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Workshop: Cost-effective Building Renovation at District Level Combining Energy Efficiency and Renewable Energies

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SBE 2022 conference, Delft, The Netherlands, 12 October 2022

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Energy in Buildings and Communities Programme

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

January 2018 – November 2022

13 participant countries | AT, BE, CH, CN, CZ, DK, ES, GE, IT, NL, NO, PT, SE

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University of Minho, Portugal

SBE22 Delft | Workshop

12th October'2022

SBE22 DELFT

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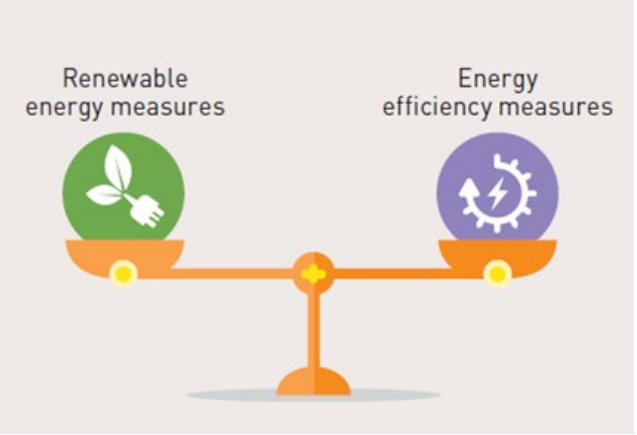
Goals

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

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Objectives

- Give an overview of existing and emerging technology options for cost-effective strategies
- Define a methodology, supported by an efficient tool, to identify cost-effective strategies for the renovation of urban districts
- Identify and document good examples, 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

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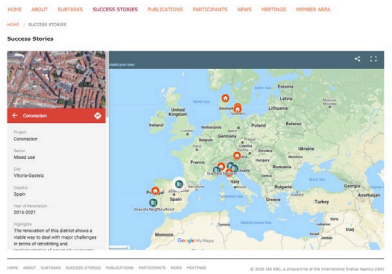
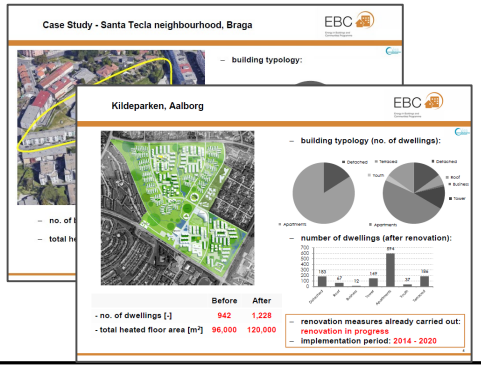
Outputs

- 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



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

- ❑ **Has the potential to accelerate buildings renovation**
- ❑ **May allow economies of scale for energy efficiency measures due to aggregated demands and synergies in construction procurement, processes and planning**
- ❑ **Gives the opportunity of benefiting from centralised renewable energy approaches**
- ❑ **Offers an opportunity to address transversal issues:**

  Housing affordability, energy grid integration and urban planning (mobility, accessibility, culture and leisure, green and blue spaces, 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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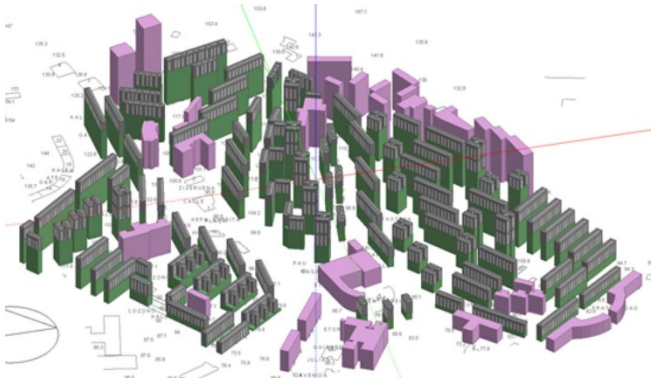
Renovation at district level is also challenging



Source: IEA EBC Annex 75

- Synergies between energy efficiency measures and the installation of renewable energy systems at district level are difficult to achieve as they depend on the existing heating systems and 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

