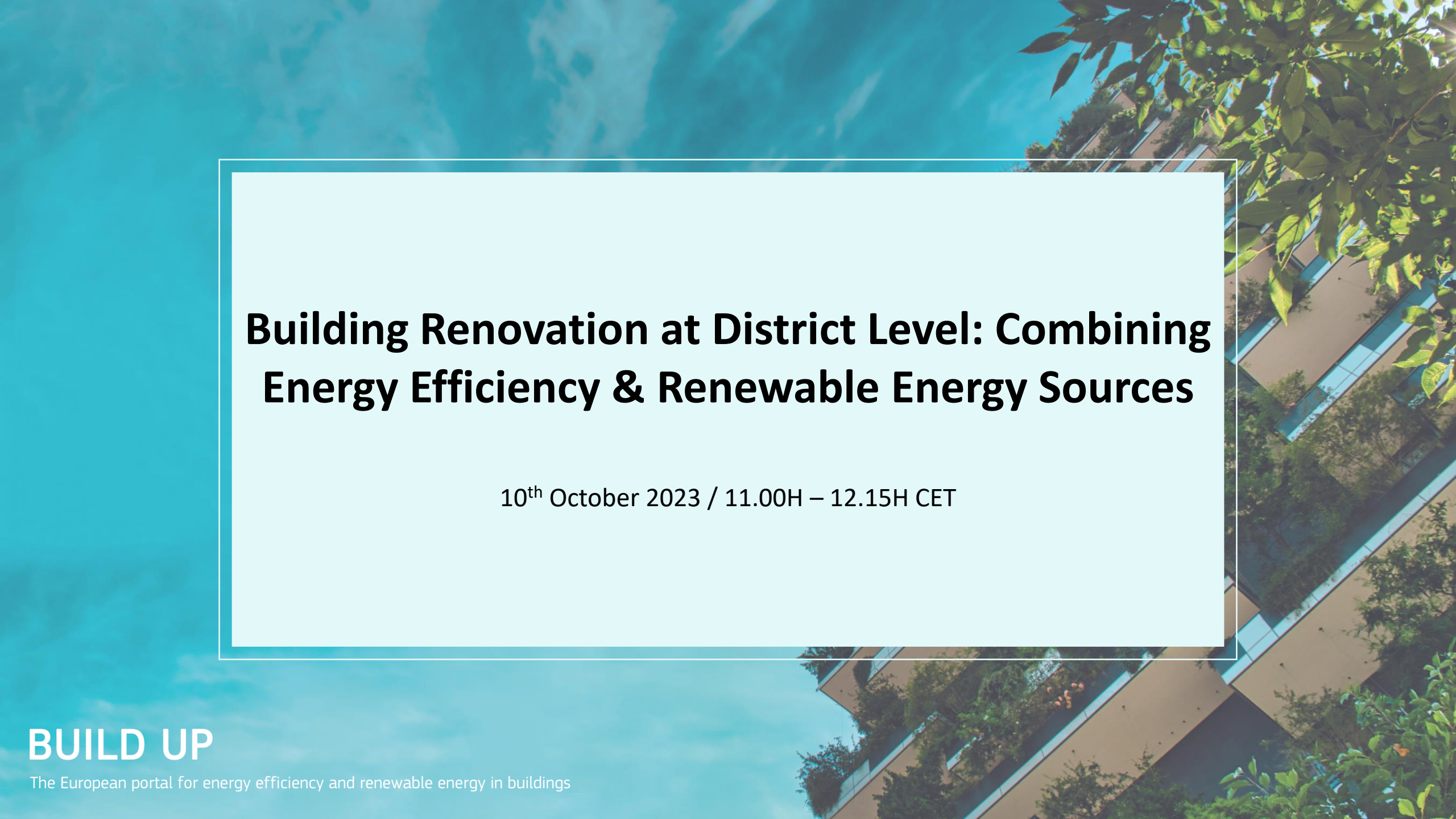

BUILD UP
The European portal for energy efficiency
and renewable energy in buildings
WEBINAR

Building Renovation at District Level: Combining Energy Efficiency & Renewable Energy Sources

10th October 2023 / 11.00H – 12.15H CET



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AGENDA

Presentation	Speaker
Building Renovation at District Level – a brief overview of IEA EBC Annex 75 project	Manuela Almeida, Associate Professor at Pl University Minho, Portugal
Optimisation methodology and strategy development for building renovation at district level combining energy efficiency and renewable energy systems	Roman Bolliger, Project Manager at INDP, Switzerland
Barriers and Drivers for energy efficient renovation at district level	Erik Johansson, Associate Professor at Lund University, Sweden
Q&A session and Attendee Poll	BUILD UP
Policy instruments for building renovation at district level combining energy efficiency and renewable energy systems	Erwin Mlecnik, Assistant Professor at TU Delft, The Netherlands
Business models for building renovation in districts combining energy efficiency and renewable energy systems	Thaleia Konstantinou, Associate Professor at TU Delft, The Netherlands
Annex 75 MAIN RECOMMENDATIONS: TOP recommendations for Policy Makers and Professional Home Owners	Manuela Almeida, Associate Professor at Pl University Minho, Portugal
Q&A session	BUILD UP
Thank you from BUILD UP	BUILD UP

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Energy in Buildings and Communities Programme

IEA EBC Annex 75

Cost-Effective Building Renovation at District Level Combining Energy Efficiency & Renewables

January 2018 – June 2023
13 participant countries | AT, BE, CH, CN, CZ, DK, ES, GE, IT, NL, NO, PT, SE

IEA EBC Annex 75

Brief Overview

Manuela Almeida | Operating Agent

University of Minho, Portugal

Webinar

10 October 2023

IEA EBC Annex 75

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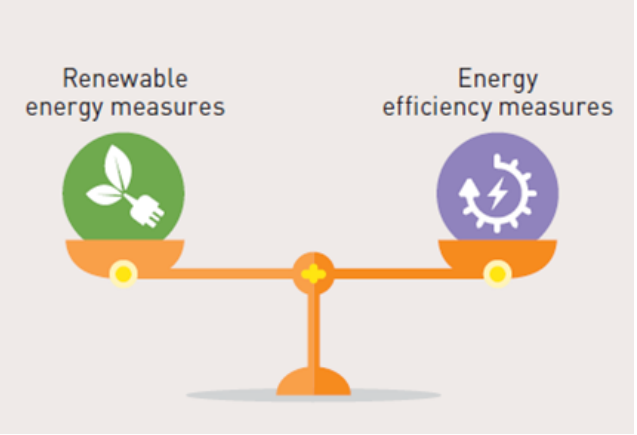
Goals

Investigate cost-effective strategies for reducing carbon emissions and energy use in buildings at the district level, combining energy efficiency measures and measures that promote the use of renewable energy

Provide guidance to policymakers, companies working in the field of the energy transition, as well as building owners, to cost-effectively transform the existing building stock into low-emission and low-energy solutions

Key-question

Where is the balance point between energy efficiency measures and measures that promote the use of renewable energy?



Scope

Residential Buildings and non residential buildings without complex HVAC systems

Renovation at district level

Opportunities and Challenges

- At district level there are specific opportunities as well as specific challenges when compared to the building level
- Finding the balance between renewable energy supplies and energy efficiency measures for the renovation of the existing stock is more complex at district level than for individual buildings, but may also bring larger benefits
- it was important to explore the potential of cost-effective renovations at district level to accelerate the transition towards low-emissions and low-energy districts

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Objectives

- Give an overview of existing and emerging technology options for cost-effective renovation strategies
- Define a methodology, supported by one or more tools, to identify cost-effective strategies for the renovation of urban districts combining energy efficiency measures and renewable energy measures
- Identify and document good examples as well as explore case studies, highlighting the strategies for an effective transformation of existing districts into low-energy and low-emission districts
- Provide guidelines for policymakers and energy-related companies on how to encourage the market uptake of cost-effective strategies combining energy efficiency measures and renewable energy measures
- Provide guidelines for building owners and investors on cost-effective district-level solutions

IEA EBC Annex 75

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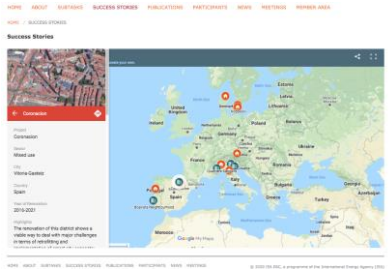
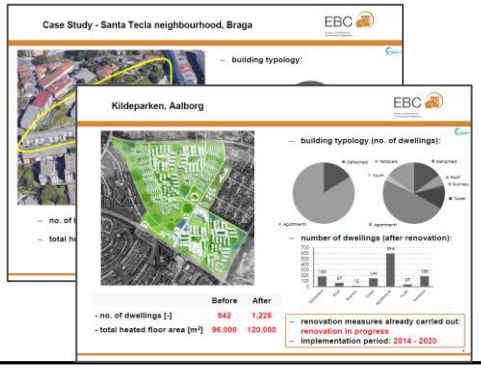
Outputs

- ❑ Technology Overview
- ❑ IEA EBC Annex 75 Methodology
- ❑ IEA EBC Annex 75 online Supporting Tool
- ❑ Application of the methodology in generic districts
- ❑ Strategy development for low-carbon renovation of districts
- ❑ Good practice examples (available online)
- ❑ Parametric assessments of case studies
- ❑ Barriers and drivers for energy-efficient renovation at district level
- ❑ Good practice guidance for low-carbon renovation of districts
- ❑ Policy instruments to support district renovations
- ❑ Business models and models for stakeholder dialogue
- ❑ Guidebook for policymakers and energy-related companies
- ❑ Guidebook for building owners and investors





https://annex75.iea-ebc.org/publications

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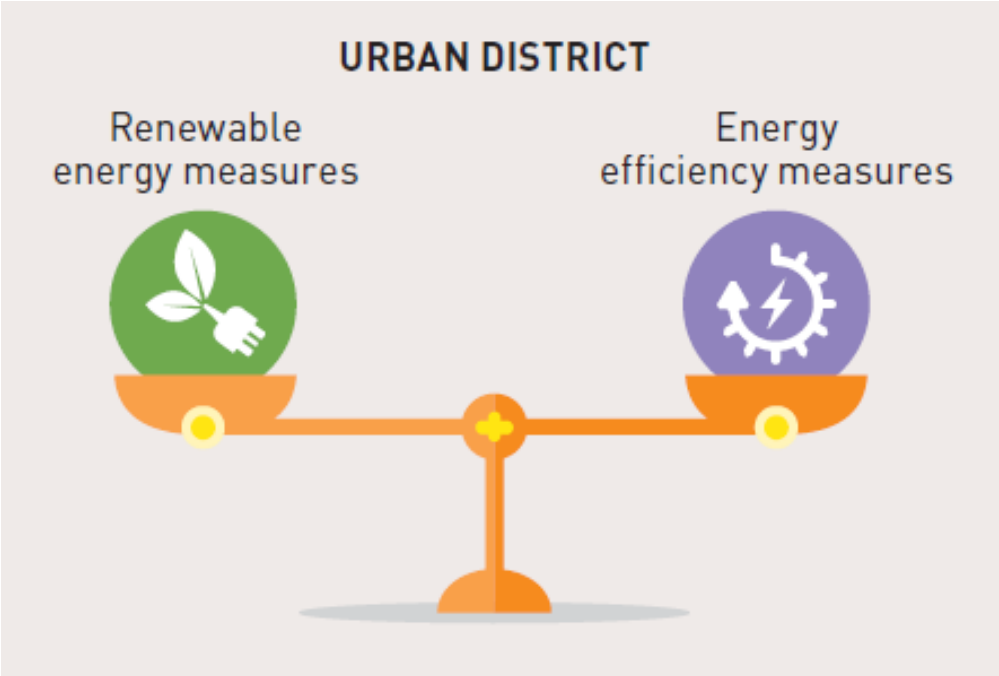
Cost-Effective Building Renovation at District Level Combining Energy Efficiency & Renewables

Optimisation methodology and strategy development for building renovation at district level combining energy efficiency and renewable energy systems

presented by Roman Bolliger, INDP, Switzerland , on behalf of IEA EBC Annex 75 team of researchers

Webinar on BUILD UP platform
10 October 2023

Objectives


URBAN DISTRICT
Renewable energy measures
Energy efficiency measures

Selected research questions

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- What are cost-effective combinations between renewable energy measures and energy efficiency measures to achieve far-reaching reductions in greenhouse gas emissions and primary energy use in urban districts?
- Under which circumstances does it make sense to use available renewable energy potentials in cities at a district level, and under which circumstances are decentralised renewable energy solutions, in combination with energy efficiency measures on the buildings' envelopes, more advantageous?
- To what extent does the cost-effectiveness of renovation measures on the building envelopes in the case of a district heating system based on renewable energies differ from the cost-effectiveness of such measures in case of a decentralised use of renewable energy sources for heating in each individual building?

Methodology (I)

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Renewable energy measures

District heating system:
- Lake water heat pump
- Groundwater heat pump
- Geothermal heat pump
- Wood energy
- Lake water + decentralized heat pumps
- ...

Individual heating systems:
- Air source heat pumps
- Geothermal heat pumps
- Wood energy
- ...

Solar energy

Energy efficiency measures

Measures on building envelope:
- Insulation of wall
- Insulation of roof
- Insulation of cellar ceiling
- New windows
- ...

