Energy and Carbon Emissions Optimisation in Building Renovation

IEA EBC Annex 56

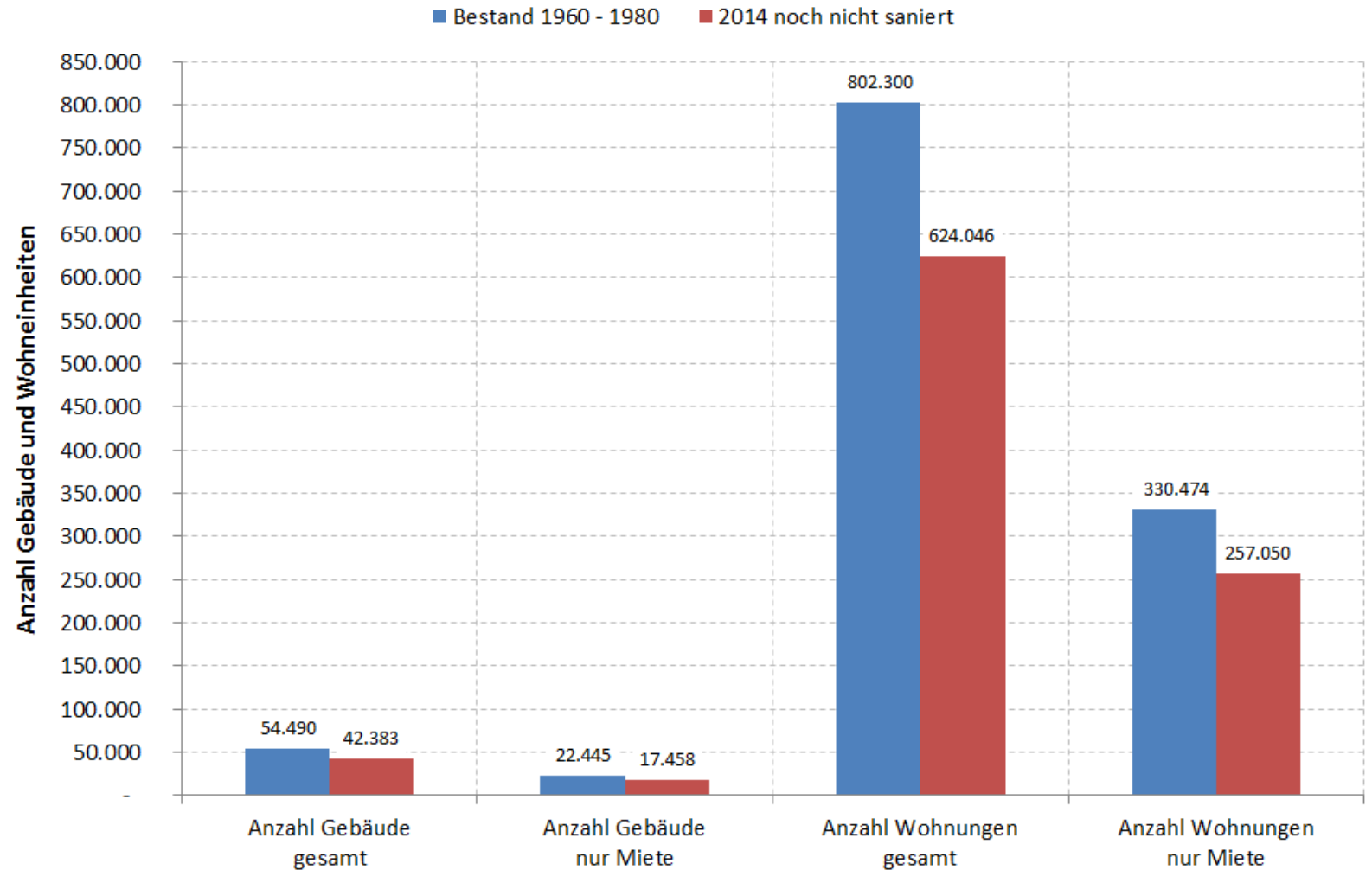
Kosteneffiziente Optimierung bei der Gebäudesanierung

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IEA EBC Annex 56 | Background

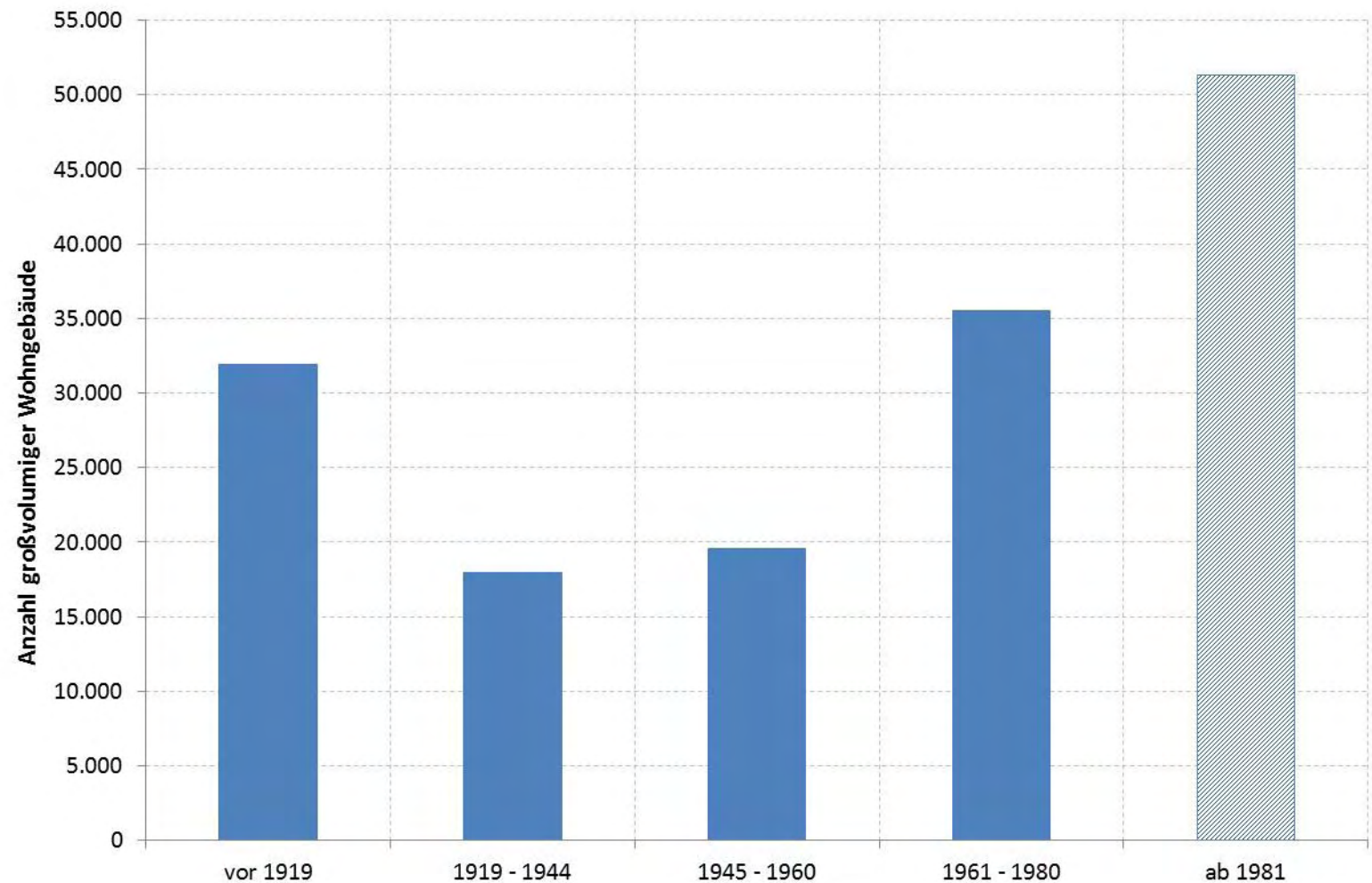
Multi-family residential buildings in Austria