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General Findings

- **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 system, available energy sources and the possibility of integrating renewable energies)**
- **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 essential to implement district energy renovations because the market by itself is unlikely to deliver district solutions to a large extent**

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Recommendations

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- ❑ Adapt laws and regulations to stimulate building energy renovation at the district level
- ❑ Create a certification scheme also at the district level
- ❑ Make the implementation of RES mandatory whenever a heating system or district grid is replaced and when there are adequate conditions for renewables integration
- ❑ Promote a holistic approach linking buildings renovation to urban planning, energy grid development and carbon reduction goals
- ❑ Assure quality in procurement, design and execution by facilitating easy-to-use and reliable tools
- ❑ Provide a single point of contact offering integrated solutions and services
- ❑ Deploy financial measures and business models to promote zero-carbon renovations
- ❑ Create financial incentives and unburden local collectives to make RES and energy storage systems more accessible
- ❑ Facilitate specialised training for the whole chain of the building sector professionals, building owners and local administration staff
- ❑ Provide transparent communication

Annex 75 information

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

linkedin.com/company/ebc-annex-75-project/

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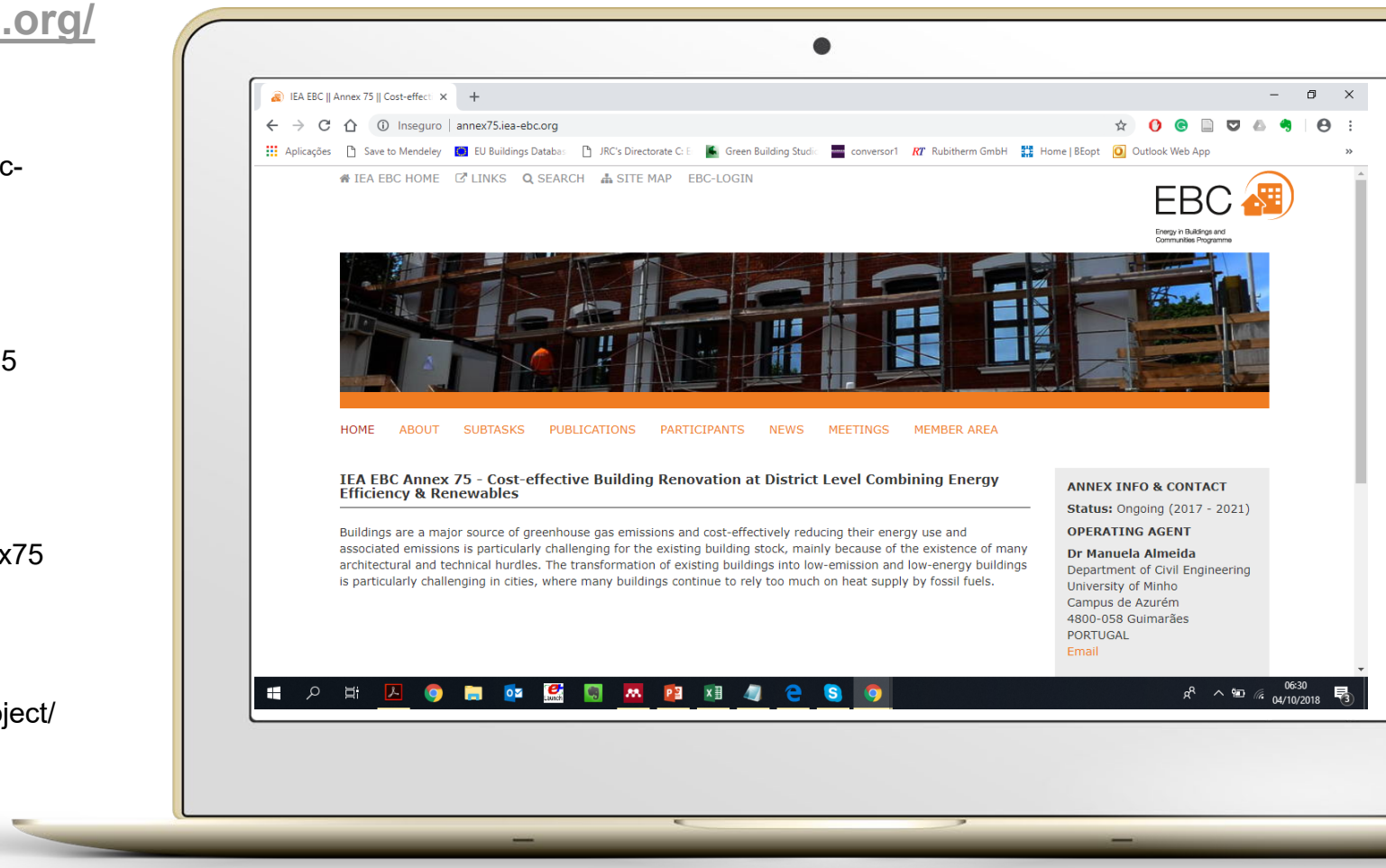
twitter.com/iea_ebc_annex75