Methodology (II)

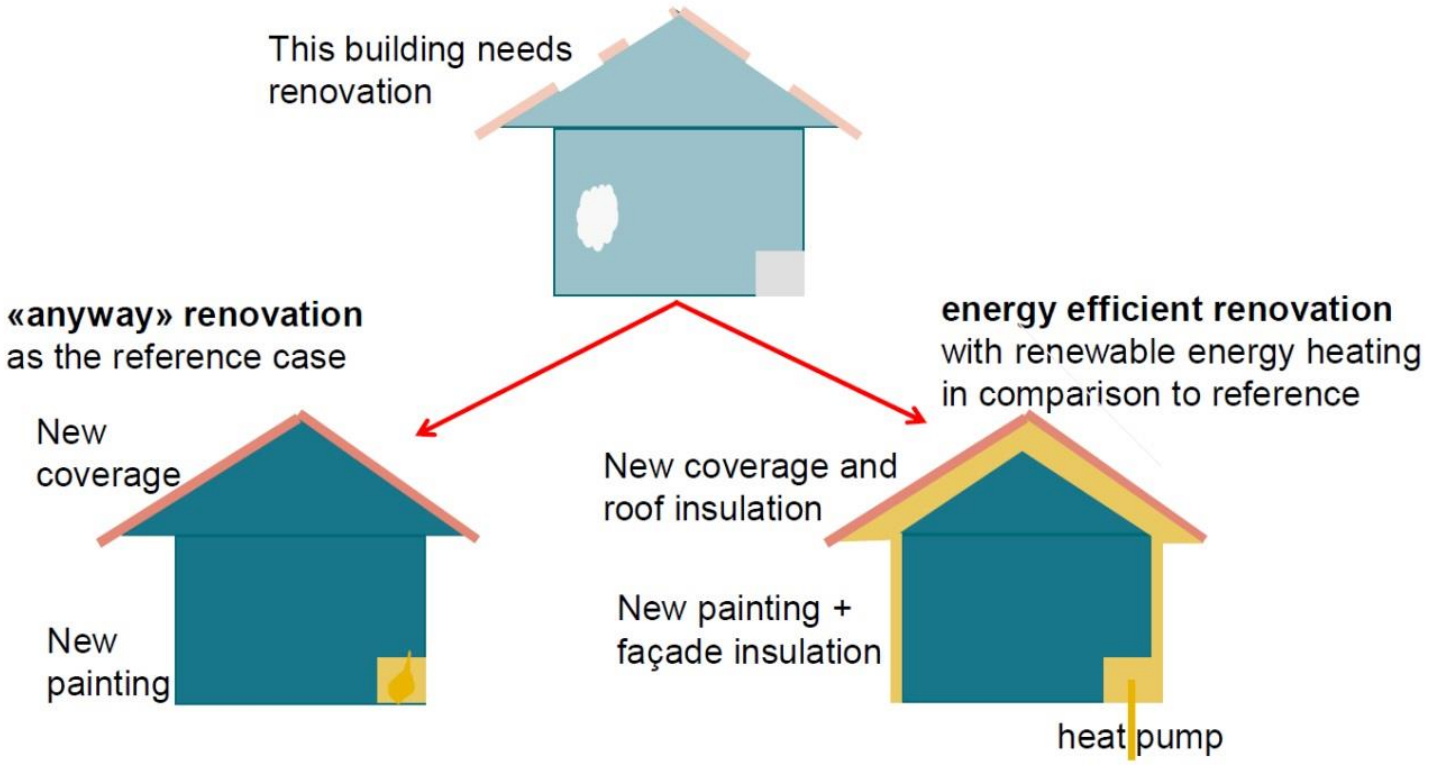
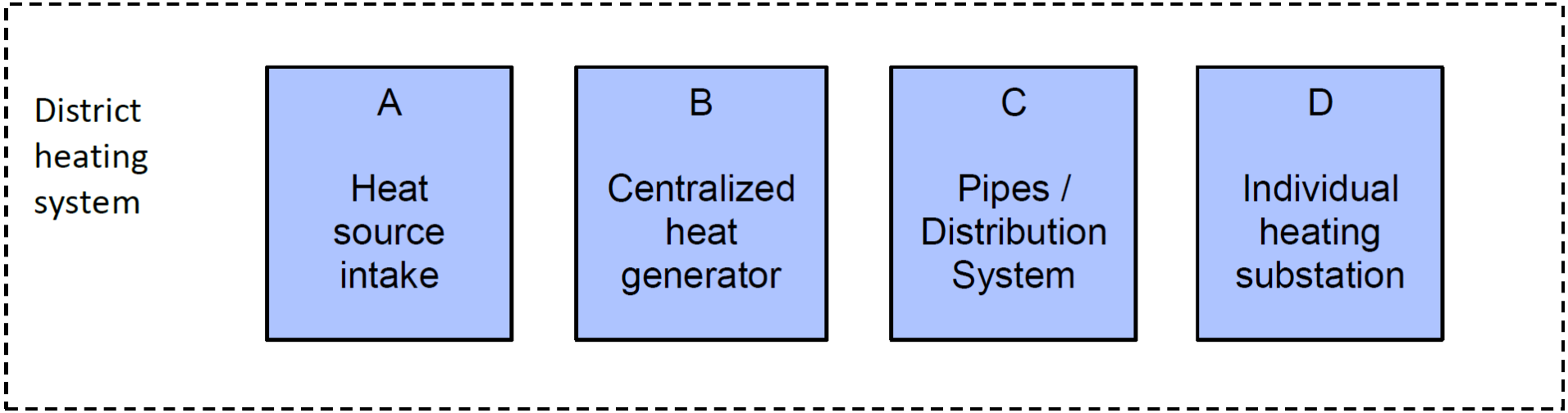


Image source: Ott et al. 2017

Methodology (III)



Annex 75 case studies

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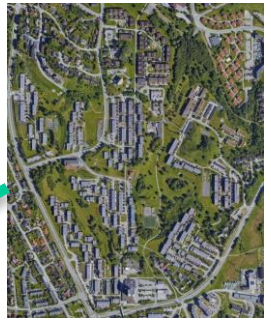





Case study Luzern, Switzerland (I)

Image source: Google Maps

Case study Luzern, Switzerland (II)

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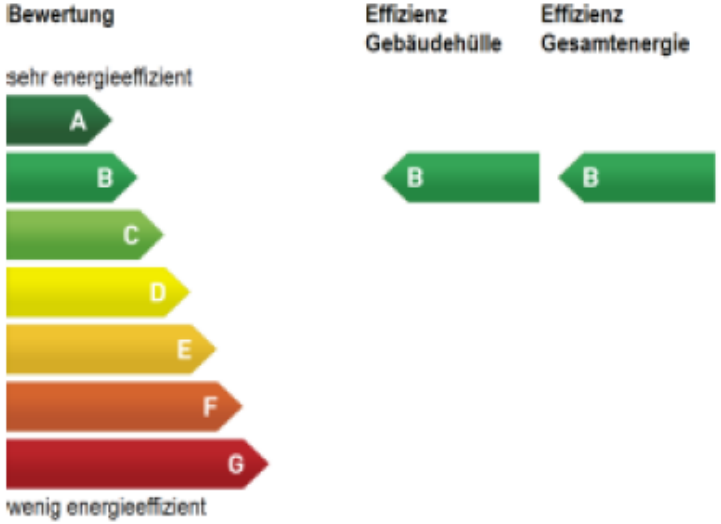
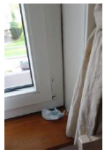
Characterization of building envelopes with energy performance certificates



Bauteilkategorie, Bild	Beschreibung	Mögliche Verbesserungen	Pr
Dächer / Decken ≤ 2 m im Erdreich 	Die Terrasse des Attika Geschosses ist intakt. Das Flachdach konnte nicht beurteilt werden.	Die Dämmwerte entsprechen nicht mehr ganz dem heutigen Standard. Eine Nachrüstung der Dämmung kann im Zuge einer anstehenden Sanierung angezeigt sein.	
Wände gegen aussen / ≤ 2 m im Erdreich 	Aussenw einer Aus Die Auss ausgespa		

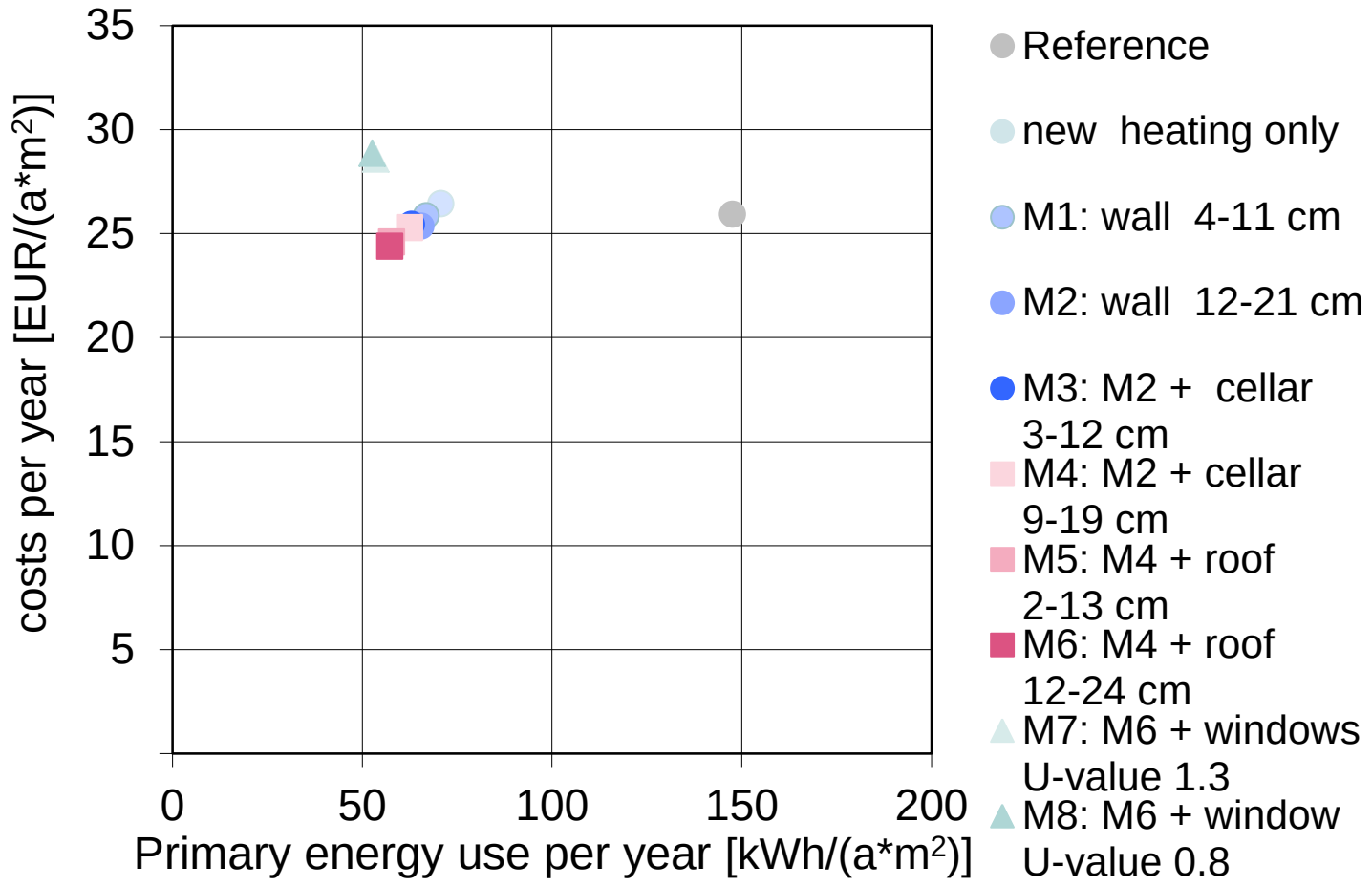
		Dämmung kann im Zuge einer anstehenden Sanierung angezeigt sein.	
Übrige Wände*	Wände im EG gegen Keller und Nebenräume sind minim gedämmt	Bei einer Sanierung Dämmung auf heutigen Standard ergänzen	
Fenster und Türen 	alte 2-fach Wärmeschutzverglasung in Kunststofffenstern	Fenstererersatz durch moderne 3-Fach Verglasung	
Böden gegen aussen / ≤ 2 m im Erdreich 	Böden gegen Eingangsbereich sind nur minimal gedämmt.	Aussendämmung von unten nachrüsten	
Übrige Böden* 	Kellerdecke ungedämmt, Keller unbeheizt.	Dämmung der Kellerdecken von unten mit Dämmplatten nachrüsten	
Wärmebrücken (linear und punktförmig) 	Balkone sind duchbetoniert	Längerfristig Abtrennung der Balkone und Ersatz durch Stahlbau (Vergrösserung möglich) oder alle Balkonbauteile Dämmen (ev. Vergrösserung des Wohnzimmers um Balkonfläche möglich)	

Case study Luzern, Switzerland (III)

Renovation package	Scope of included energy efficiency measures
Reference	Refurbish wall/roof + windows; or wall, roof an windows, without improving energy efficiency
V1	Insulation of exterior wall with 4 – 11 cm rock wool
V2	Insulation of exterior wall with 12 – 21 cm rock wool
V3	V2 + insulation of cellar ceiling with 3 – 12 cm PUR
V4	V2 + insulation of cellar ceiling with 9 – 19 cm PUR
V5	V4 + insulation of roof with 2 – 13 cm EPS
V6	V4 + insulation of roof with 12 – 24 cm EPS
V7	V6 + new windows with U-value 1.3 W/(m²K)
V8	V6 + new windows with U-value 0.8 W/(m²K)

Type of heating system	Heating system
Reference	Oil and gas heatings
Decentralized renewable	Air source heat pump
	Geothermal heat pump
Centralized renewable	Lake water with centralized heat pump
	Lake water with decentralized heat pumps
	Centralized geothermal heat pump, regeneration with solar energy