Quelle: Basisdaten von Tabula - Episcopo

IEA EBC Annex 56 | Background

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Barriers for high performance renovations!!

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Architecture and building physical aspects change!

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Use of Renewable Energy Sources!

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Question?

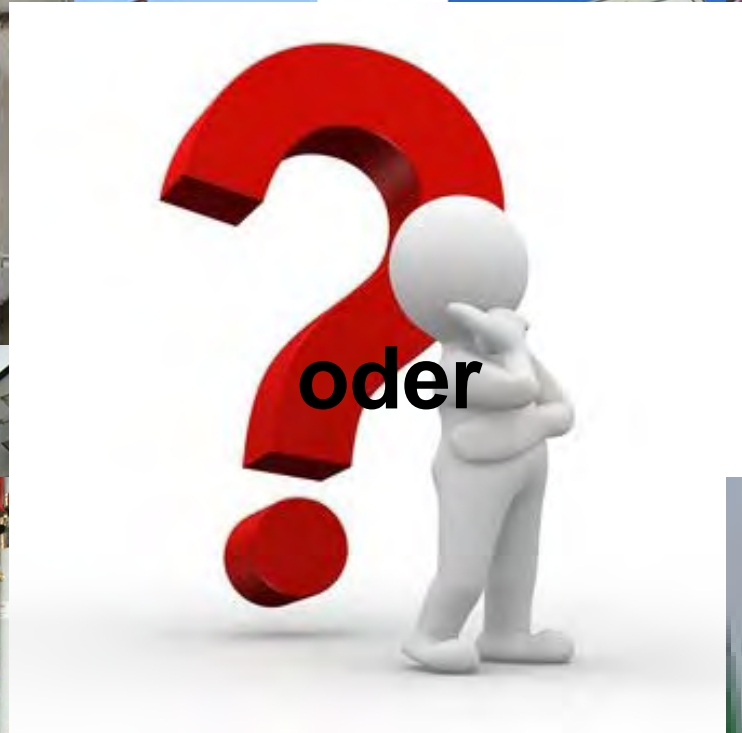
How to achieve the best performance with minimal effort?



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Cost-Effective Energy and Carbon Emissions Optimisation in Building Renovation

2011-2015

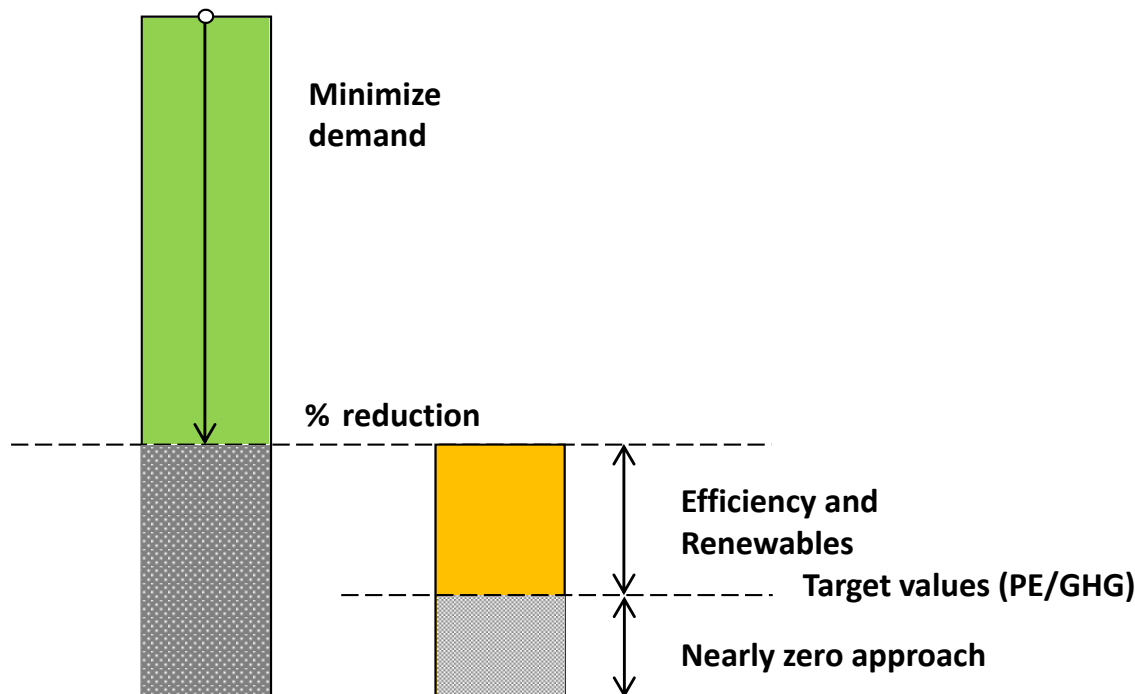
Participating Countries (12): AT, CH, CN, CZ, DK, ES, FI, IT, NL, NO, PT, SE

**OA: Manuela Almeida
University of Minho
Portugal**

IEA EBC Annex 56 | Main Goals

Develop a **new methodology** for a cost optimal building renovation **towards both the nearly zero energy and nearly zero emissions objective**

Identify the **optimal balance** between the “minimization of demand” and “generation of renewable energy” measures **in a cost/benefit perspective**



Questions?

