Renovating Buildings with Cost-Effective Reductions in Energy and Carbon Emissions – Findings from IEA EBC Annex 56

Webinar
8 November 2016

Agenda:

Introduction from **Isabel Rodriguez-Maribona Galvez** on BEA Retrofit activities

Presentation of the main findings of the project IEA EBC Annex 56:

- Cost Effective Energy and Carbon Emissions Optimization in Building Renovation: a general overview of the project, objectives and proposed renovation methodology
  Manuela Almeida (PT)
- Annex 56 Detailed Case Studies: Main results, conclusions and lessons learnt from the analysis of real case studies from the residential building stock of participating countries
  David Venus (AT)
- Inspiration and Experiences from the Joint Analysis of Shining Examples of Comprehensive Energy Renovation Building Projects within IEA EBC Annex 56 project
  Ove Morck (DK)
- Annex 56 MAIN RECOMMENDATIONS: TOP recommendations for Policy Makers and Professional Home Owners
  Manuela Almeida (PT)

IEA EBC Annex 56

Cost-Effective Energy and Carbon Emissions Optimisation in Building Renovation

2010-2016

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

OA: Manuela Almeida
University of Minho
Portugal

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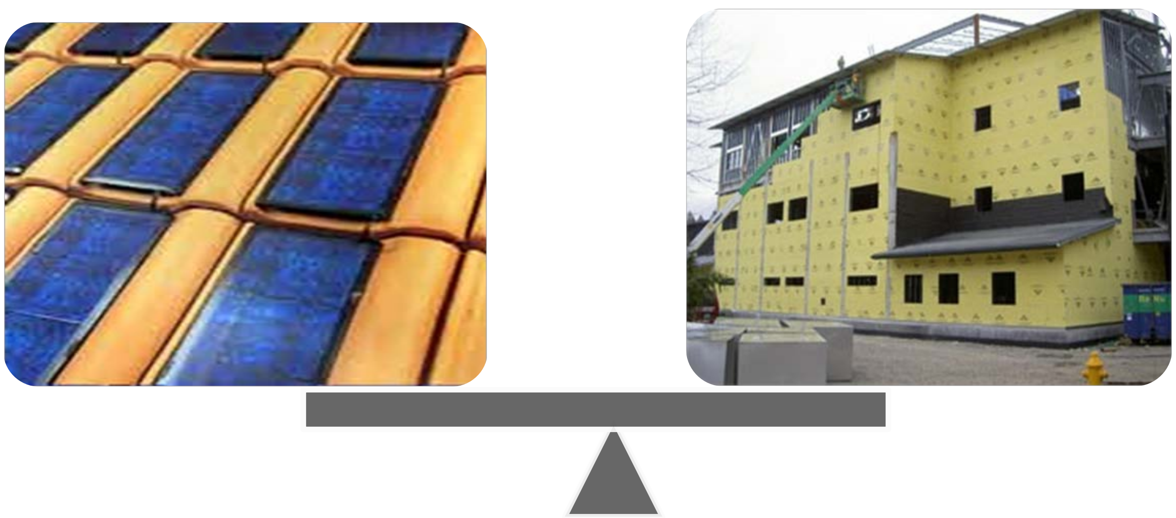
IEA EBC Annex 56 | Background

In existing buildings, the most cost-effective renovation solution is often a combination of energy efficiency measures and carbon emissions reduction measures.

So, it is relevant to investigate where is the balance point between these two types of measures in a cost/benefit perspective.