Efficiency measures on building envelopes with air-source heat pumps



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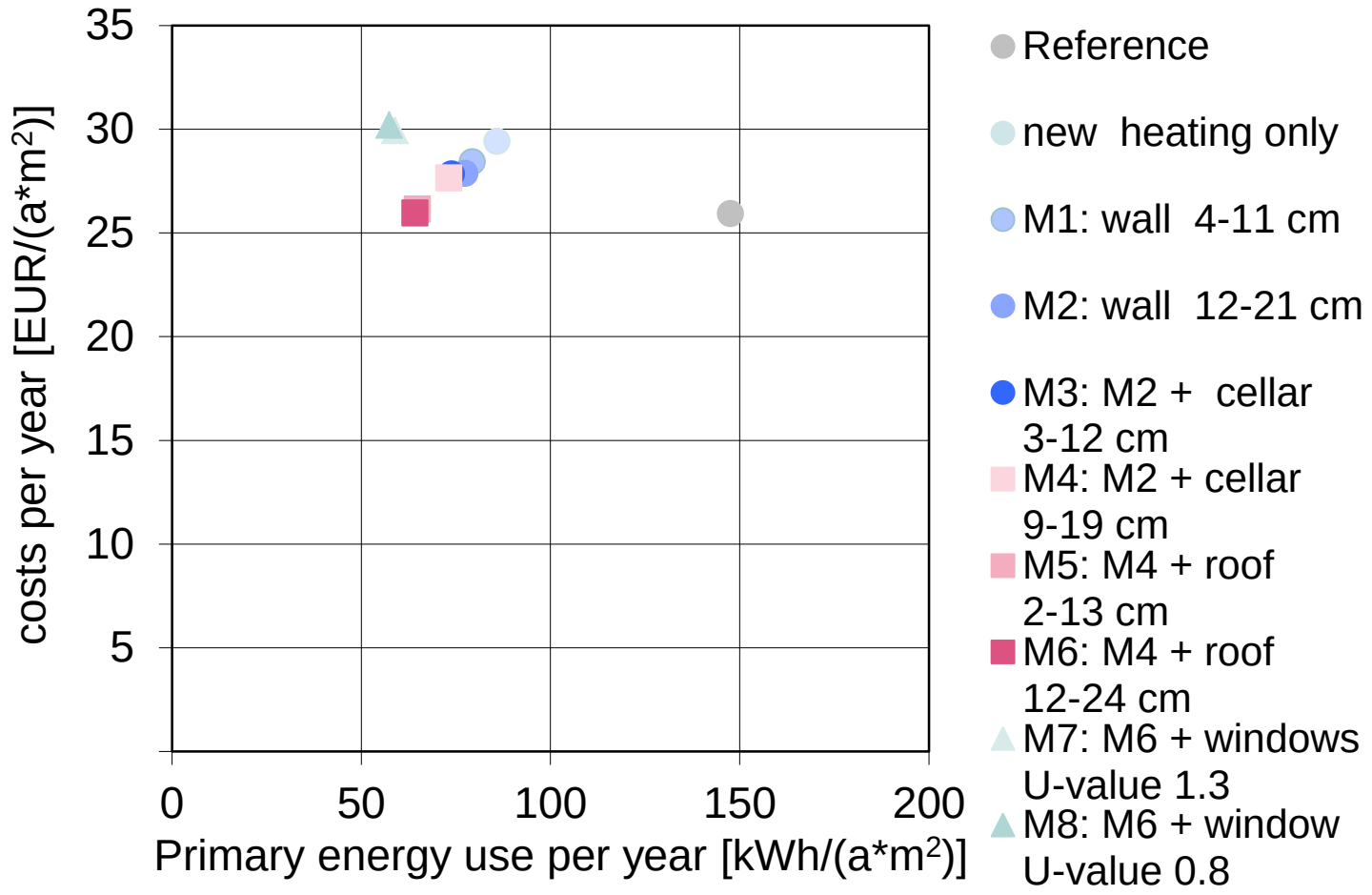
Efficiency measures on building envelopes with lake-water centralized heat pump



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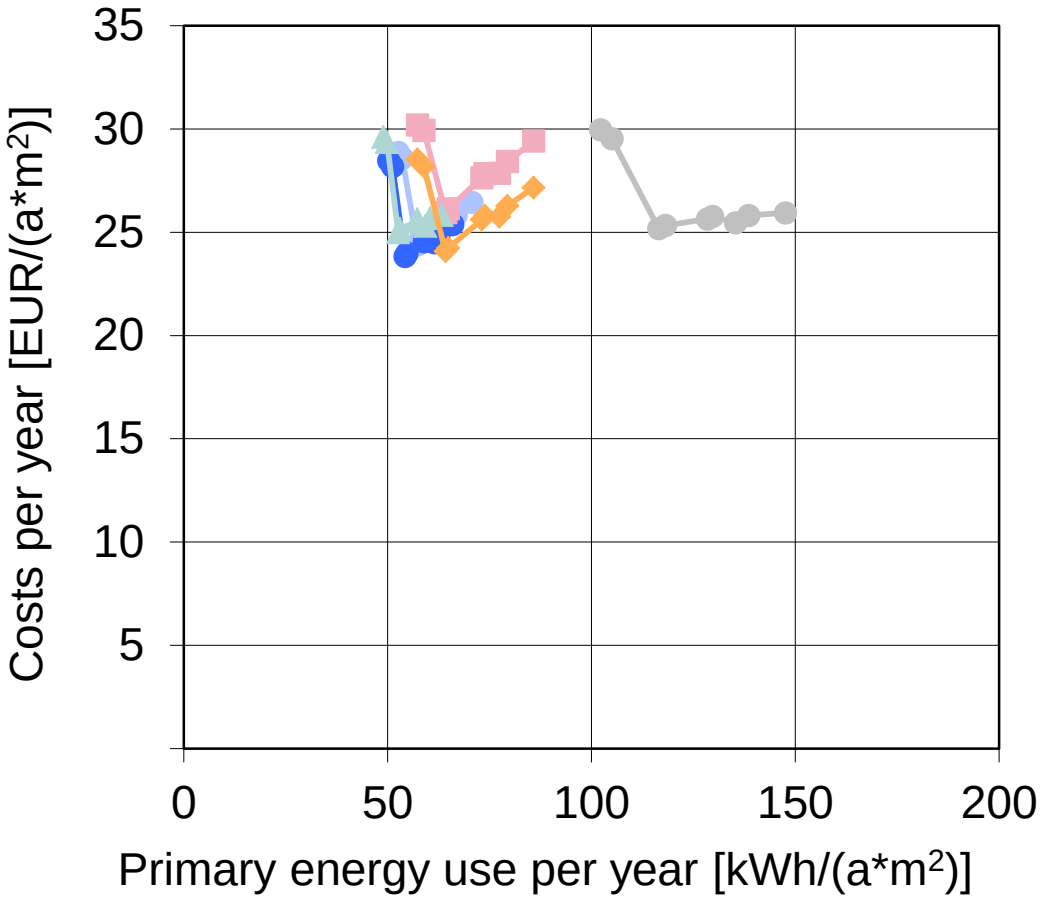
Efficiency measures on building envelopes with various heating systems



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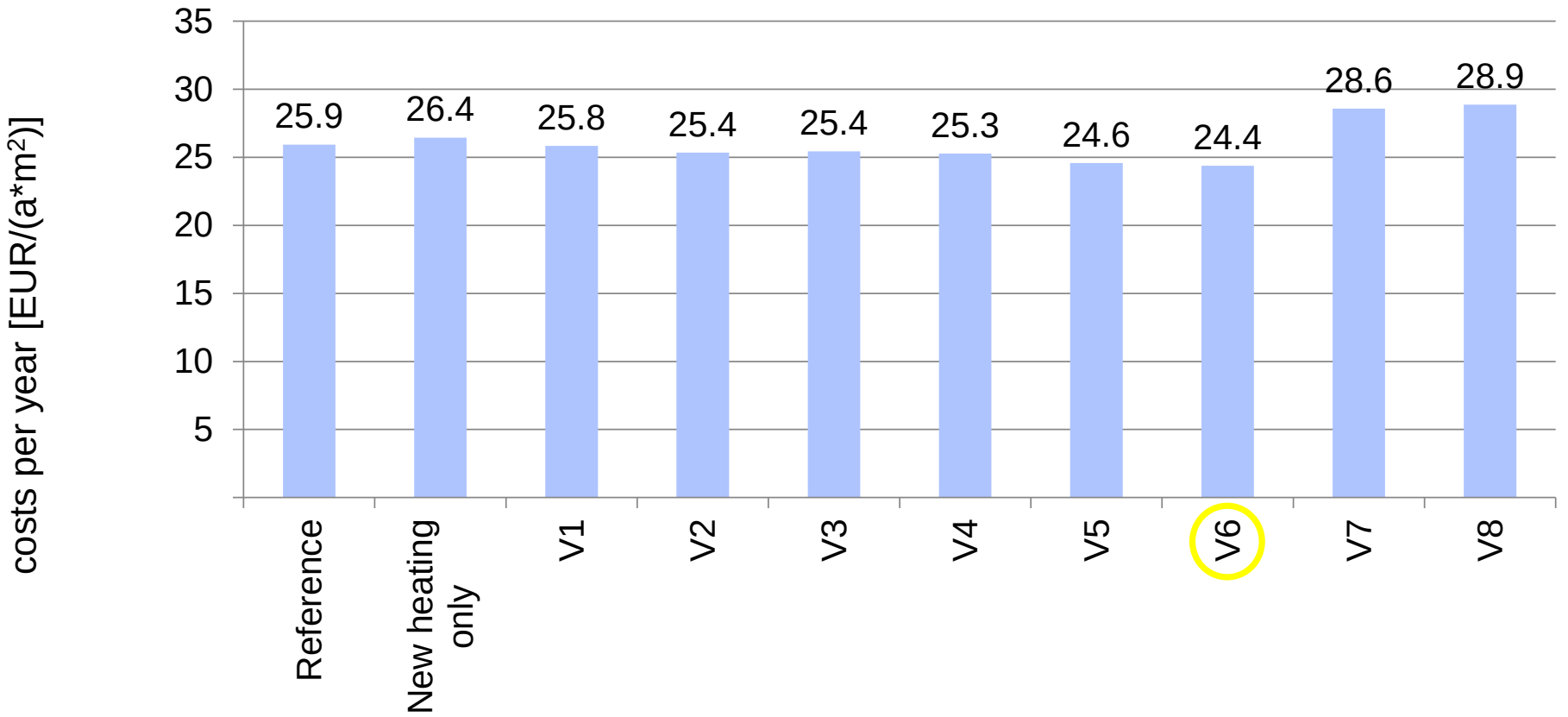
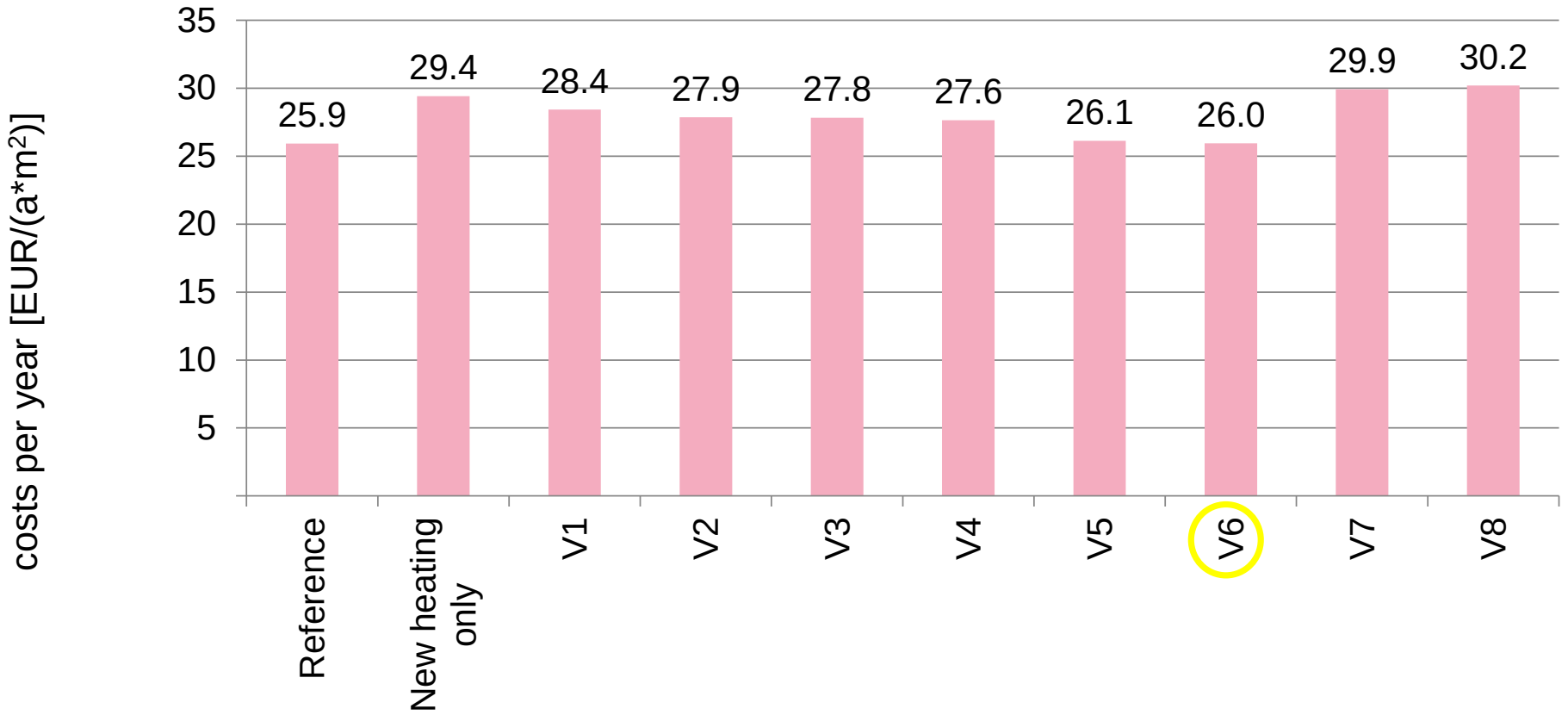
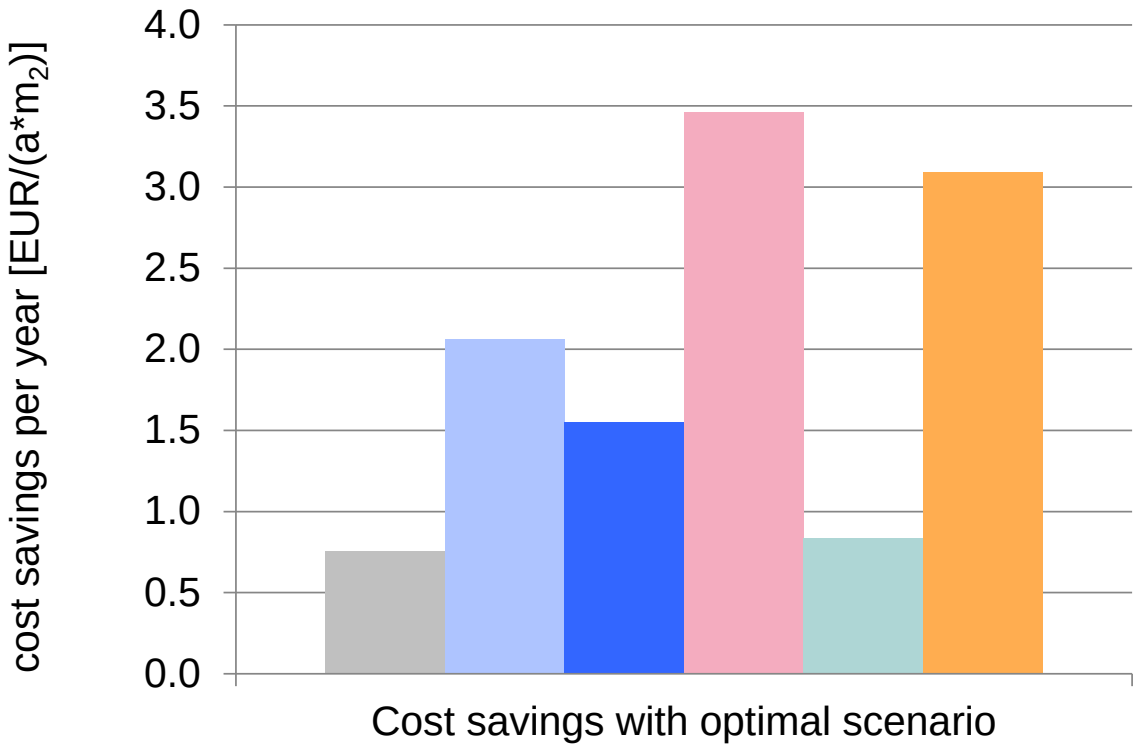
Efficiency measures on building envelopes with air-source heat pumps