How far is it possible to go with energy conservation and **efficiency measures** (initially often less expensive measures) and

From which point the **carbon emissions reduction measures** become **more economical**

IEA EBC Annex 56 | **Main Objectives**

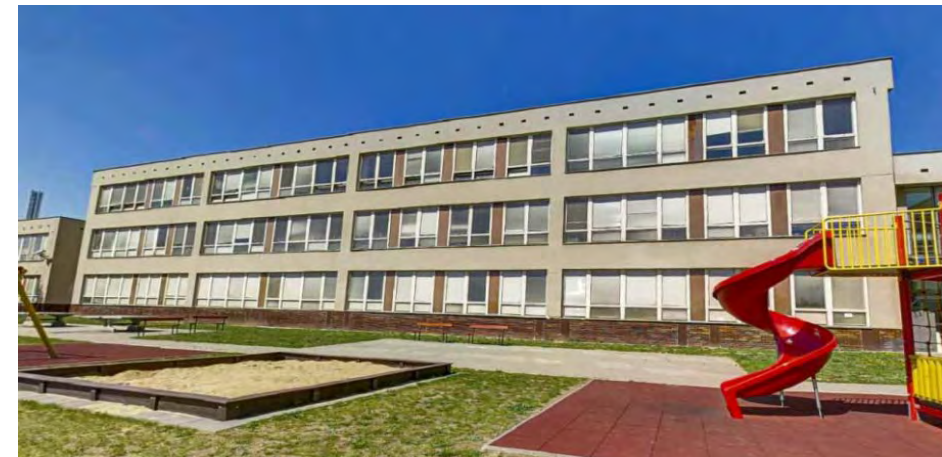
- **Define a methodology for the establishment of cost optimized targets for energy and carbon emissions in building renovation**
- **Clarify the relationship between the emission and the energy targets and their eventual hierarchy**
- **Determine cost effective combinations of energy efficiency measures and carbon emissions reduction measures**
- **Highlight the relevance of co-benefits achieved in the renovation process**
- **Collect exemplary case-studies within the concept of Annex 56 to encourage decision makers to promote efficient and cost effective renovations**
- **Characterize and understand the acceptance, motivation, needs, obstacles and drivers of the renovation process**
- **Develop/Adapt tools to support the decision makers in accordance with the developed methodology (including the production of Renovation Guidelines)**

IEA EBC Annex 56 | Scope

- **Residential buildings**
Single-family houses and multi-family buildings
- **Non residential buildings without complex HVAC systems**
 - if relevant and useful information can be extracted from them
 - used to prove the applicability of the developed methodology and tools to other buildings' categories (besides residential buildings)



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IEA EBC Annex 56 | Target Groups

Policy makers

To define the most appropriate policies, measures and incentives to put into practice for an effective renovation strategy

Decision makers (professional owners, investors, promoters)

To make better decisions and choose the best renovation options that apply to their needs

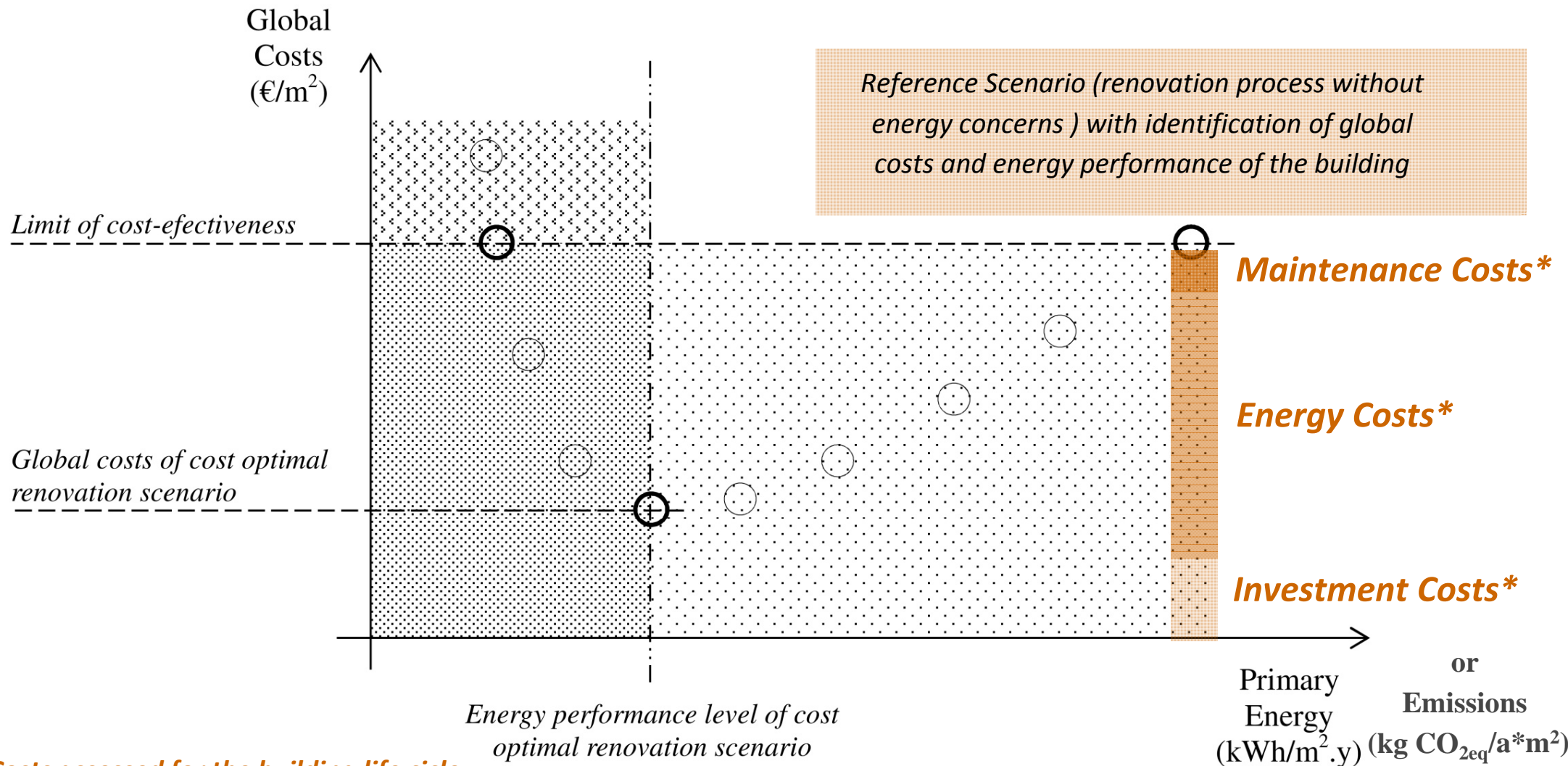
Multipliers (architects, planners, consultants and professionals of construction and building renovation industry)