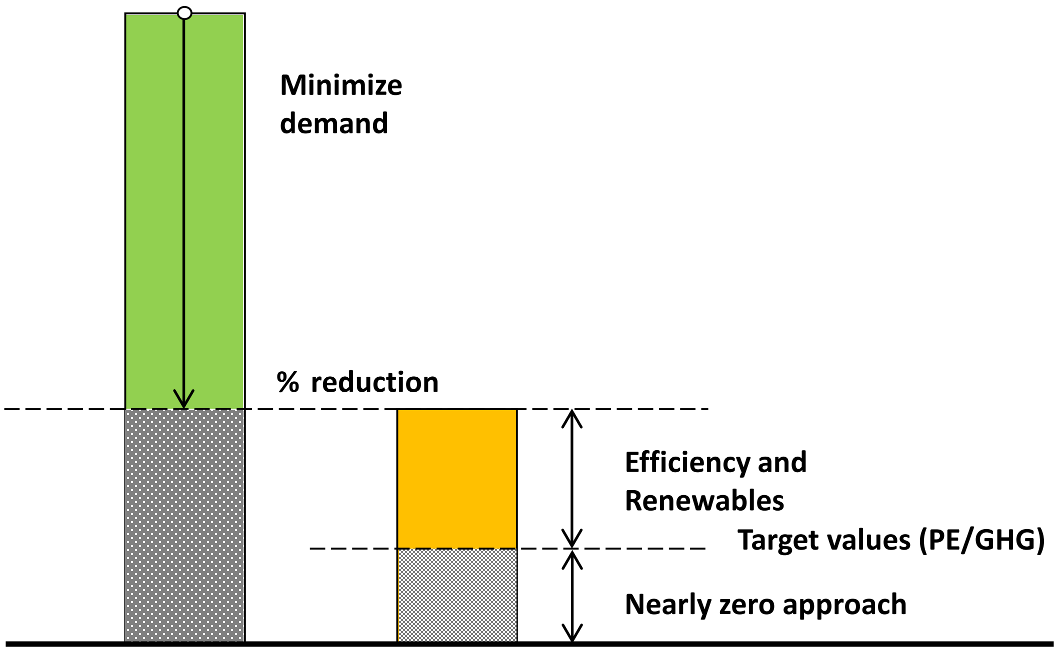
Question?

How to achieve the best performance with minimal effort?

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 two Renovation Guidebooks and some tools that allow applying the developed methodology)**

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)

Bairro Rainha D. Leonor, Porto, PT

Primary school – Svážná 9, Brno, CZ

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

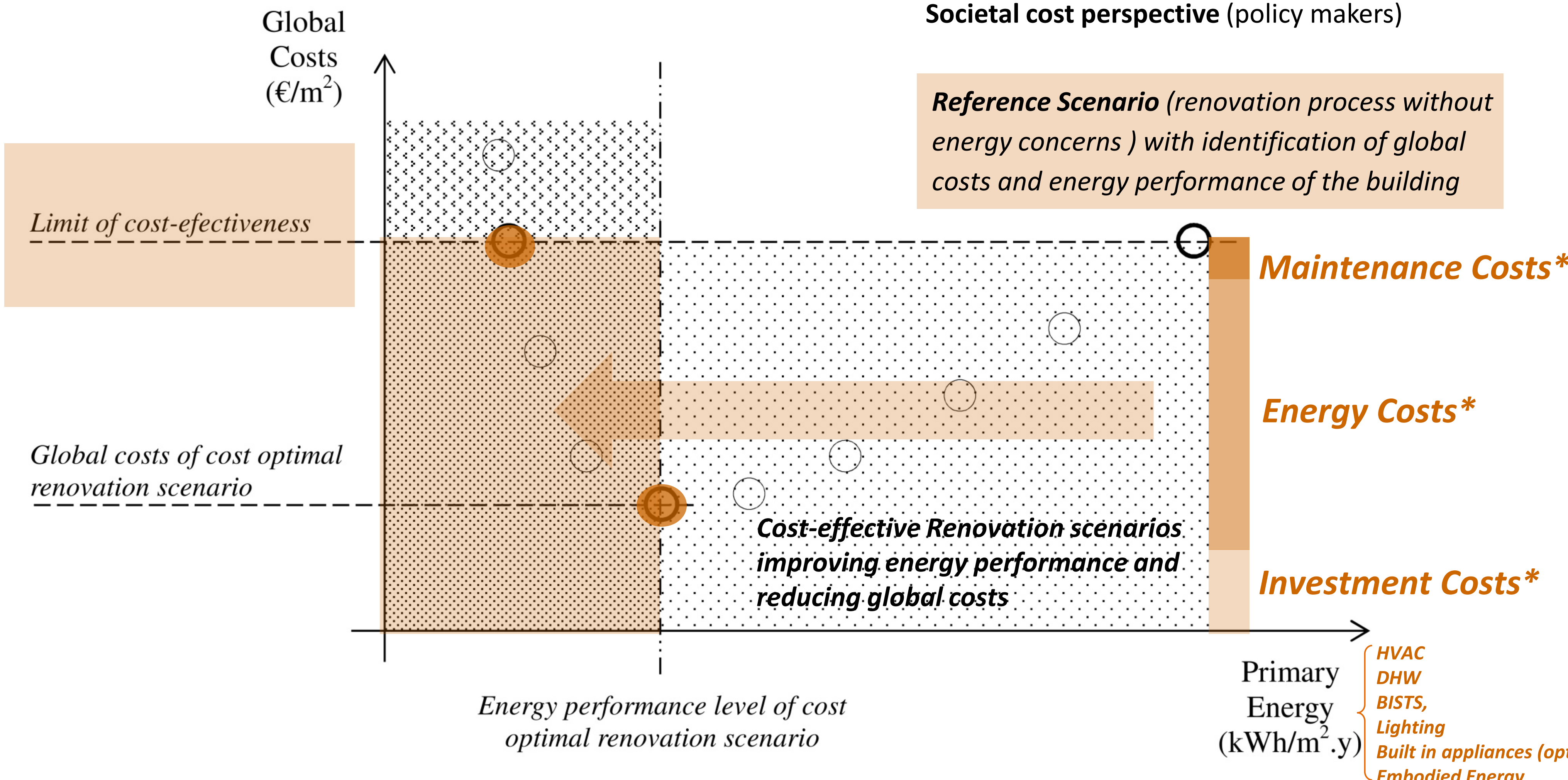
- Takes into account country specific situations (like climate, electricity mix, conversion factors, national energy targets, etc.)
- Allows prioritizing either nearly-zero emissions renovation (NZEmB) or nearly-zero energy renovation (NZEB) , each with an additional energy or emission goal that has 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 with the renovation process