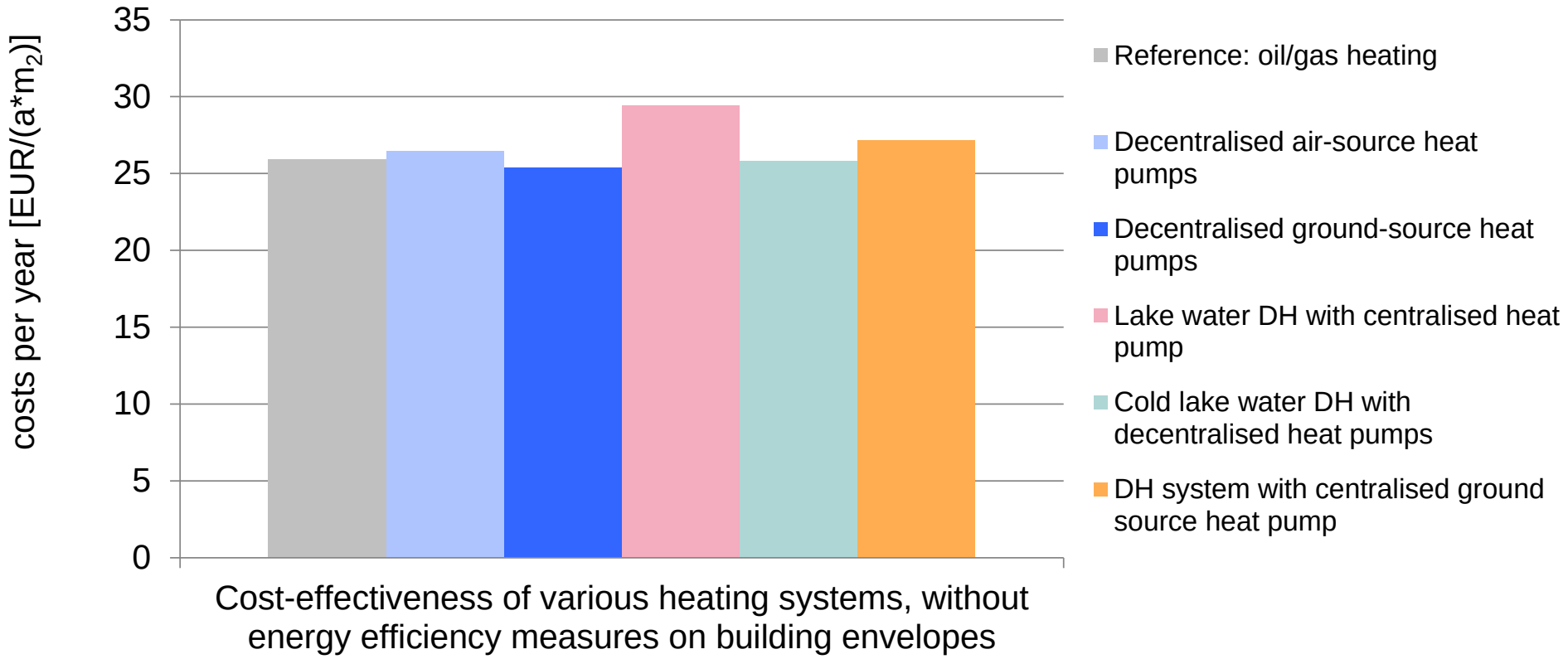
Efficiency measures on building envelopes with lake-water centralized heat pump



Cost savings through energy efficiency measures with various types of heating systems



Comparison between heating systems, without energy efficiency measures on building envelopes



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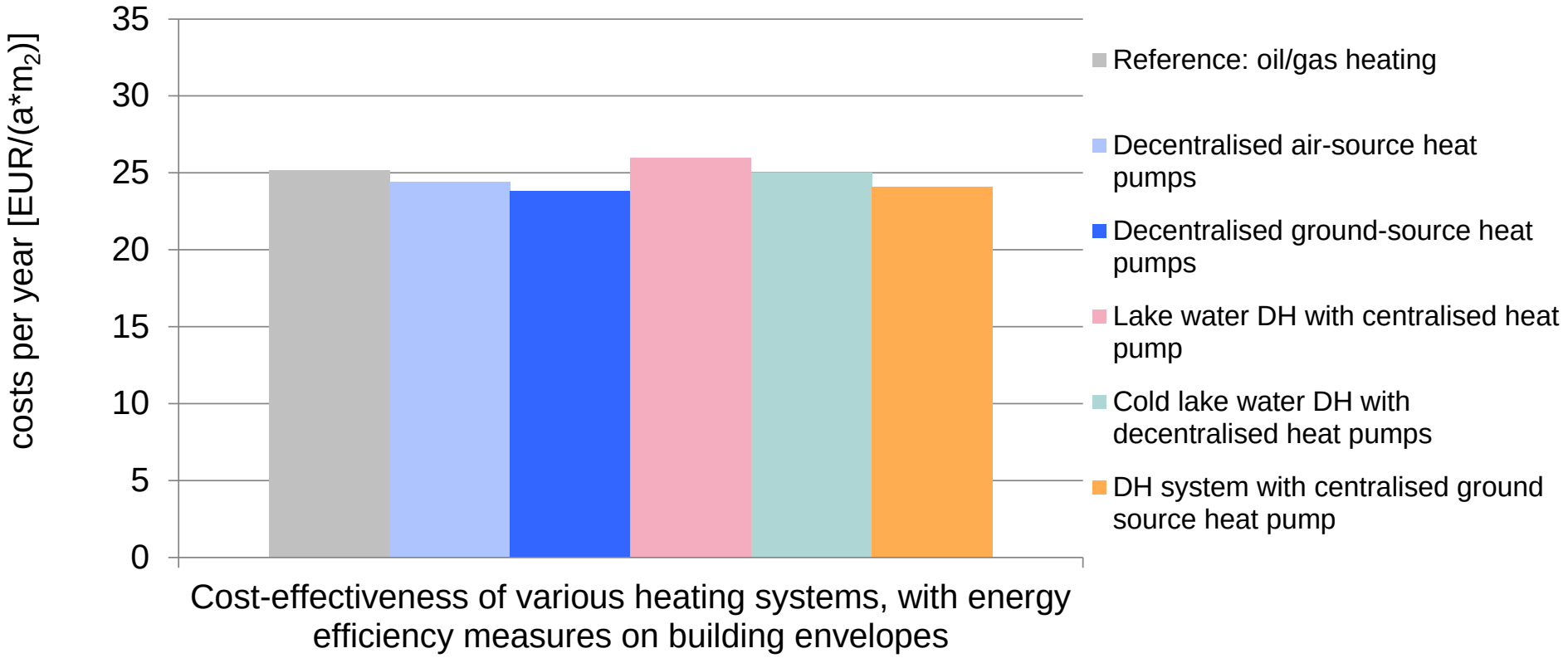
Comparison between heating systems in combination with their optimal packages of energy efficiency measures on building envelopes



Conclusions of case study

- For all investigated renewable energy systems, energy efficiency measures on building envelopes are at least as cost-effective as with a fossil fuel based heating system
- For individual heating systems and for district heating systems, the same package of efficiency measures on the building envelopes is most cost-effective
- The cost-effectiveness of various investigated heating systems is relatively similar.
- Synergies between efficiency measures on building envelopes and the use of renewable energies are larger for district heating systems compared with decentralized energy efficiency systems

Strategy development

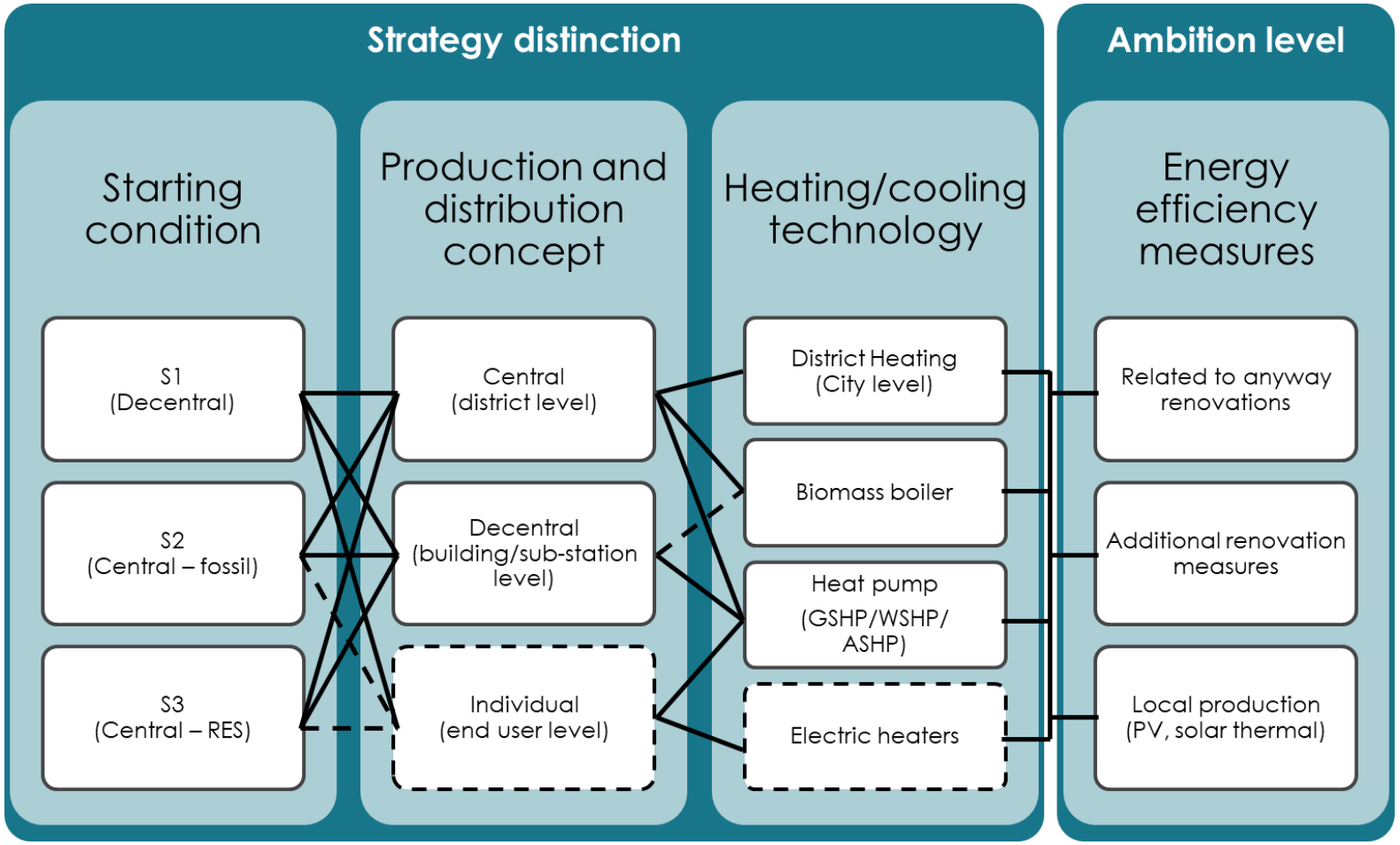


Image source: Walnum et al. 2023

Selected conclusions for strategy development (I)

- There are no one-fits-all solutions. Each district has to be investigated individually, taking into account its specificities.
- The best solutions depend on the starting situation of the district:
  - insulation levels and associated energy needs
  - availability of existing district heating system, installed heating/cooling systems
  - available energy sources
  - possibilities for integrating renewable energies

I

Selected conclusions for strategy development (II)

- Synergies between energy efficiency measures and renewable energy based heating systems occur for all types of heating systems. The same package of renovation measures on building envelopes usually most cost-effective.
- Key factor for synergies: possibility to lower the temperature of the grid due to energy efficiency measures on the building envelopes, with solutions for safety of domestic hot water from health perspective

Selected conclusions for strategy development (III)

- The difference in cost-effectiveness between centralised and decentralised solutions is often small; economies of scale vs. losses due to distribution / less efficient heat pumps at high temperatures + more planning and higher risks.

  → There is often no clear economic case for choosing centralised approaches.

- However, there may be other good reasons for preferring centralised approaches:
  - make use of a large heat source or of a seasonal thermal storage
  - have more flexibility
  - reduce the burden on the electricity grid
  - provide a heating solution also to buildings for which a switch to a decentralised system based on renewable energies is a big challenge.
  - ...
- If policy makers would like to see district projects be implemented to harness these benefits, policy measures are necessary, because the market all by itself is unlikely to deliver district solutions to a large extent.

Energy in Buildings and Communities Programme

https://annex75.iea-ebc.org

EBC Annex 75 Tool:

https://annex75.bim.energy/

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EBC

Barriers and drivers for energy efficient renovation at district level

Authors:
Erik Johansson & Henrik Davidsson, Lund University, Sweden

Research approach

Energy-efficient renovation at district level

RQ 1: What are the main barriers and drivers?

RQ 2: What barriers must be overcome to achieve successful renovation?

RQ 3: What are the most important drivers enabling renovation?