Technical guidance

IEA EBC Annex 56 | Methodology

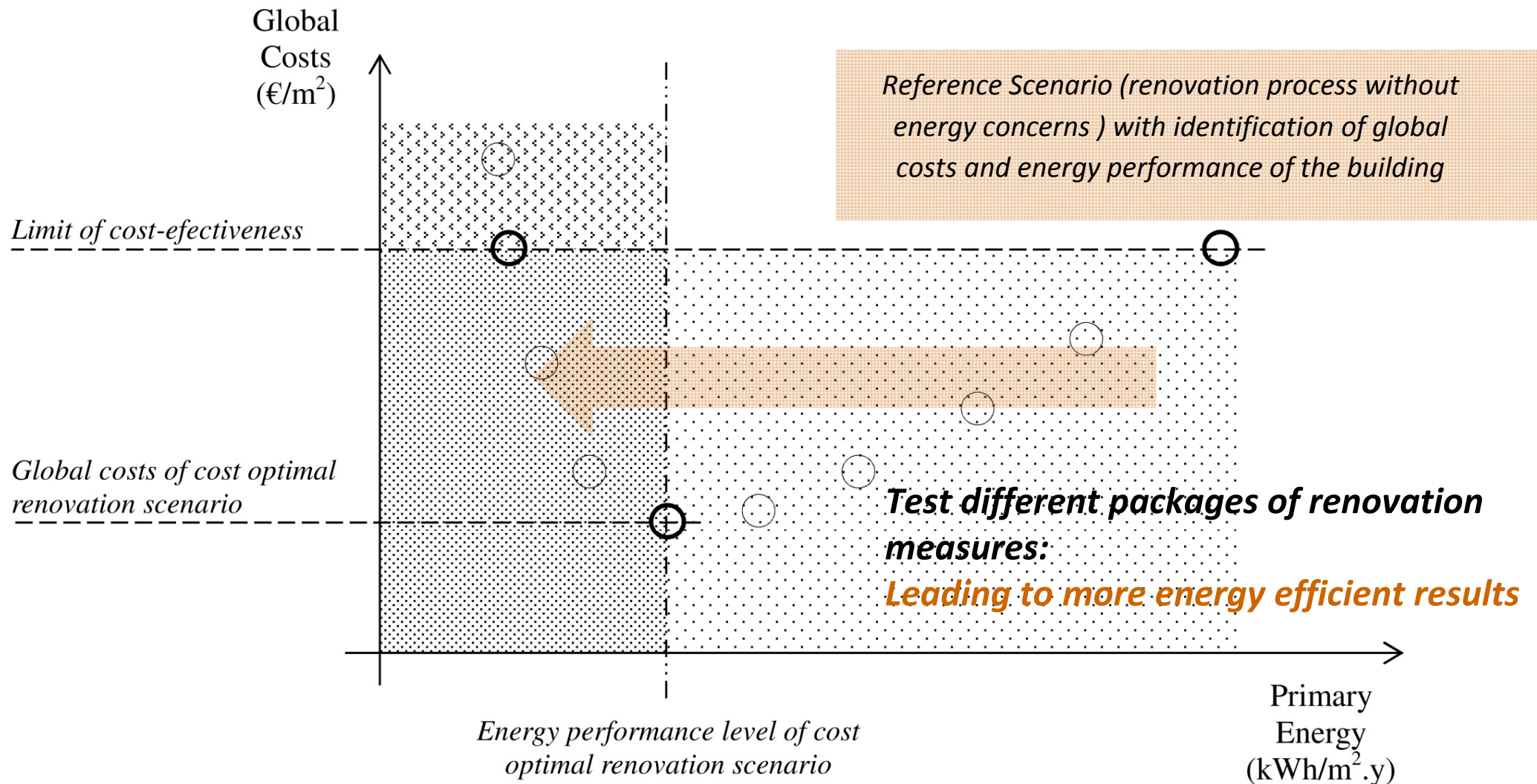
- Takes into account **country specific situations** (like climate, electricity mix, conversion factors, national energy targets, etc.)
- Allows **prioritizing either nearly-zero emissions renovation (NZEmB) or nearly-zero energy renovation (NZEB)**, each with an additional energy or emission goal that has to be achieved at the same time
- In any situation there is a strong requirement **to make sure that substantial energy reductions must be achieved whatever the priority chosen**
- It also **evaluates life cycle impacts** like **embodied energy use** and take into consideration, as much as possible, the **co-benefits** associated to the renovation process