www.researchgate.net/project/IEA-EBC-Annex-75



Thank you for your attention!

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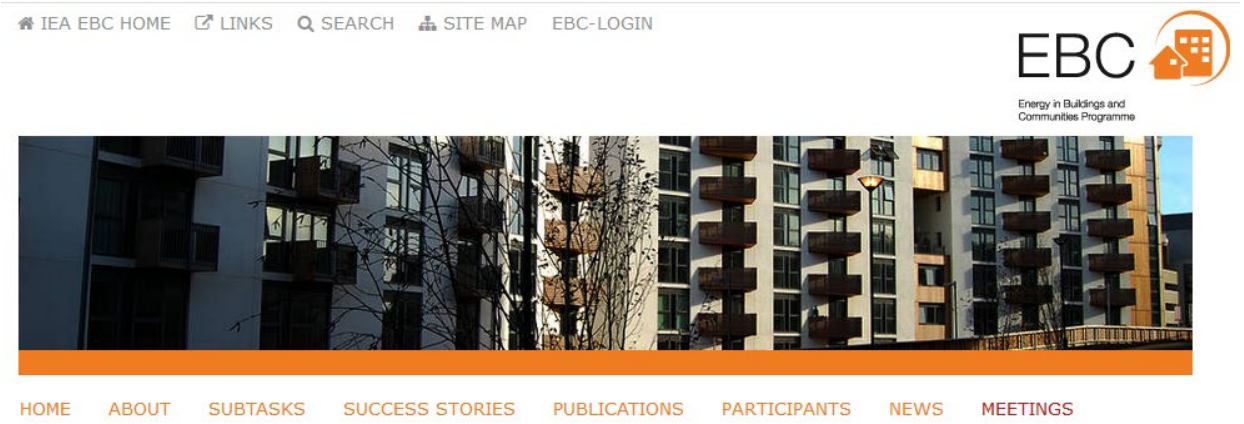

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Cost-Effective Building Renovation at District Level Combining Energy Efficiency & Renewables

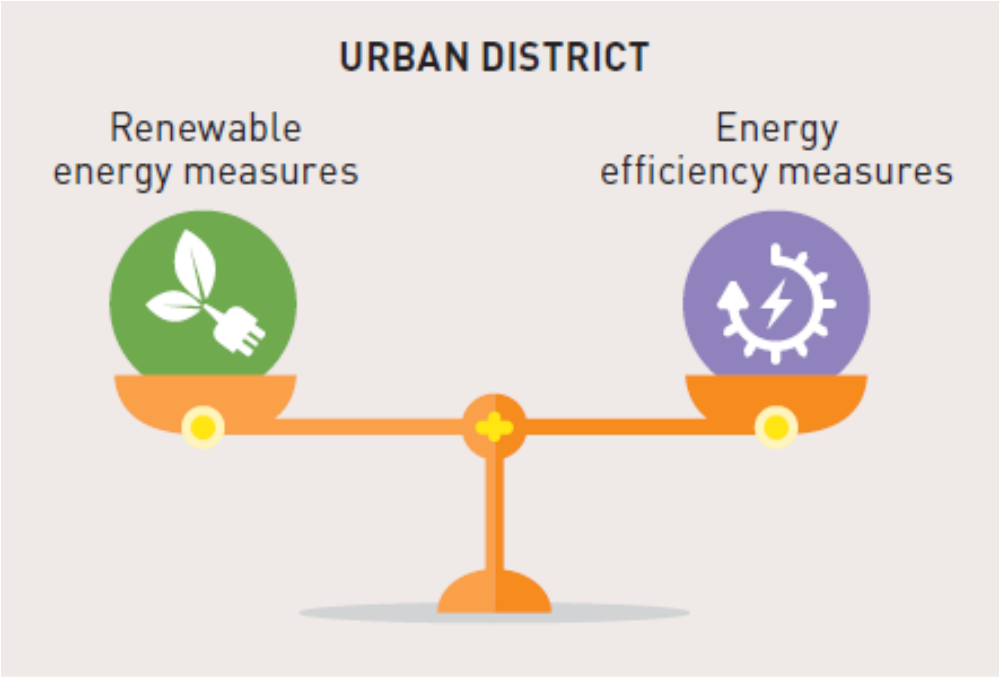
Optimization methodology and strategy development for building renovation at district scale combining energy efficiency and renewable energy systems