Research approach

Method

- Analysis of 15 success stories – recent renovation projects at district level
- 38 interviews with different stakeholders

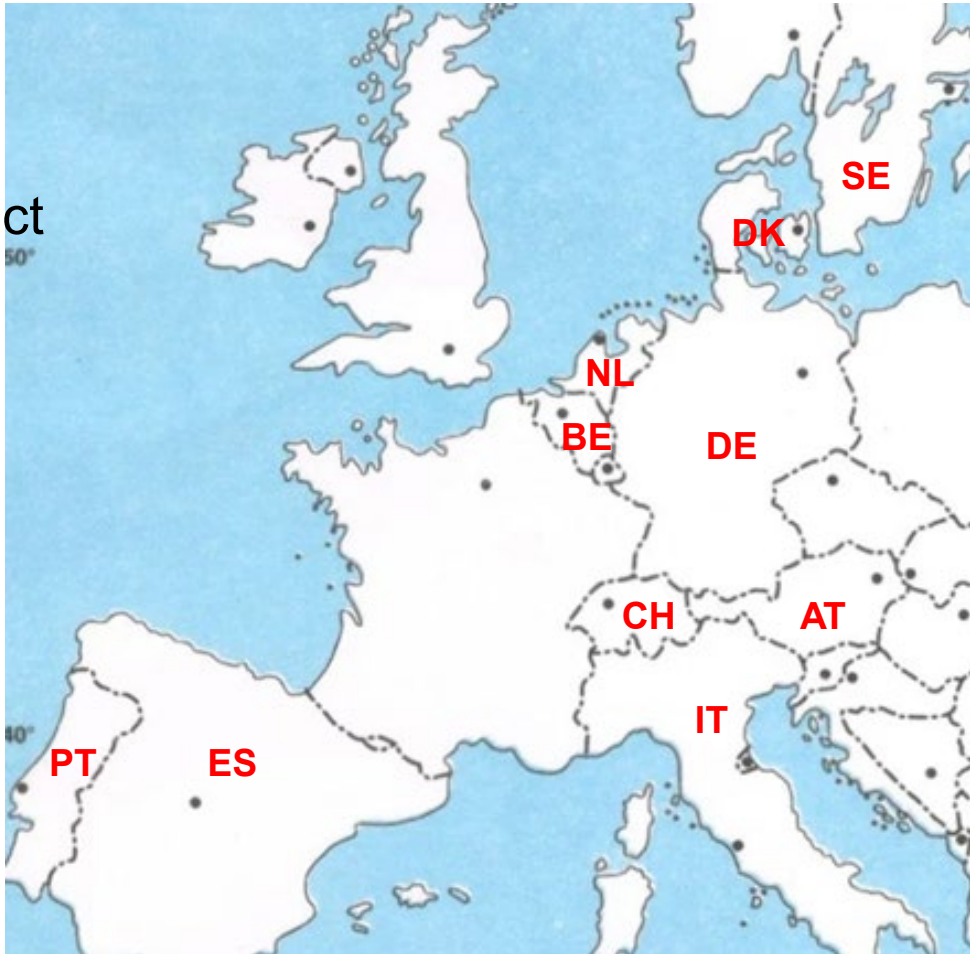
Research approach

Method

- Analysis of 15 success stories – recent renovation projects at district level
- 38 interviews with different stakeholders

Countries involved

- Success stories: 7 countries
- Interviews: 8 countries
- Representing northern, central and southern Europe



Research approach

Type of stakeholder

- **Policy actors**
  (authorities, public agencies, etc)
- **Renovation solution suppliers**
- **Energy solution suppliers**
- **Clients and beneficiaries** (investors, residents, homeowner & housing associations, etc)
- **Financing intermediaries**
  (banks, real estate developers, etc)
- **Other intermediaries**
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Categories of barriers and drivers

- Policy aspects
- Legal aspects
- Economic aspects
- Social aspects
- Communication
- Technical aspects
- Knowledge and training

Results – main barriers

Results – main barriers

Policy aspects

- Lack of synchronization between authorities at local, regional and national level
- Local authorities lack financial and human resources and technical expertise, especially small municipalities
- It is often difficult for municipalities to influence private actors and homeowner associations

Results – main barriers

Policy aspects

- Lack of synchronization between authorities at local, regional and national level
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Legal aspects

- Too rigid legal framework (energy requirements, tenant laws, etc)
- Complex ownership structure in districts

Results – main barriers

Economic aspects

- Lack of financial incentives, especially at district level
- Lack of financial support to low-income people
- Private homeowners do not want to take out loans

Results – main barriers

Economic aspects

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Social aspects

- Risk that low-income people need to move from the district (being vulnerable to increase of costs)
- Lack of trust in authorities and other actors involved in energy renovation

Results – main barriers

Communication

- Poor dialogue and coordination between stakeholders
- Lack of adequate advice and guidance

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Technical aspects

- Difficult for residents to switch from individual to centralised installations
- Great variation in technical condition of buildings in the district

Results – main barriers

Communication

- Poor dialogue and coordination between stakeholders
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Technical aspects

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- Great variation in technical condition of buildings in the district

Knowledge and training

- Insufficient knowledge and expertise among several stakeholders (authorities, consultants, contractors, …)

Results – main drivers

Results – main drivers

Policy aspects – the role of *local authorities/municipalities*:

- Act as coordinating actors to reach many stakeholders
- Develop visions, energy strategies and tools
- Organise consulting and awareness campaigns
- Improve the outdoor environment in the districts
- Facilitate necessary permissions
- Provide funding framework for homeowners and housing associations

Results – main drivers

Economic aspects

- Use of bank guarantees and revolving loan funds
- Economic incentives to encourage a shift to carbon free energy
- Financial help to low-income groups
- Economy of scale: change from individual heating of each building to district heating

Results – main drivers

Economic aspects

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Social aspects

- Citizen involvement and user participation to raise acceptance
- Facilitate for residents to stay in the district to maintain social cohesion

Results – main drivers

Communication

- Advice and guidance to involved actors during the whole renovation period
- Stakeholder dialogue throughout the project, eg thematic workshops
- Dialogue between local authorities and citizen groups to build trust

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Technical aspects

- Standardization and prefab solutions at district level, especially when many buildings are of a similar type

Results – main drivers

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Technical aspects

- Standardization and prefab solutions at district level, especially when many buildings are of a similar type

Knowledge and training

- Training of key actors involved in different parts of the renovation

Recommendations/conclusions

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- Holistic approach to district renovation, combining energy renovation with upgrading of the district (improved outdoor environment and social infrastructure) – this will help creating trust.

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- Local authorities should have a leading role in coordinating district renovation including:
  - communicating with different stakeholders
  - identifying appropriate solutions for a given district,
  - support the creation of appropriate legal structures.

Recommendations/conclusions

- Holistic approach to district renovation, combining energy renovation with upgrading of the district (improved outdoor environment and social infrastructure) – this will help creating trust.
- Local authorities should have a leading role in coordinating district renovation including:
  - communicating with different stakeholders
  - identifying appropriate solutions for a given district,
  - support the creation of appropriate legal structures.
- Public housing associations can play an important role in energy renovation at district level especially if the municipality has ambitious goals as regards energy efficiency and use of renewable energies.

Recommendations/conclusions

- Already implemented projects can lead to certain standardisation and thereby more efficient construction, to achieve synergy effects, prefab solutions and standardization of processes.

Recommendations/conclusions

- Already implemented projects can lead to certain standardisation and thereby more efficient construction, to achieve synergy effects, prefab solutions and standardization of processes.
- Best practise examples constitute a good way to encourage the spread of renovation at district level, either starting by single buildings and upscaling it to districts or to spread good district examples to other districts.

Further information

- Johansson E & Davidsson H (2023): Barriers and drivers for energy efficient renovation at district level, IEA EBC Annex 75
- Rose J et al (2021): Building renovation at district level – Lessons learned from international case studies, Sustainable cities and Society, 103037
- Domingo-Irigoyen S (2023): Success stories of cost-effective building renovation at district level combining energy efficiency and renewables, IEA EBC Annex 75

Q & A

moderated by BUILD UP

Attendee poll

moderated by BUILD UP

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EBC

Policy instruments for building renovation at district level combining energy efficiency and renewable energy systems

Authors:
Erwin Mlecnik, TU Delft, The Netherlands
Juan Maria Hidalgo-Betanzos, Universidad del País Vasco UPV/EHU, Spain

Introduction

EU Energy Performance of Buildings Directive: need for increasing renovation rates, minimum building energy performance standards and long-term renovation strategies

EU Renovation Wave: placing an integrated participatory and neighbourhood based approach at the heart of renovation

New Leipzig Charter: the district as an important level for integrated urban transformation

Renewable energy systems at district scale are better developed then renovations at district scale

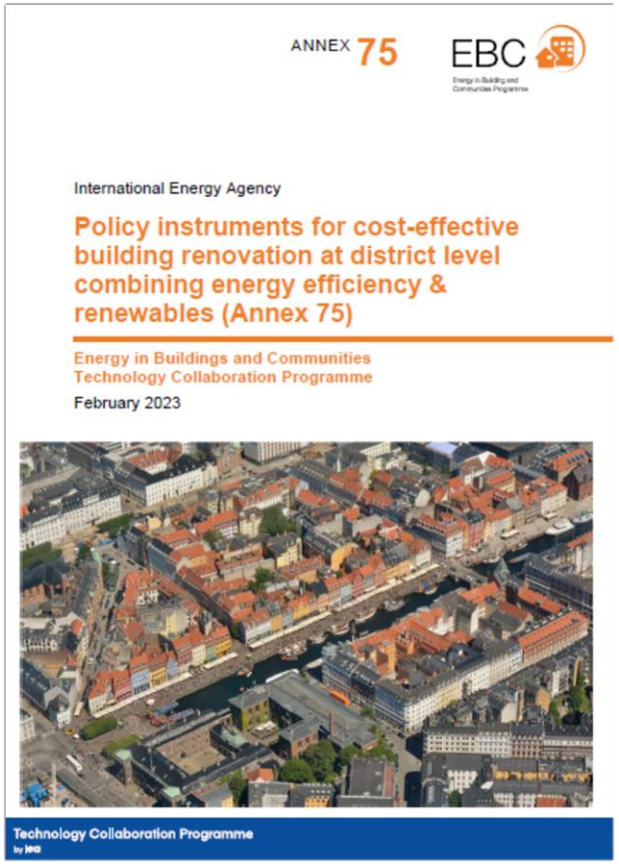
Policy instruments are needed to achieve breakthroughs regarding building renovation at district scale

⇒ Stronger **steering and shaping role for Local Authorities** for upscaling the number of renovations including energy efficiency measures, combined with a switch to renewable energy systems

Research approach

Research Question: How can policies (deployed at local level) increase residential building renovation and renewable energy systems at district level?

- Catalogue of policy instruments
- 3 international workshops & 38 in-depth interviews from 8 countries, using a standardized questionnaire
- Quantitative assessment on the degree stakeholders think proposed policy instruments can be useful, important and easy to implement
- Qualitative assessment about the use of policy instruments to engage stakeholders and about the perceived successes and failures of the policy instruments



Catalogue of policy instruments

- **Regulations**
  - Enforcement of minimum energy standards in districts
  - Inspections and audits in districts
- **Incentives**
  - Financial incentives created by local authorities for districts
- **Planning and tendering for districts**
- **Organizational instruments**
  - Creation of renovation services in districts
  - Energy advice services for citizens

⇒ **opportunities/ barriers**

- **Communication instruments**
  - Local media development
  - Energy benchmarking in districts
  - Education and training for building professionals
  - Labels for low-energy/low-emission districts
  - Local events for building owners
- **Emerging initiatives**
  - Citizen energy cooperatives
  - Energy demand side management in districts
  - Facilitation of trading of white, green and black certificates

Example top-down: Local authority planning

Opportunities:

Dealing with efficiency of buildings and energy grids at the same time

Professional top-down planning

Performance-based tendering

Legal basis

Barriers:

Mentality change needed for various stakeholders

Participation processes are still needed

Possible resistance due to ineffective consultation or lack of options

Gentrification risk

Ex. bottom-up: District advice desk

Opportunities:

Focus on unburdening the homeowners

Targeting multiple homeowners at the same time, referral to 'trusted' actors

Individual awareness raising, providing easy access to solutions

Alliances to connect supply and demand

Barriers:

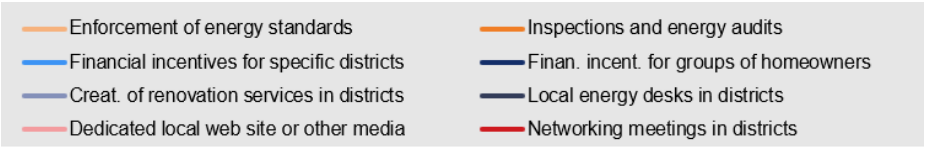
Procurement barriers, experimental tendering processes, resource-intensive

Service not necessarily targeting a specific district or customer segment

Possible lack of client follow-up

Lack of long-term engagement of stakeholders (often project-based initiatives)

Stakeholder viewpoints on policy instruments



Use & interest:

62% interviewees have direct experience and 9% more are planning to apply them.

Importance:

72% value them as important or very important to stimulate building renovation and renewable energy in districts or neighbourhoods.

Ease of development / implement:

only 25% consider them easy or somewhat easy, while 49% find them somewhat difficult or somewhat difficult to develop.