IEA EBC Annex 56 | Methodology

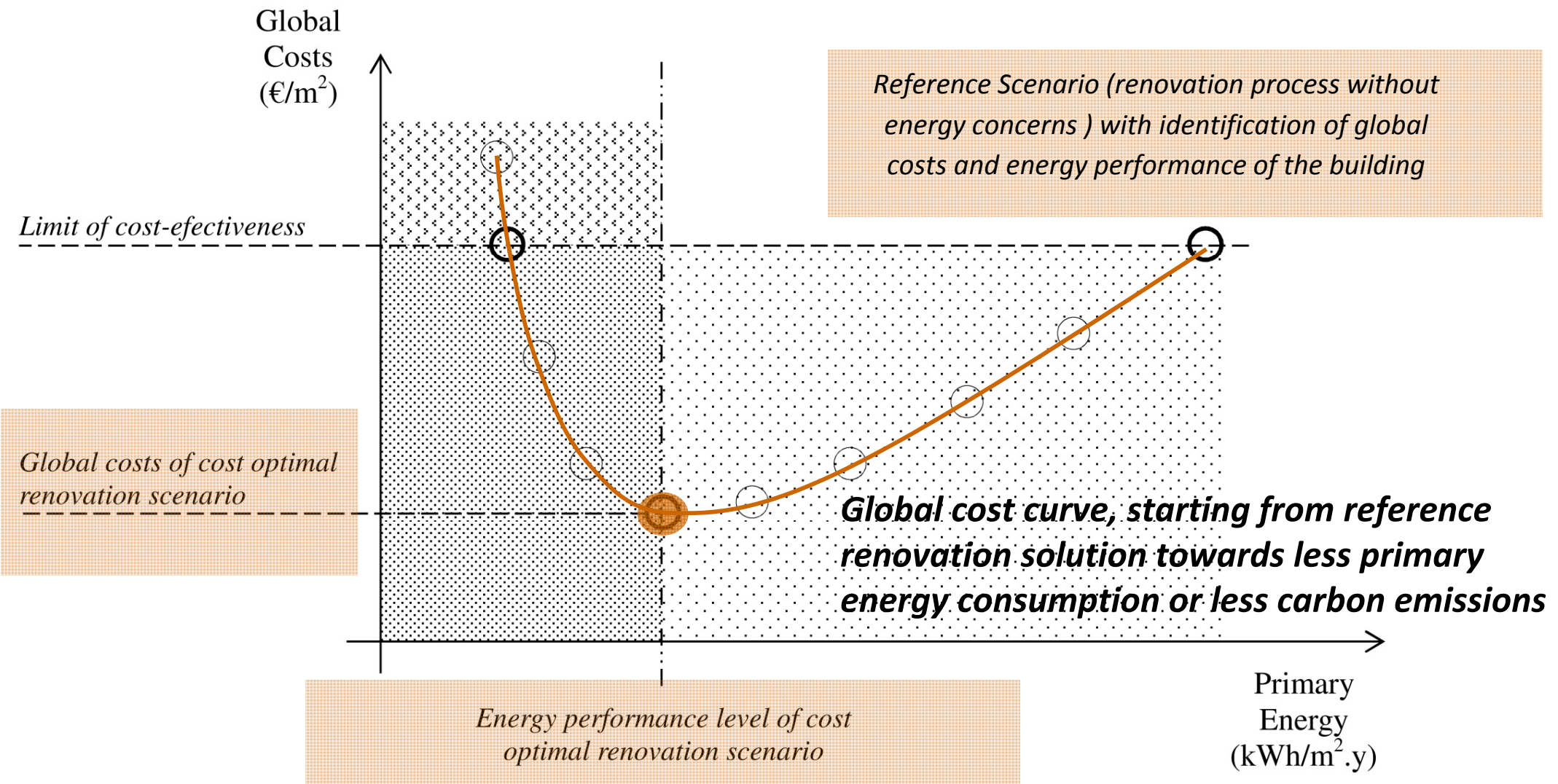


* Costs assessed for the building life cycle

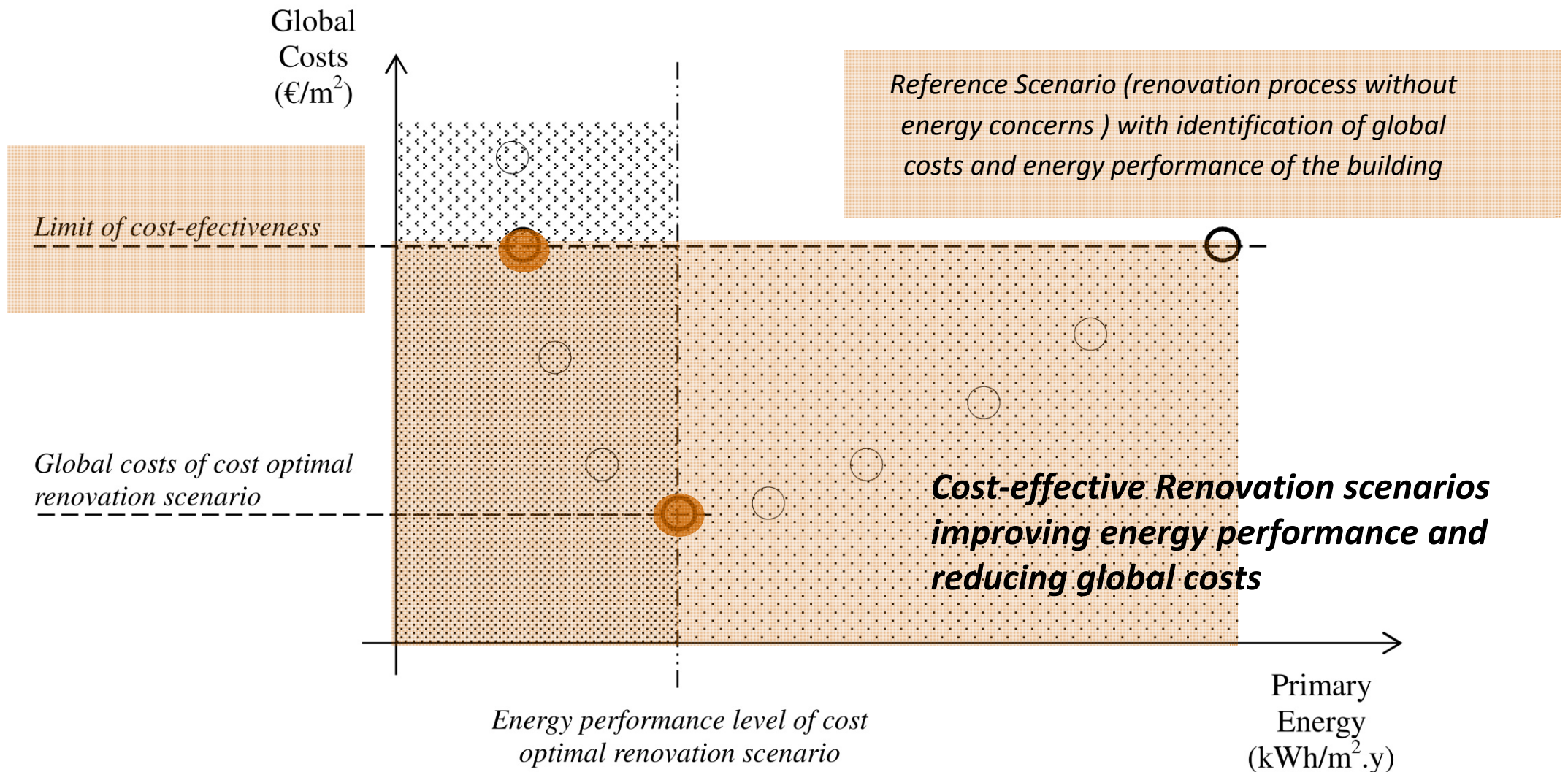
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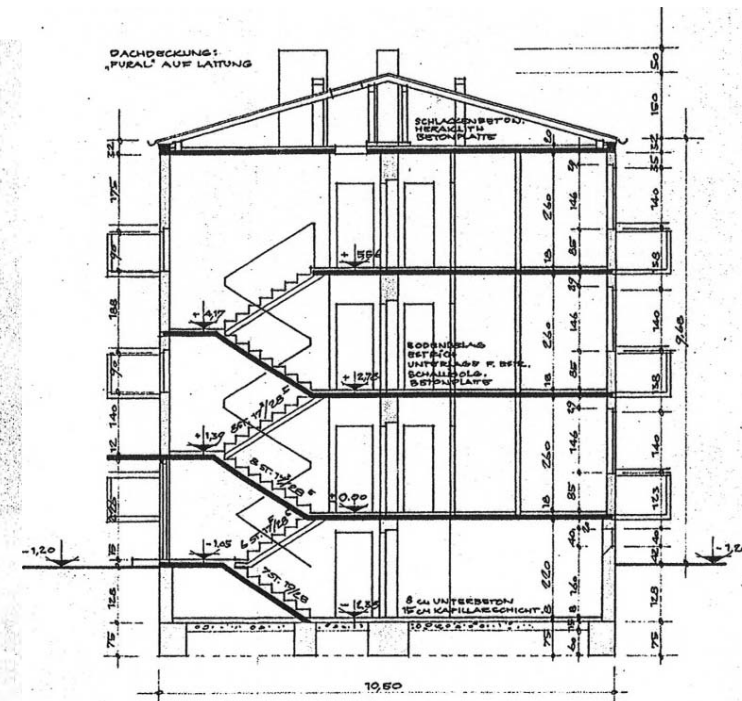
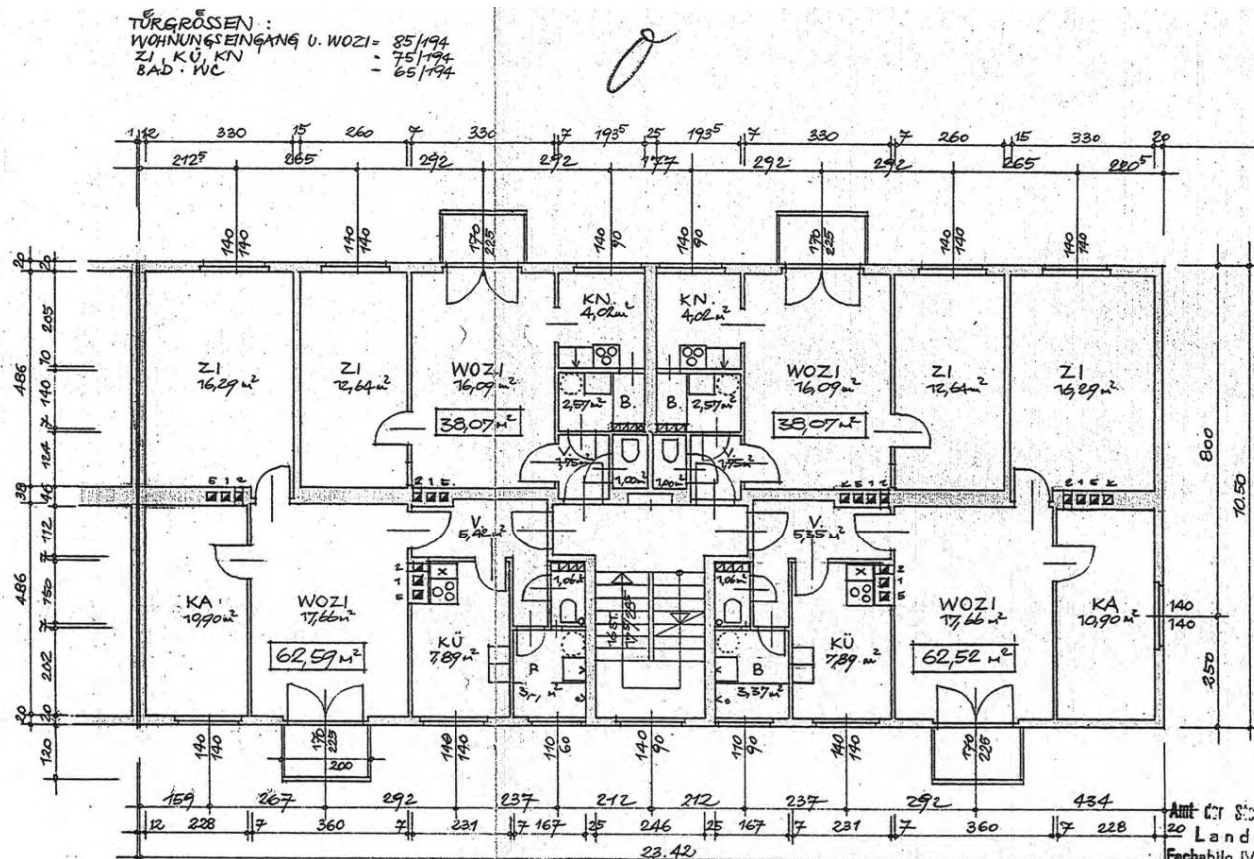


IEA EBC Annex 56 | Calculations on Generic Buildings



IEA EBC Annex 56 | Calculations on Generic Buildings

TÜRGRÖßEN :
WOHNUNGSEINGANG U. WOZI = 85/194
ZI, KÜ, KN = 75/194
BAD · WC = 65/194



SCHNITT.

REGELGESCHOSS = zw. ERDGESCHOSS.

„Heimat Steiermark“
gemeinnützige Wohnbau- und Stadtgesellschaft
mit beschränkter Haftung
Graz, Pöchlacherstraße 11, 8000 Graz
Architekt: *[Signature]*

3 GESCHOSSIGES WOHNHAUS
TYPE „C/L“
EINREICHPLAN
GRUNDRISSSE, ANSICHTEN, SCHNITT.

515
1: 100
[Signature]