IEA EBC Annex 56 | Methodology

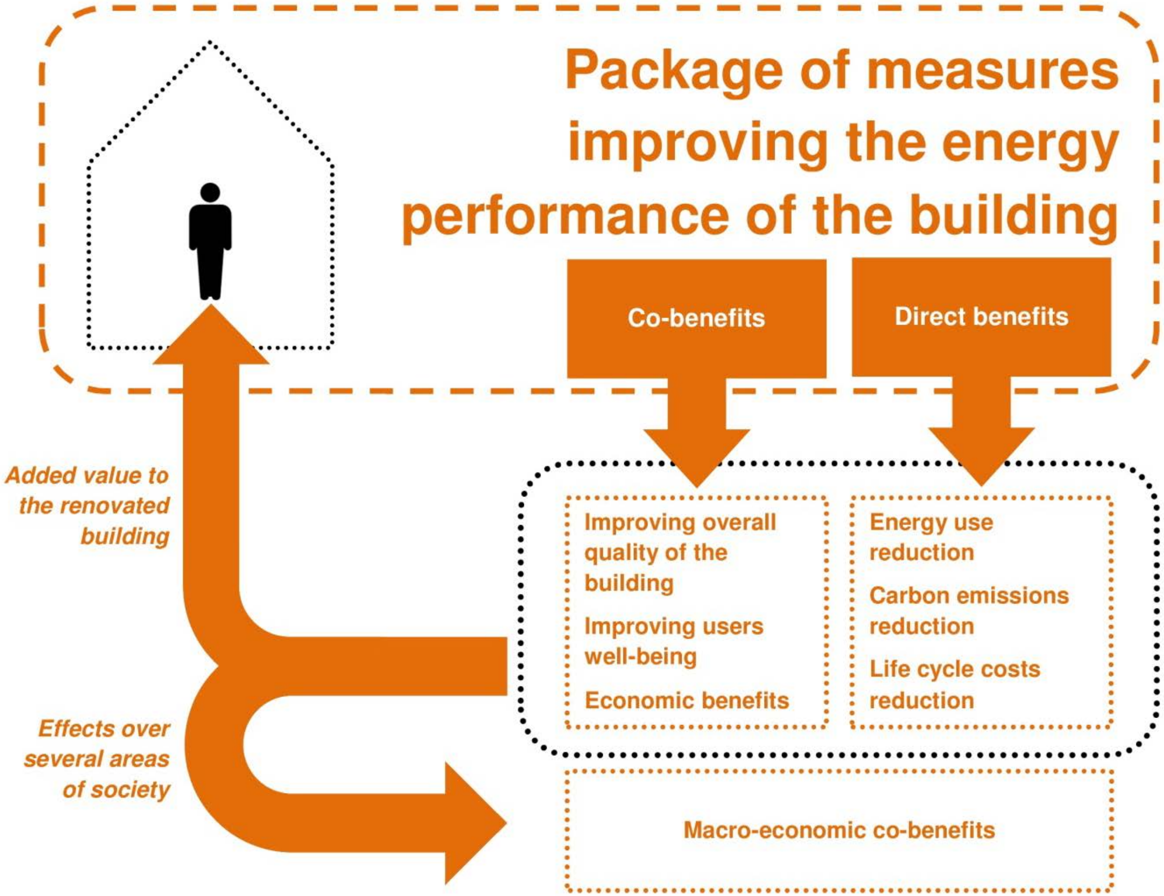
* Costs assessed for the building life cicle – 30 years