SBE22, Delft

12 October 2022

Roman Bolliger, INDP, Switzerland

Objectives


URBAN DISTRICT
Renewable energy measures
Energy efficiency measures

Research questions

- 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?
- In particular: What are cost-effective strategies to combine district-level heating or cooling based on available environmental heat, solar energy, waste heat or natural heat sinks, with energy efficiency measures on the buildings' envelopes?
- How do related strategies compare in terms of cost-effectiveness and impacts with strategies that combine a decentralized switching of energy carriers to renewable energies with energy efficiency measures on the buildings' envelopes?
- In particular: Under which circumstances does it make sense to use available renewable energy potentials in cities at a district level, and under which circumstances are decentralized renewable energy solutions, in combination with energy efficiency measures on the buildings' envelopes, more advantageous?

Methodology (I)

Renewable energy measures

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

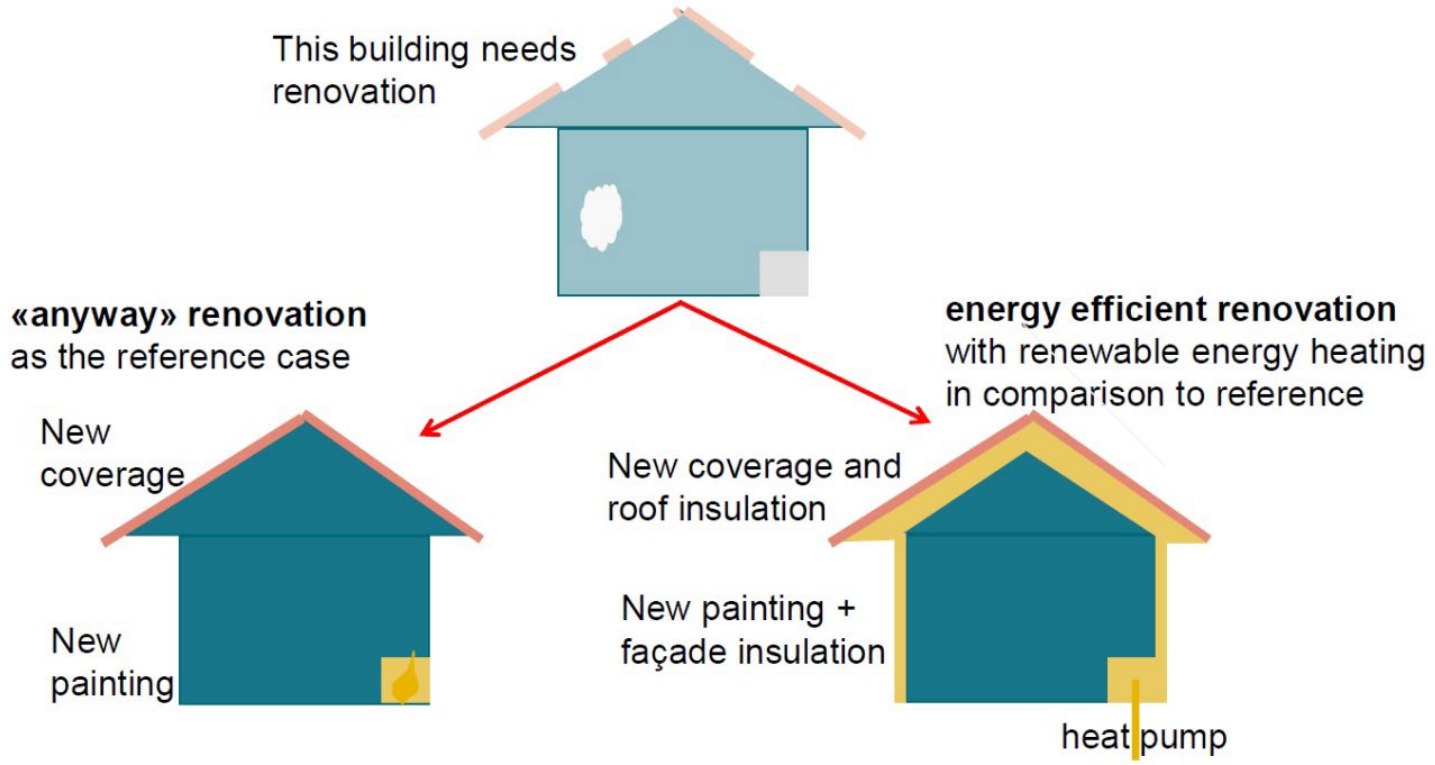
Individual heating systems:
- Air source heat pumps
- Geothermal heat pumps
- Wood energy
- ...