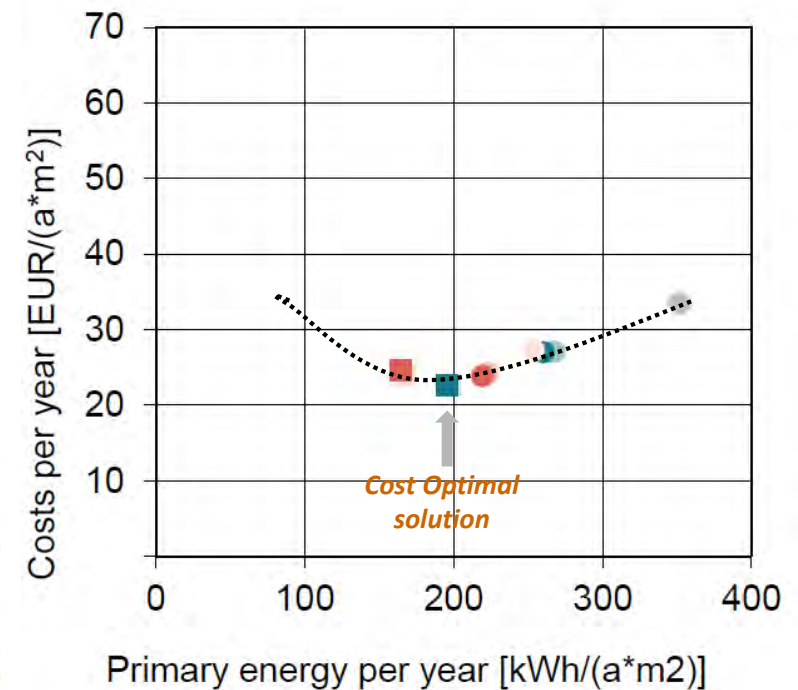
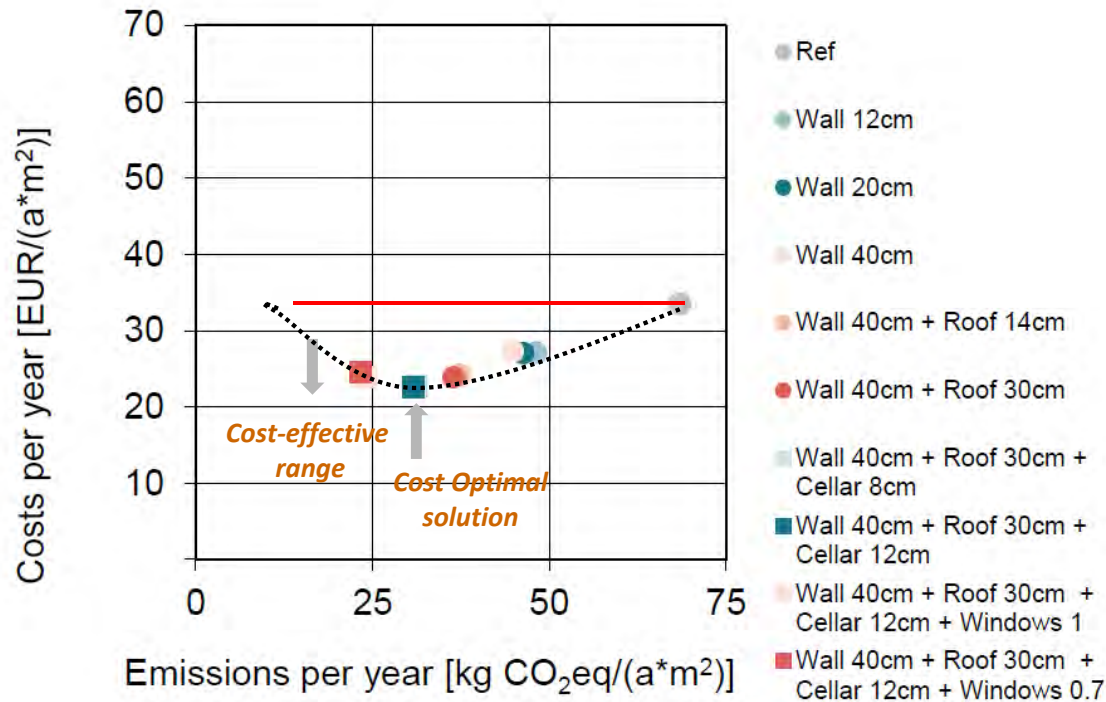
Arch. GY Steierm. Landesregierung
Landesbauamt
Fachabtlg. IV Landeshochbau

IEA EBC Annex 56 | Calculations on Generic Buildings

MFB in Austria

Energy Efficiency measures on the envelope

Oil Heating System



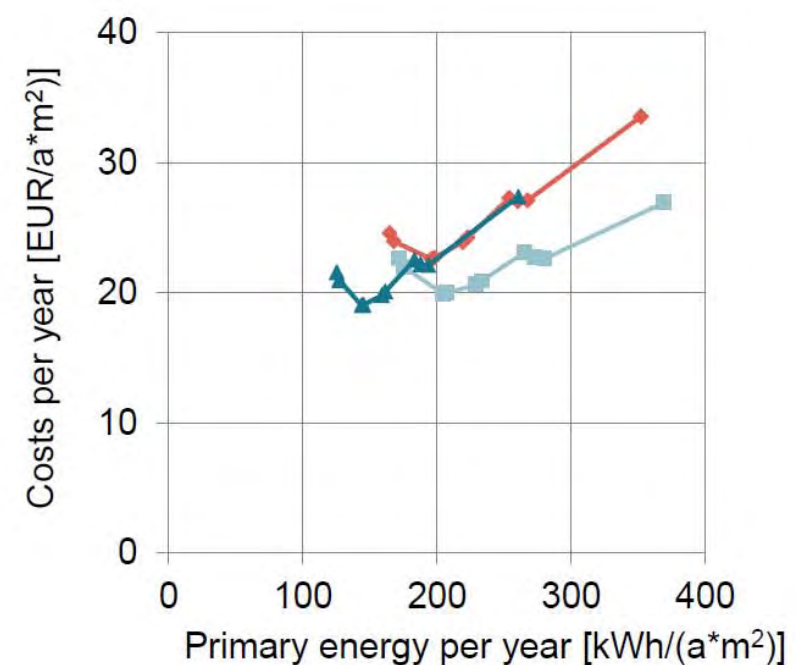
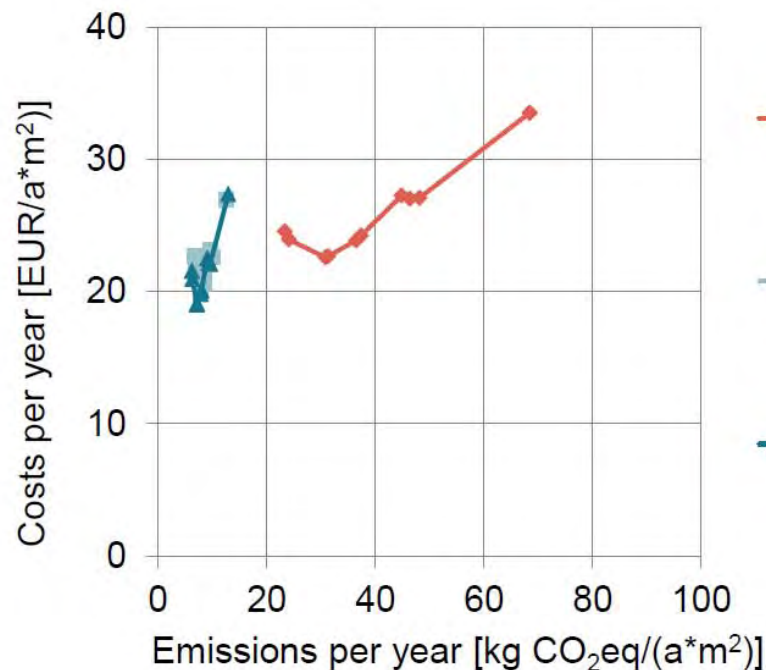
Impact in terms of Primary Energy and Emissions of different renovation measures on the envelope for a specific heating system