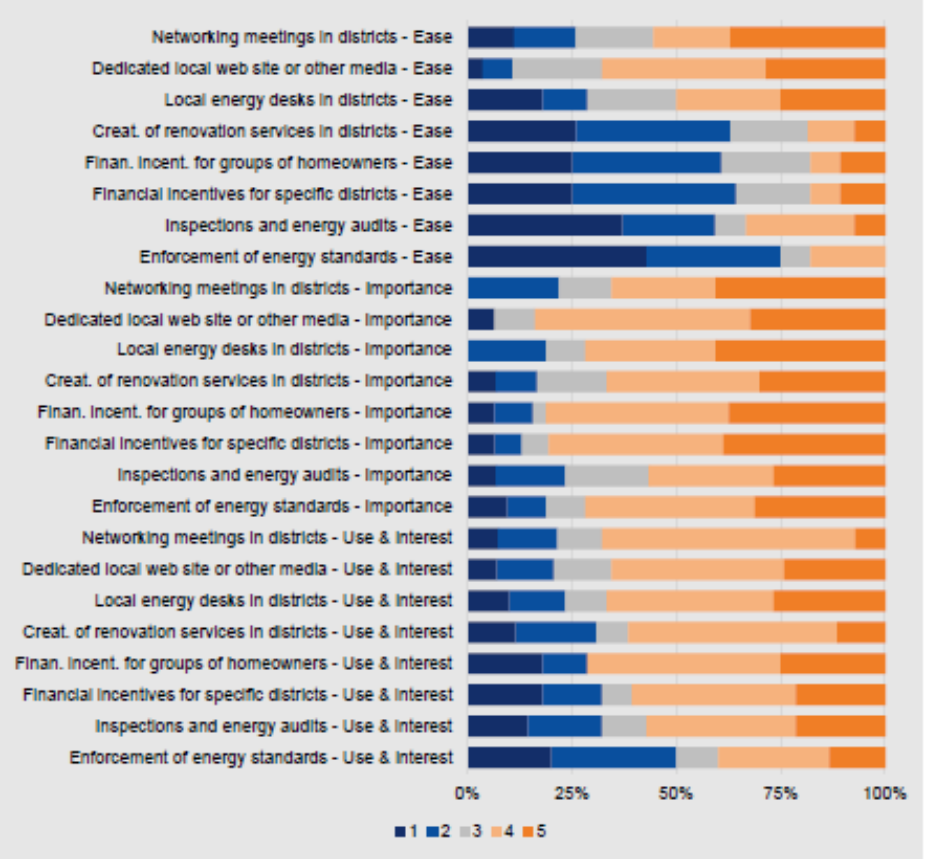
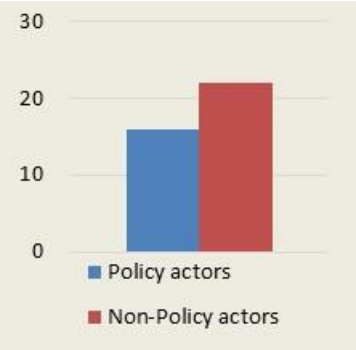
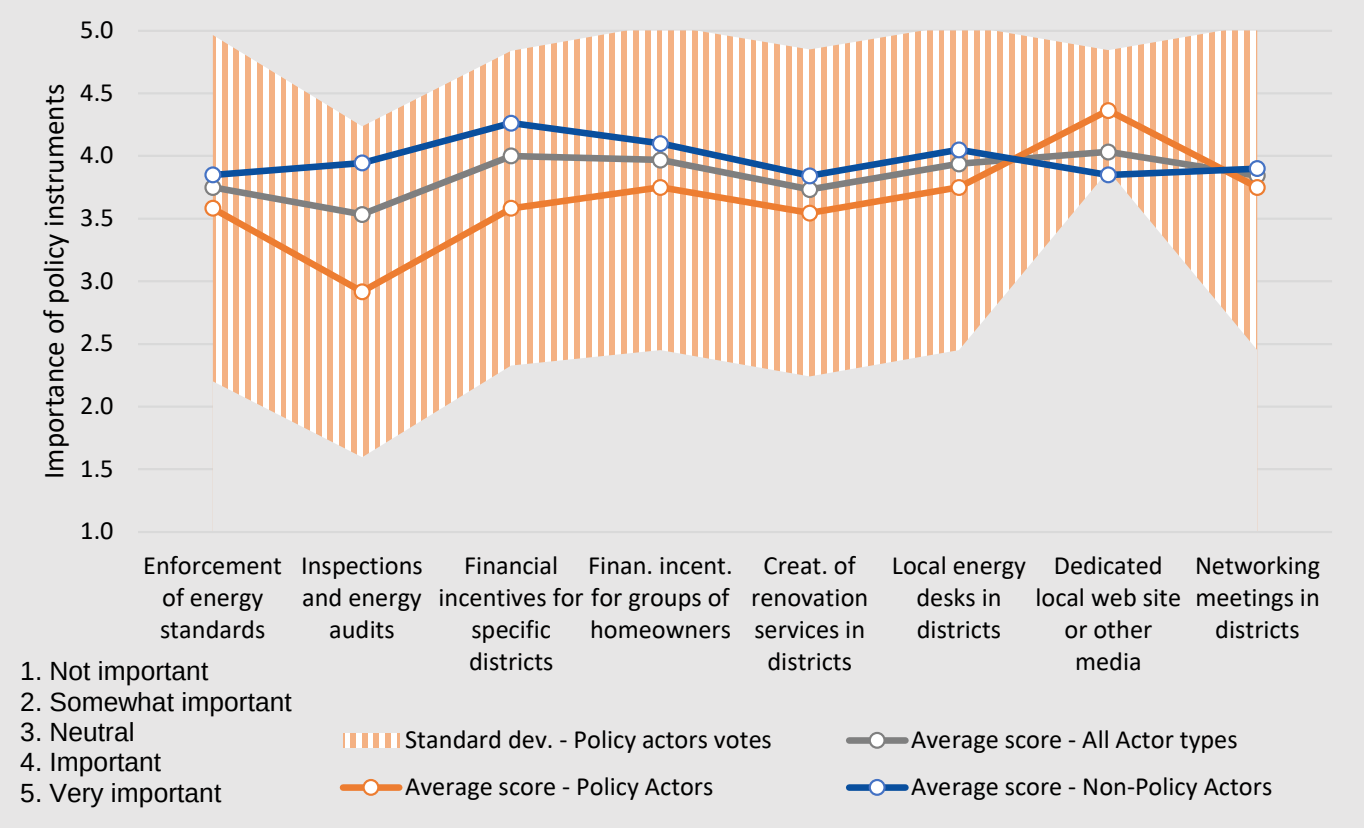


Figure 3. Summary of all scores per question and policy instrument, obtained relative frequency distribution.

Stakeholder viewpoints on policy instruments





Discussion

Countries can learn from each other's successes and failures

AT: district management offices take care of energy related renovations (Vienna)

BE: 'neighbour grant' didn't lead to expected outcome

CH: cantonal subsidies (and obligations) for switching to renewable energy based heating systems; voluntary energy performance labels (Minergie, 2000-Watt areas)

GE: combination of KfW 432 grant with Städtebauförderung & regional & local add-ons

NL: responsibility of local authorities for developing district heat plans

ES: policy for rehabilitation of rural areas

Local Authorities can be drivers of district projects but largely depend on available (sometimes inconsistent) national and regional structures, initiatives, support and resources

Conclusion

A district scale approach can lead to upscaling of energy renovations, but comes with important local and social challenges, that can be addressed with various types of policy instruments

The proposed policy instruments are generally considered useful and important for accelerating building renovations at district scale combining energy efficiency and renewable energy systems

⇒ **Put emphasis on making the local implementation of these instruments easier**

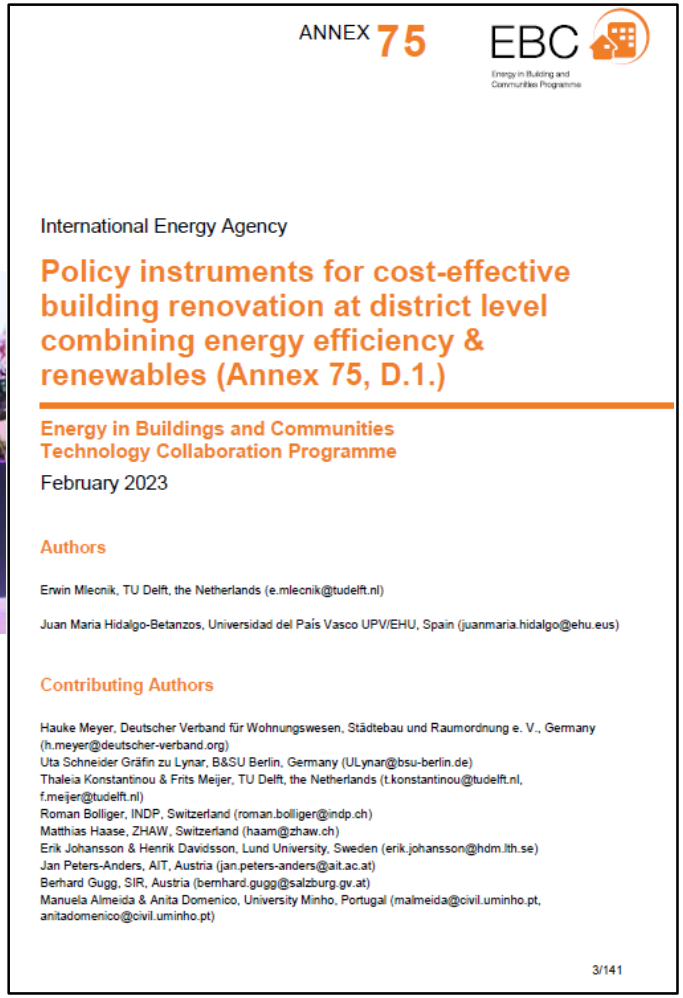
⇒ **National policy to alleviate possible barriers**

⇒ **Empower or unburden Local Authorities**

Thank you

This work was supported by:

- Dutch Enterprise Energy Agency (RVO)
- Laboratory of Quality Control of Buildings, the Department of Territorial Planning, Housing and Transport, of the Basque Region Government



ANNEX 75

EBC
Energy in Building and Communities Programme

International Energy Agency

Policy instruments for cost-effective building renovation at district level combining energy efficiency & renewables (Annex 75, D.1.)

Energy in Buildings and Communities Technology Collaboration Programme

February 2023

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EBC

Business models for cost-effective building renovation at district level combining energy efficiency & renewables

Authors:
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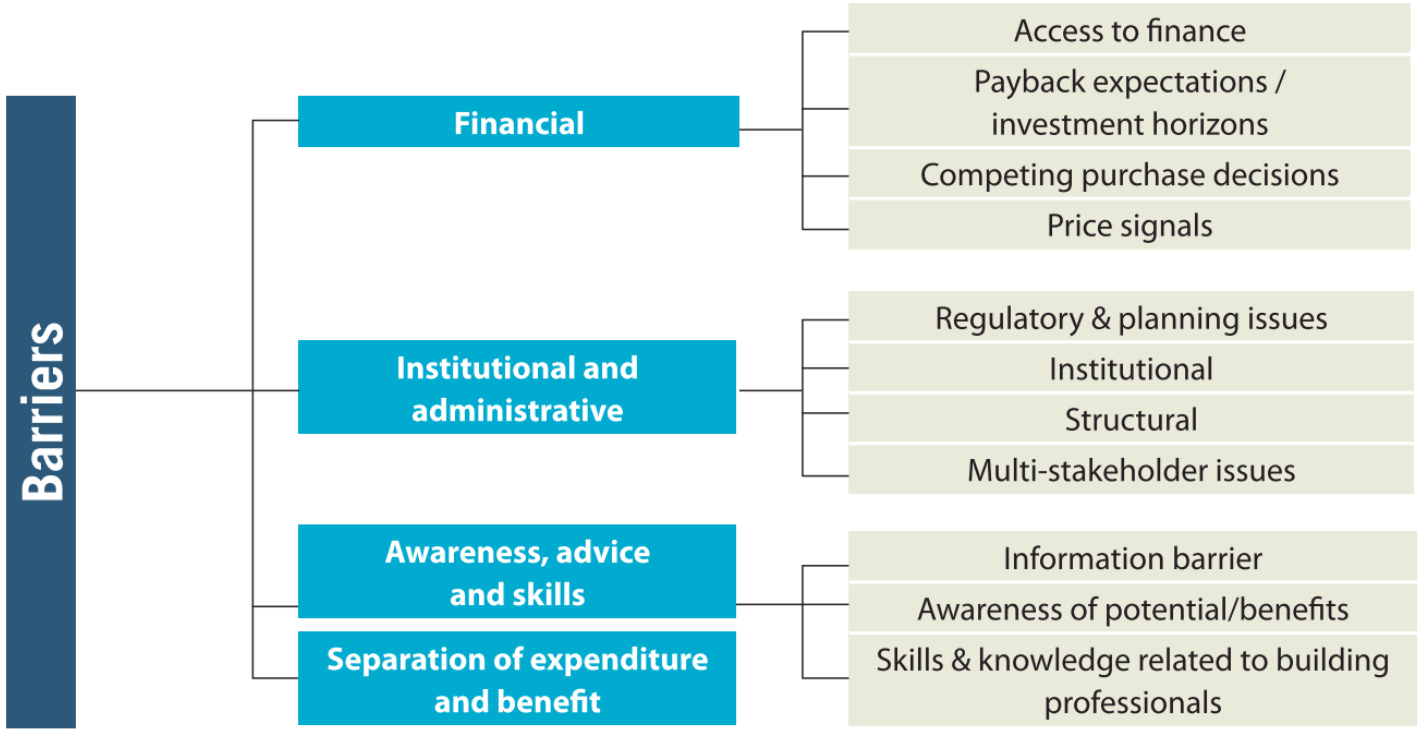
Introduction

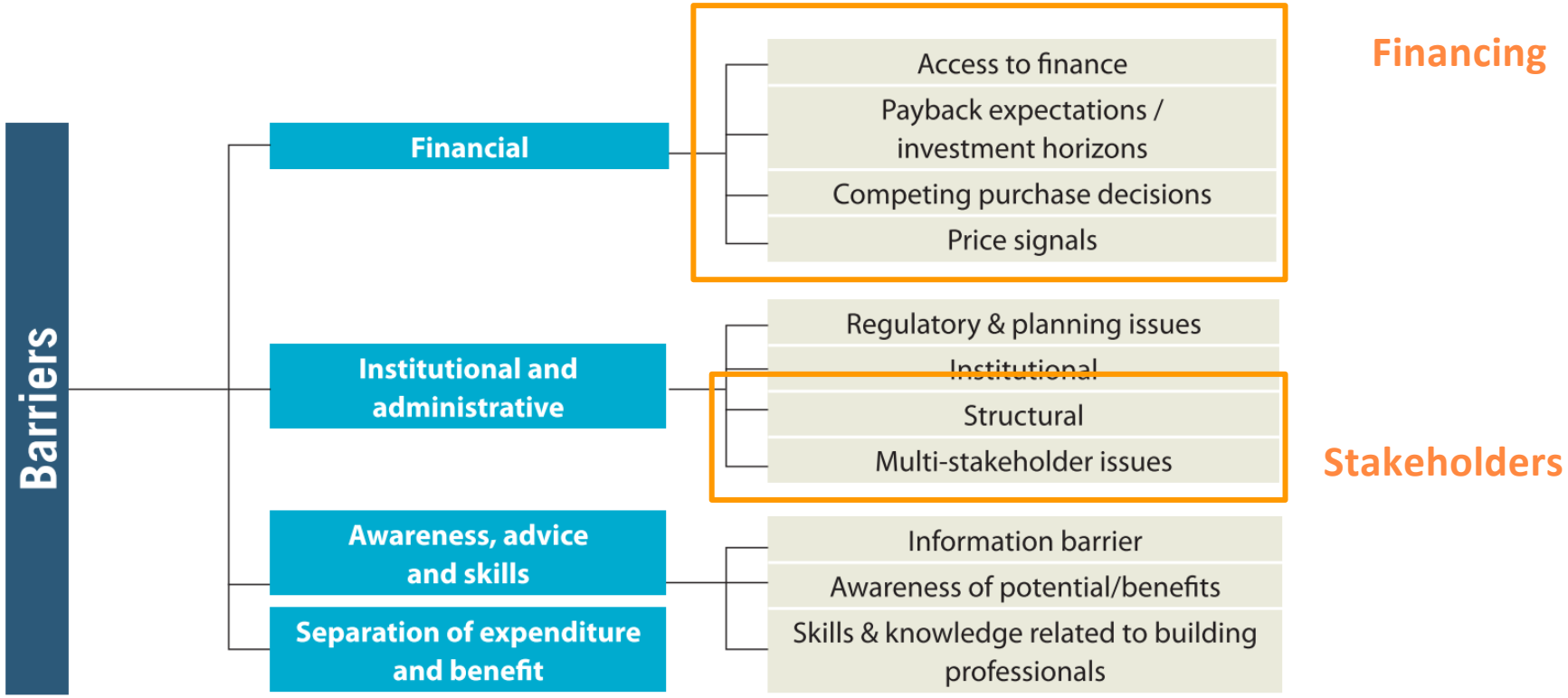
The role of Business models for energy renovation



Barriers to renovation identified by the BPIE survey "European buildings under the microscope. *Figure from: BPIE, 2011*

Introduction

The role of Business models for energy renovation



Barriers to renovation identified by the BPIE survey "European buildings under the microscope. *Figure from: BPIE, 2011*

Introduction

Goals

- Identifying the key characteristics of business models are important to upscale business from building to district level.
- Gain insights about the opportunities that BMs offer for the different stakeholders, in order support the implementation of the renovation and the stakeholder dialogue.
- Give recommendations to stakeholders about BM to support the uptake of cost-effective combinations of energy efficiency measures and renewable energy measures in building renovation at district level.