Private cost perspective (owners, investors, users)

Societal cost perspective (policy makers)



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**

IEA EBC Annex 56 | Co-Benefits

CO-BENEFITS		Thermal Comfort	Natural Lighting	Air Quality	Building Physics	Internal Noise	External Noise	Ease of Use / Control by User	Reduced Exposure to Energy Price Fluctuations	Aesthetics	Useful Living Area	Pride / Prestige	Ease of Installation / Reduced Annoyance
Ref. Pack.	Replacement of heating system												
Ref. Pack.	Replacement of DHW system												
Renovation Package 1	Insulation of entire building envelope	P			P				P	P		P	
Renovation Package 1	Internal shading	P	N					N			N		
Renovation Package 1	Replacement of heating system	P						P	P				
Renovation Package 1	Replacement of DHW system								P				
Renovation Package 2	Windows replacement	P											
Renovation Package 2	Insulation of entire building envelope	P			P				P	P		P	
Renovation Package 2	Internal shading	P	N					N			N		
Renovation Package 2	Replacement of heating system	P						P					
Renovation Package 2	Replacement of DHW system								P				
Chosen Renovation	Windows replacement	P											
Chosen Renovation	Insulation of roof	P			P				P				
Chosen Renovation	Insulation of facades	P			P				P	P		P	
Chosen Renovation	Internal shading	P	N					N			N		
Chosen Renovation	Replacement of heating system	P						P					
Chosen Renovation	Replacement of DHW system								P				

Legend: P - Positive Effect; N - Negative Effect

- The integration of co-benefits into the decision making process is difficult

- These benefits are often difficult and almost impossible to quantify and measure making it very difficult to add their contribution into a traditional cost-benefit analysis

- Through the case-studies a matrix has been developed in order to correlate the renovation measures with the Positive or Negative impacts

IEA EBC Annex 56 | Calculations on Generic Buildings

Inputs from 8 European countries (AT, CH, DK, ES, IT, NO, PT, SE)

To develop and support the methodology:

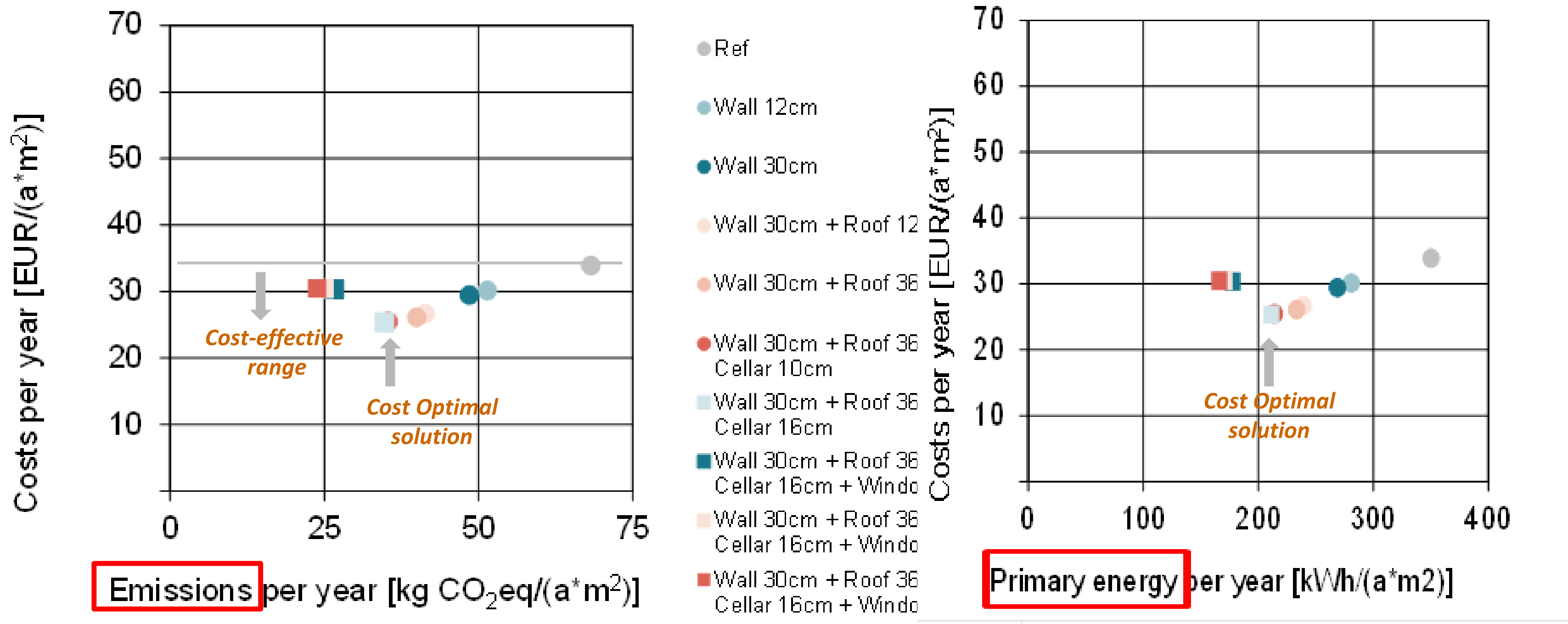
- **Generic buildings with the prevailing typologies and constructive solutions in each country have been selected**
- **Parametric studies were performed on them**
- **Validation with real case-studies from 6 countries (AT, DK, ES, IT, PT, SE)**