IEA EBC Annex 56 | Calculations on Generic Buildings

MFB in Austria

Energy Efficiency measures on the envelope

Different heating systems



Impact of using different systems using renewable and non-renewable sources

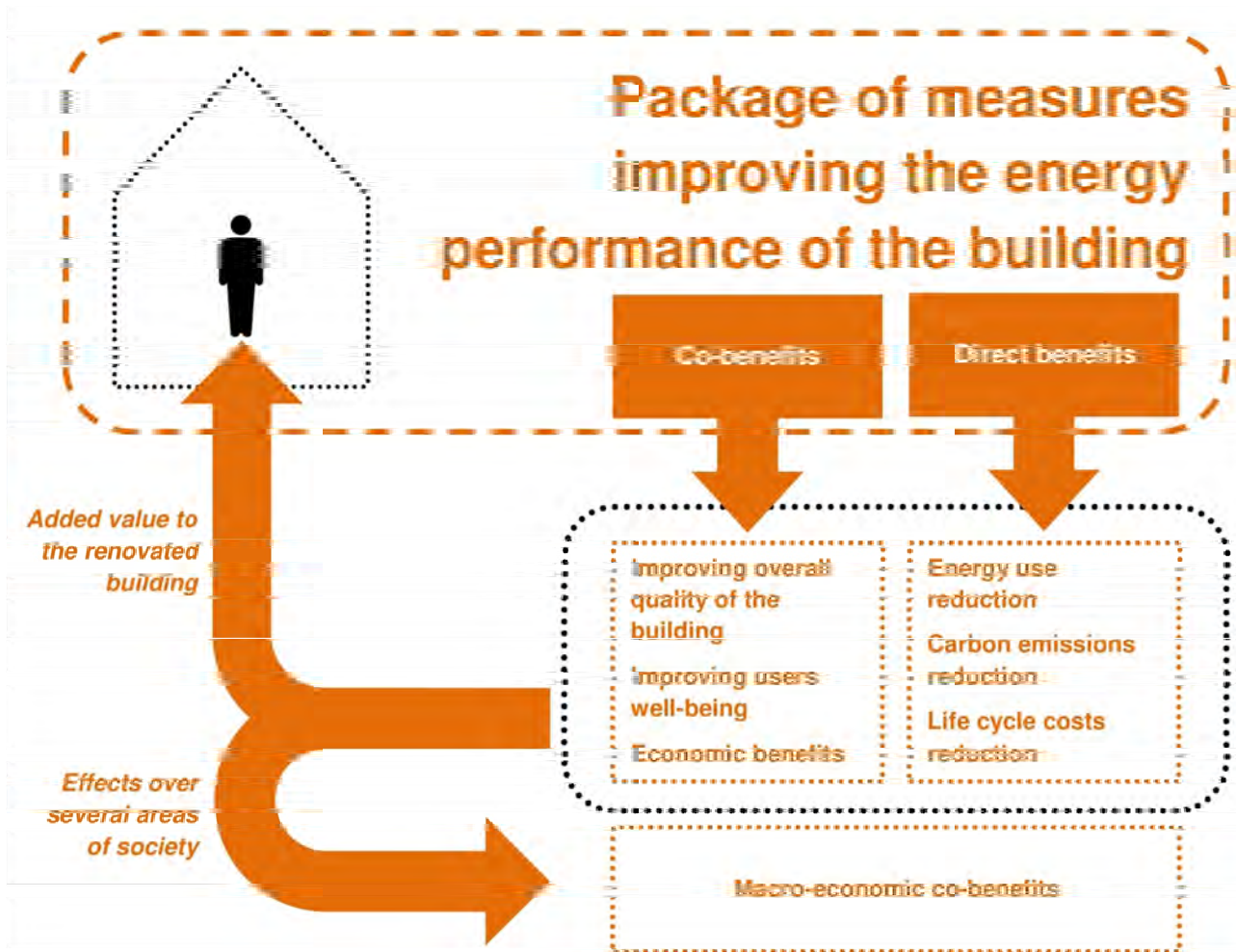
IEA EBC Annex 56 | Calculations on Generic Buildings

Hypothesis	SFB AT	MFB AT	SFB DK	MFB DK	SFB NO	SFB NO	SFB PT	MFB PT	MFB ES	SFB SE	SFB SE	SFB CH	MFB CH
The number of building elements renovated is more important for the energy performance of the building than the efficiency level of individual elements	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓
A switch to RES reduces emissions more significantly than energy efficiency measures	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓
A combination of energy efficiency measures with RES measures does not change significantly cost optimal efficiency level	(X)	(✓)	(✓)	(✓)	✓	✓	✓	✓	✓	(✓)	X	✓	✓
Synergies are achieved when a switch to RES is combined with energy efficiency measures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
To achieve high emission reductions, it is more cost-effective to switch to RES and carry out less far-reaching renovations on the building envelope than to focus primarily on energy efficiency measures alone.	✓	✓	✓	✓	X	✓	X	✓	✓	✓	✓	✓	✓

IEA EBC Annex 56 | Conclusions

- It is important to act on as many envelope elements as possible
- The number of building elements renovated is more important than the energy efficiency level of a single building element
- A switch to RES reduces emissions more significantly than energy efficiency measures on the envelope.
- Energy efficiency measures on the envelope have a larger impact on the reduction of primary energy needs
- If the target is net zero emissions, it is cost effective to combine energy efficiency measures with RES
- The change of the heating system doesn't change the cost-effectiveness of energy efficiency measures on the envelope. The cost optimal package of renovation measures on the envelope remains the same
- In the renovation process the impact of embodied energy use is low

IEA EBC Annex 56 | Co-Benefits



Besides energy, emissions and costs reductions, the co-benefits are relevant because:

- *Increase the added value of the building (relevant for owners);*
- *have effects over several areas of society (relevant for policy makers);*

co-benefits can have a significant value but most often they are disregarded being the reason for the underestimation of the full value of the renovation works