Research Approach

Q 1: Are the current practices in BM for building renovation and energy supply applicable to district renovation?

Q 2: Who are the main stakeholders and what is their role in the BM for district renovation to combine energy efficiency and RES?

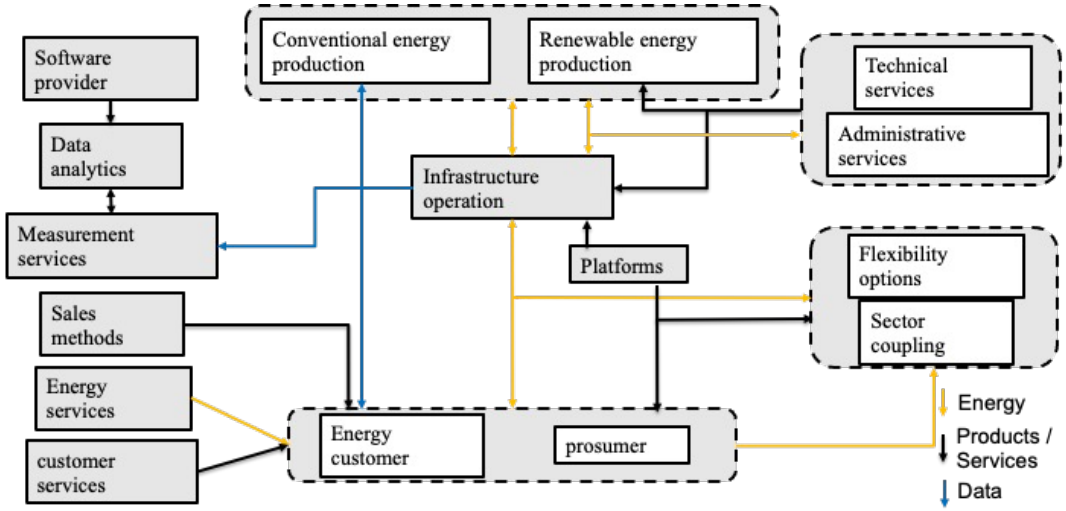
Q 3: Which BM characteristics are important to upscale district renovation to combine energy efficiency and RES?

Key findings

Catalogue of Business models

Characterised by:

- Management of the process
- Role of the beneficiary
- Involvement of intermediaries
- Service and product provided
- Benefits distribution

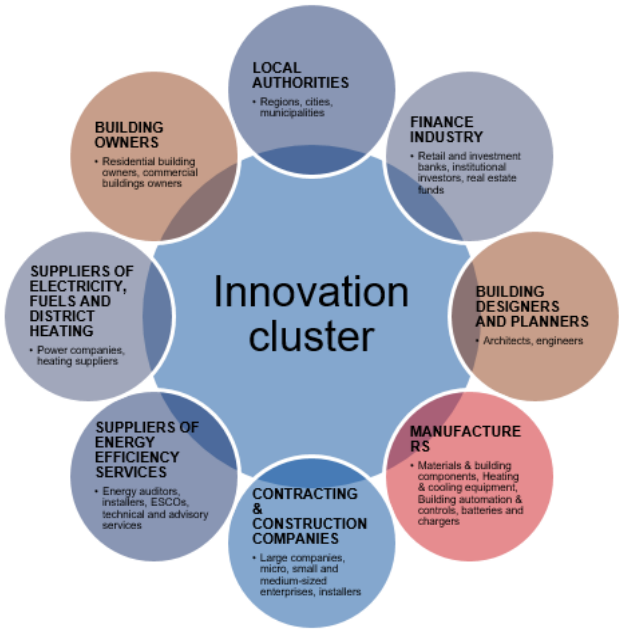


Key findings

Catalogue of Business models

Key considerations in combining building renovation and energy supply business models

- Stakeholders mapping
- Value creation
- Combine costumer segments
- Main driver: renovation or energy supply



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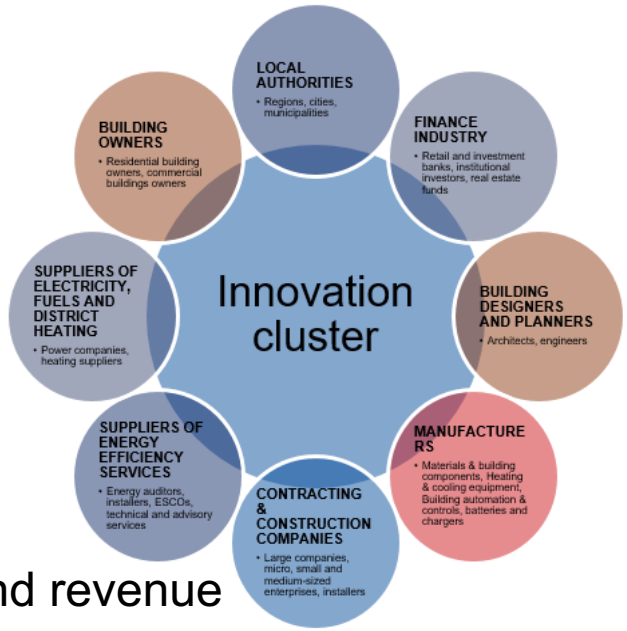


Stakeholders' views

- Role and Level of influence
- BM achetypes, Customer segment,
- Value proposition, activities, partnerships, cost and revenue
- Opportunities for upscaling

Conclusion

Current practices in BM for building renovation and energy supply applicable to district renovation

- No specific business models for energy supply applied to renovation of districts → New possibilities for new players
- Large-scale renovation BM with a single point of contact for all project's needs
- Renovation project already apply RES, eg PVs, however the small scale and not always combined as a BM
- ESCOs primarily using Energy Performance Contracts (EPCs) as a financing mechanism, has advantage in offering integral solution and services, while unburden the beneficiaries from initial investment. The integral solution can incorporate energy supply and RES as well

Conclusion

Main stakeholders and what is their role

- Policy actors and beneficiaries are the main decision makers, and as a consequence their influence is very high.
- Energy suppliers are also considered as decision maker
- Intermediaries are present in the process, but their influence is medium.
- The influence of financial intermediaries is high

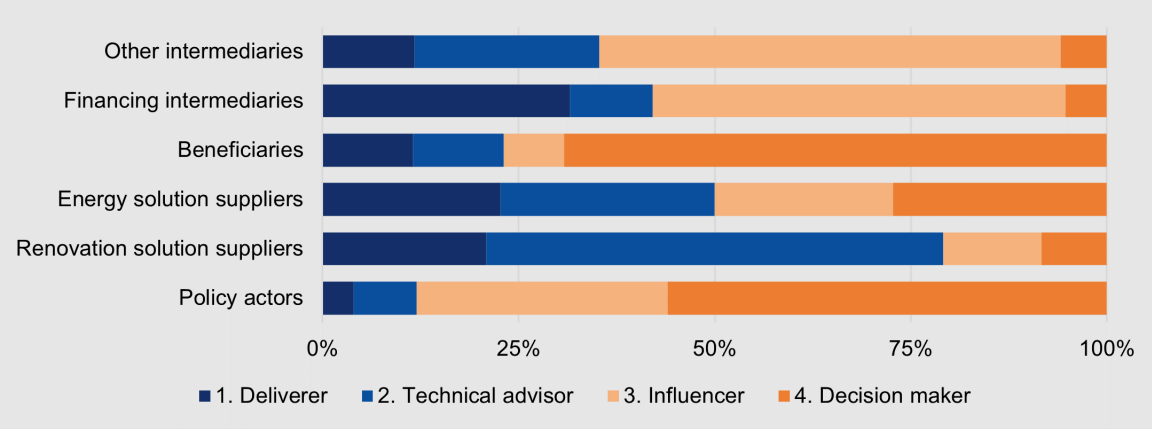


Figure 11. Role of the stakeholder types, obtained relative frequency distribution of all votes.

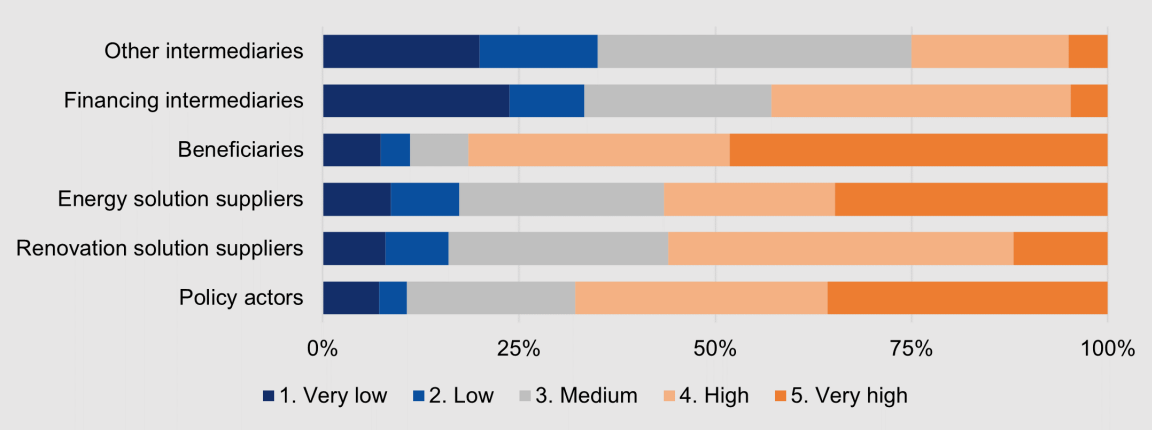


Figure 12 Perceived influence of the stakeholder types, obtained relative frequency distribution of all votes.

Conclusion

BM characteristics for upscale

Value

- Integral approach offering beyond energy efficiency technical solution
- One main point of reference
- Offer services including communication and financing
- Consider the role of the prosumer as beneficiary

Partnerships

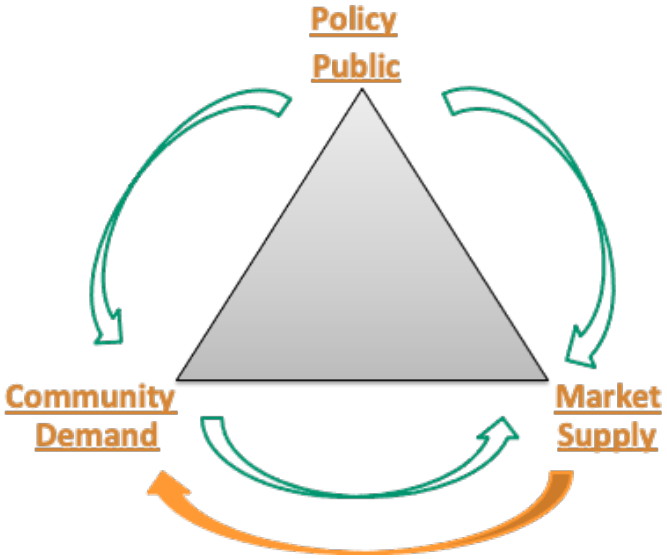
- Include both renovation and energy actors
- Policy partners need to be involved, to support communication and trust building. See it as part of district development
- Innovation in the business model and the improved energy efficiency opportunity to consider also the managing of energy and not only providing energy.