IEA EBC Annex 56 | Calculations on Generic Buildings

MFB in Switzerland

Energy Efficiency measures on the envelope

Oil Heating System



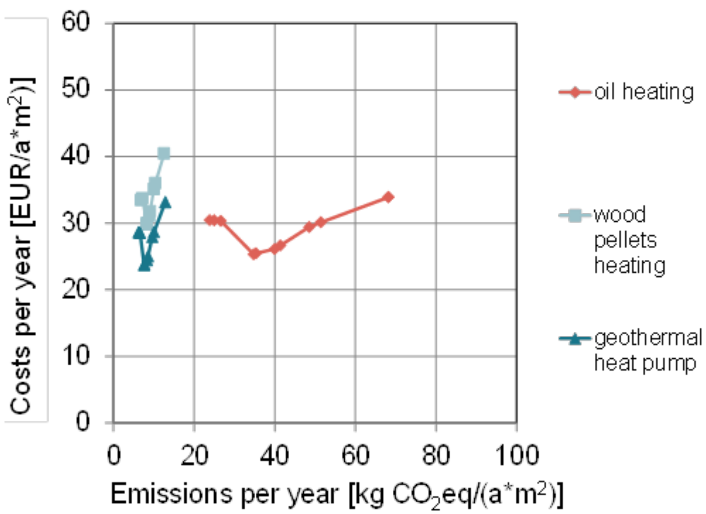
Impact in terms of Primary Energy and Emissions of different renovation measures on the envelope for a specific heating system

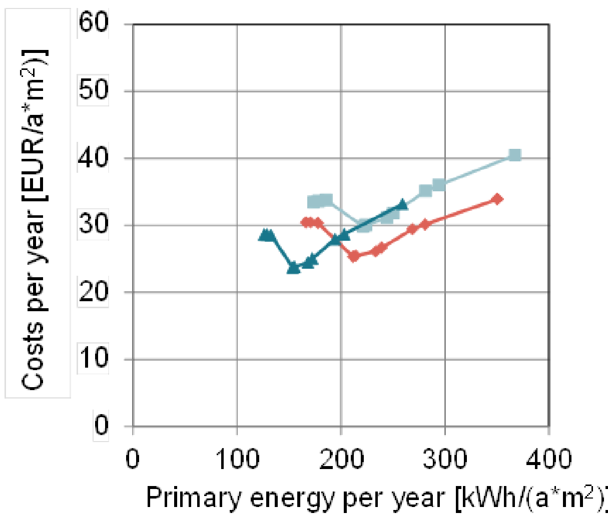
IEA EBC Annex 56 | Calculations on Generic Buildings

MFB in Switzerland

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 m… perf… effic…													
A sw… signi… mea…													
A co… mea… char… level…													
Syne… RES… mea…													
To a… more… carry… the building envelope than to focus primarily on energy efficiency measures alone.													

- 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 envelop…
- Energy … ary 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

VALIDATED IN REAL CASE-STUDIES

IEA EBC Annex 56 | Validation of the Methodology with Real Case-Studies

Annex 56 Detailed Case Studies – main results, conclusions and lessons learned from the analysis of real case-studies from the residential building stock of participating countries

David Venus
AEE – Institute for Sustainable Technology
Austria

IEA EBC Annex 56 | SHINING EXAMPLES

Annex 56 SHINING EXAMPLES: Findings from a cross analysis among exemplary renovation processes among the participating countries - Major barriers and major drivers in building renovation

Ove Morck
Cenergia Energy Consultants
Denmark