Financing

- Policy actors support with subsidies and co-financing
- Energy performance contracts that combine solution, offer high savings, unburden the beneficiaries

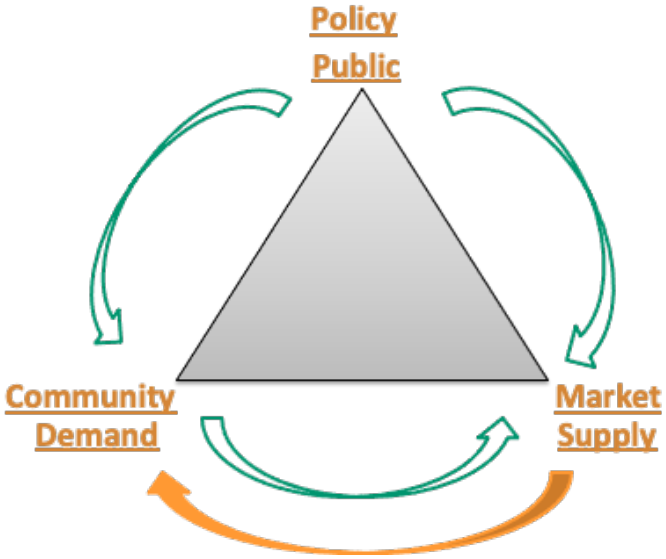
Recommendations

- District heating often involves public interest and coordination/initiation by the municipality. Need to examine possibilities for combination with renovation
- Subsidies for integral solutions and funds to co-finance
- Policy partners can give guarantees and increase trust



Recommendations

- District heating often involves public interest and coordination/initiation by the municipality. Need to examine possibilities for combination with renovation
- Subsidies for integral solutions and funds to co-finance
- Policy partners can give guarantees and increase trust
- Innovation clusters →sector coupling (building+energy)
- Offer both technical solution and process, in terms of communication, consulting and financing
- Guarantees to support the financing, long-term relation with the beneficiaries
- Combine energy renovation with other measures on building and district
- Energy companies should be part of the dialogue
- Long term planning and active participation



EBC

Business models for cost-effective building renovation at district level combining energy efficiency & renewables

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IEA EBC Annex 75

Cost-Effective Building Renovation at District Level Combining Energy Efficiency & Renewables

January 2018 – June 2023
13 participant countries | AT, BE, CH, CN, CZ, DK, ES, GE, IT, NL, NO, PT, SE

IEA EBC Annex 75

Main Findings and Recommendations

Manuela Almeida | Operating Agent
University of Minho, Portugal

Webinar

10 October 2023

IEA EBC Annex 75

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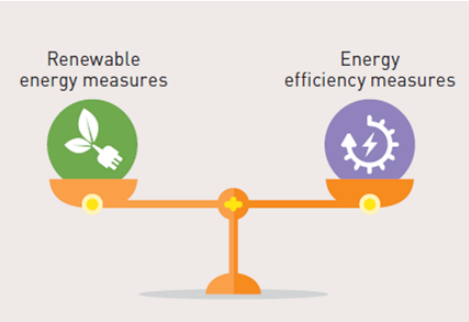
Energy in Buildings and Communities Programme

Decarbonisation of the Economy

Climate Goals

Energy Transition



- Urgency in accelerating building renovation rates towards decarbonisation
- Renovate at district or neighbourhood level is a promising approach
- Annex 75 focused on investigating cost-effective strategies for reducing carbon emissions and energy use in urban districts, with an emphasis on combining energy efficiency and renewable energy measures
- Annex 75 proved that district-level building renovation is a viable option as well as combining energy efficiency measures and renewables at a district scale
- But, success depends on a holistic approach that encompasses cost-effectiveness and co-benefits serving the public interest and improving residents' quality of life
- A framework is urgently needed that includes cooperation, information, capacity building, incentives and adapted regulations

General Findings

Renovation at district level may bring larger benefits than at individual level

- Has the potential to **accelerate building renovation**
- May allow **economies of scale** for energy efficiency measures due to aggregated demands and synergies in construction procurement, processes and planning
- Allows **benefiting from centralised renewable energy approaches** enabling to explore additional heat sources and overcome space/noise restrictions in decentralised systems
- Offers an opportunity to **address transversal issues**:

  Urban planning, housing affordability, energy grid integration (mobility, accessibility, green and blue spaces, culture and leisure, etc.)
- Has the potential to **improve the overall quality of life of the residents,** which **contributes to their acceptance** of the renovation process

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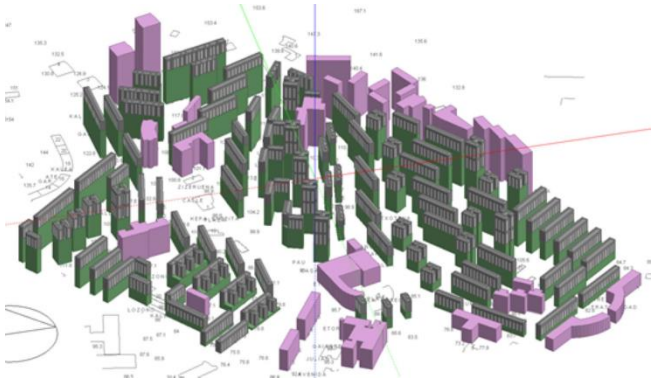
General Findings

Renovation at district level is also challenging



Source: IEA EBC Annex 75

- **Synergies between energy efficiency measures and the installation of renewable energy systems at district level may be significant, but difficult to achieve as they entail an additional level of complexity and depend on the synchronization of the buildings´ renovation cycles**
- **Districts are complex structures with several actors involved, sometimes with conflicting goals. At district level coordination and communication are crucial**
- **Building renovation at the district level is associated with:**

  High upfront costs and long payback time

  High risks of not being implemented due to a potential withdrawal of some building owners that are at different stages

Conclusions

- There are no ready-made or one-fits-all solutions. Each district has to be analysed individually, taking into account its specificities
- The best solutions depend on the starting situation of the district (as the insulation level, installed heating/cooling systems, available energy sources and the possibilities for integrating renewable energy)
- Co-benefits should be considered when deciding on the best solution to be implemented
- Not just the technical and economic aspects matter in a district energy renovation
- Social, legal and planning issues are equally important, and communication with different stakeholders is crucial
- Policy measures are necessary to make use of opportunities offered by district projects, as often they are not more cost-effective than single-building projects

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Recommendations to Policymakers

- Develop a long-term vision and a strategic plan for district-level renovations aligned with energy and climate goals and policies
- Adapt laws and regulations to stimulate building energy renovation at the district level
- Create a certification scheme also at the neighbourhood and district levels
- Promote the use of renewable energy sources, including financial incentives and unburden local collectives to make RES and energy storage systems more accessible
- Promote a holistic approach linking buildings renovation to urban planning
- Provide financial support to increase the cost-effectiveness of district-level renovation projects
- Deploy financial measures and business models to promote zero-carbon renovations
- Provide information and guidance for the different stakeholders by creating awareness campaigns, education and training programs, energy advice centres, labelling schemes, best practice guides, supporting and easy-to-use tools, etc.
- Promote stakeholder engagement and collaboration in district-level renovation projects by creating platforms for dialogue, consultation and participation, fostering trust and transparency among the parties, and addressing the social and cultural aspects of the projects
- Support innovation and research on district-level renovation by funding pilot projects, demonstration cases, technology development and testing, data collection and analysis, etc. that can show the benefits and potential of district-level renovation

- **District approaches have a significant potential for cost-effectively decarbonising the building sector, as they can offer synergies and solutions that are not possible at the individual building level**
- **However, district projects are more complex and require tailored strategies, technology combinations, policy frameworks, integrated thinking, and cooperation between different stakeholders**
- **International, national and local policymakers have to provide clear and appropriate framework conditions to make use of related opportunities and to achieve the energy transition in the building sector at a pace compatible with the decarbonisation goals**

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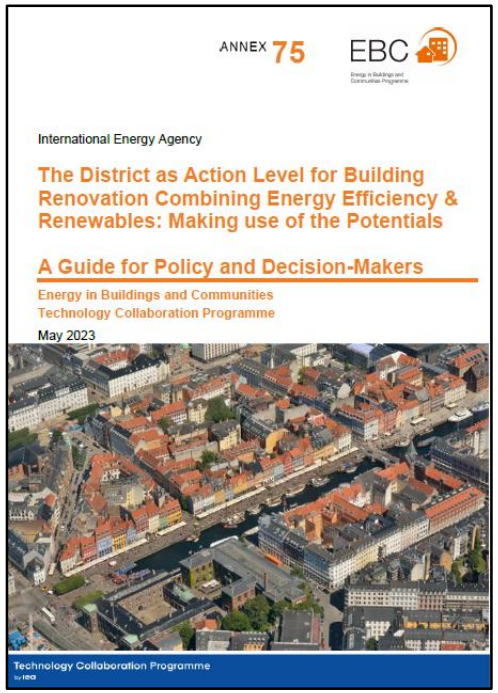
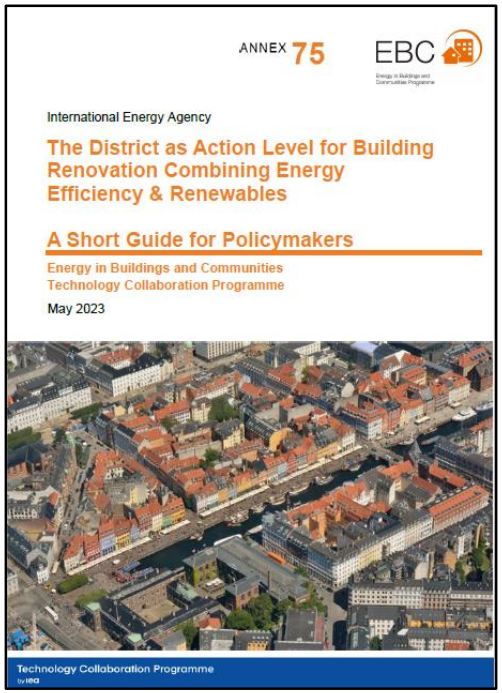
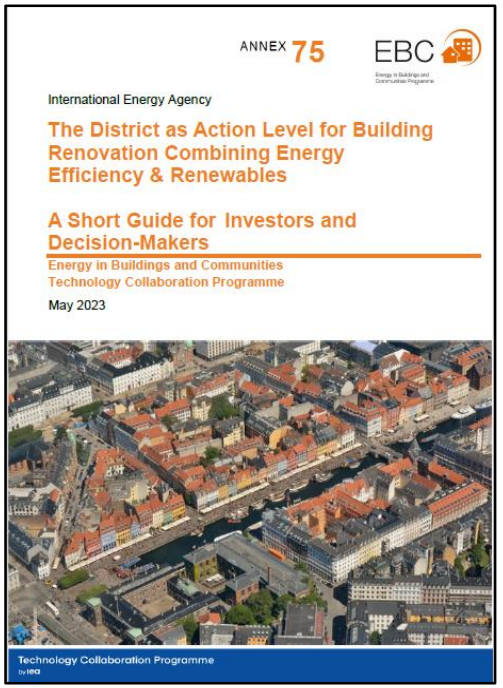
- ❑ **Guide for Policymakers and Decision-Makers**
- ❑ **Short Guide for Policymakers**
- ❑ **Short Guide for Investors and Decision-Makers**

https://annex75.iea-ebc.org/publications







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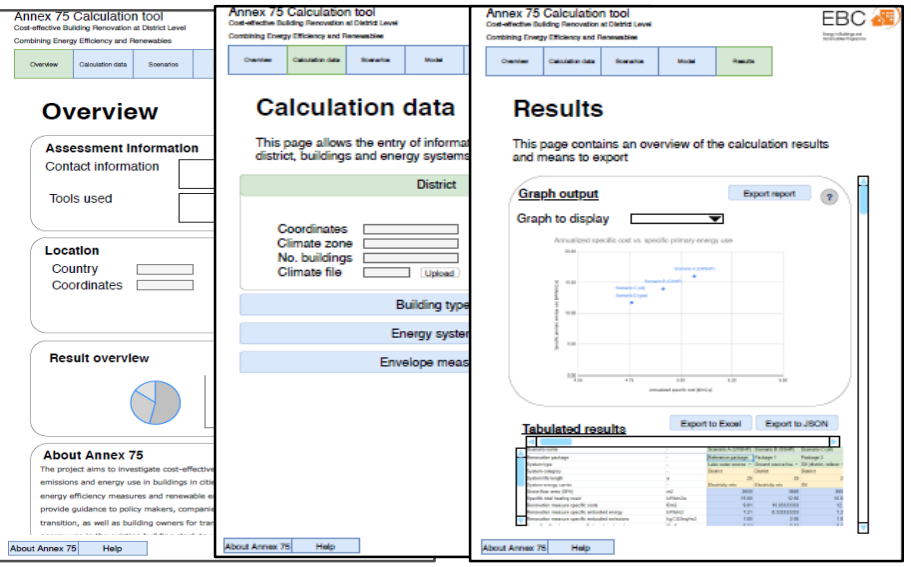
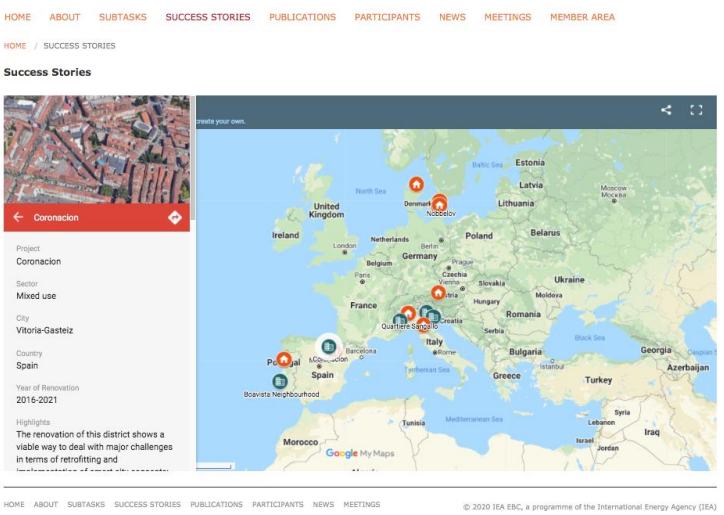


Project Outputs

Online calculation tool for district heating sizing and cost-effectiveness calculation of renovation strategies

Various Reports on Annex 75 website



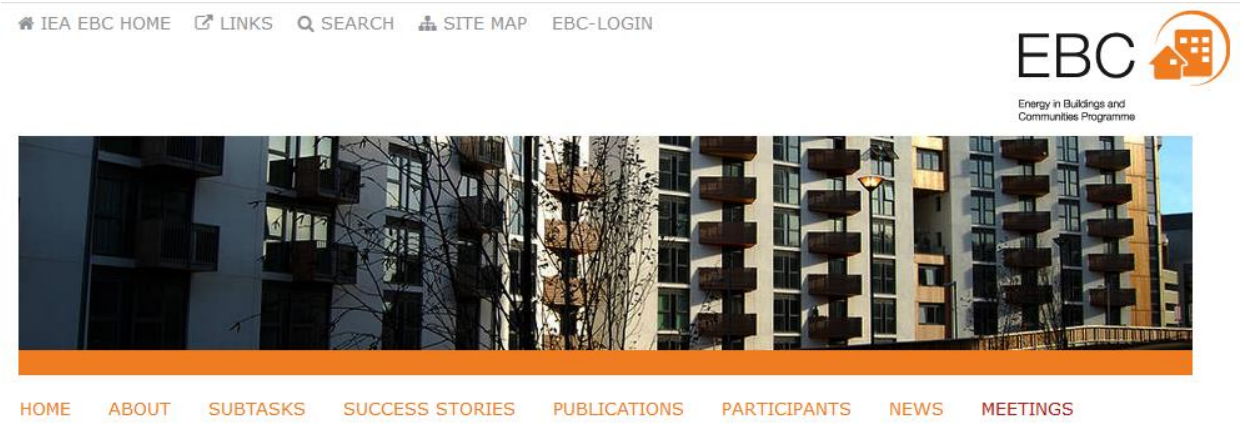
Online success stories: Interactive map integrated in the Annex 75 website

https://annex75.iea-ebc.org

Thank you for your attention!

IEA EBC Annex 75

http://annex75.iea-ebc.org/



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Q & A

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Thank you!


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