Solar energy

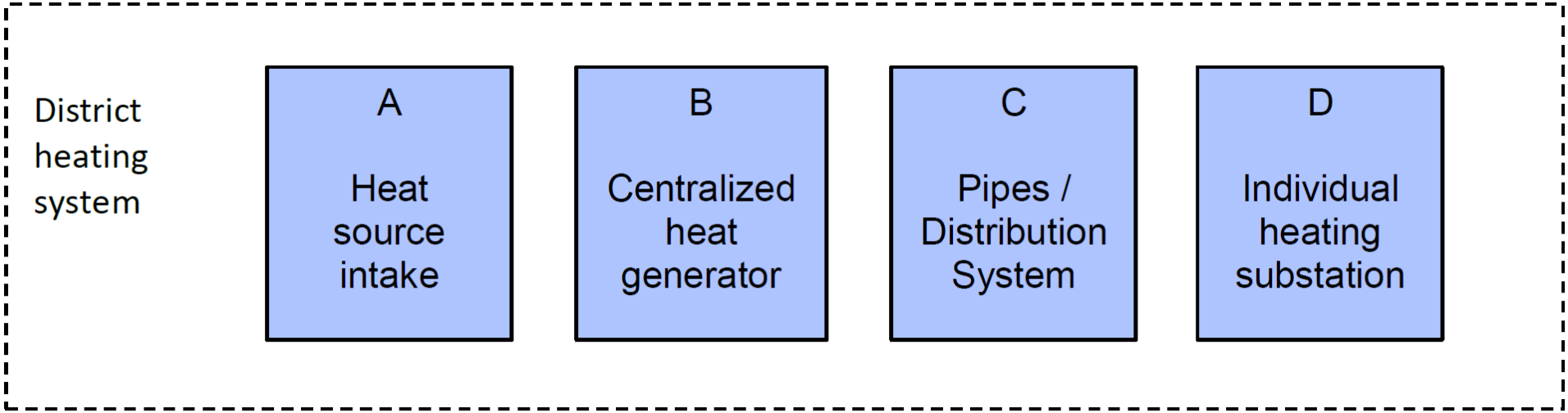
Energy efficiency measures

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

Methodology (II)

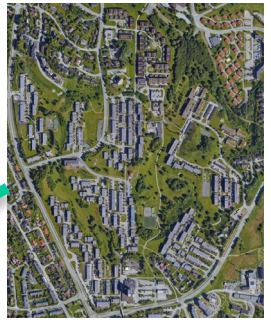


Methodology



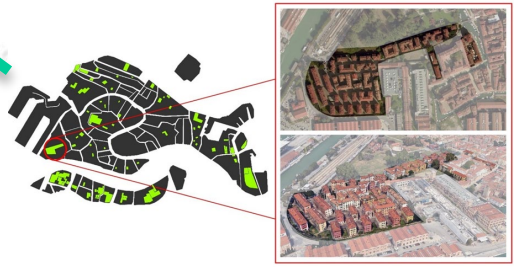
Annex 75 Case studies











Case study Luzern, Switzerland

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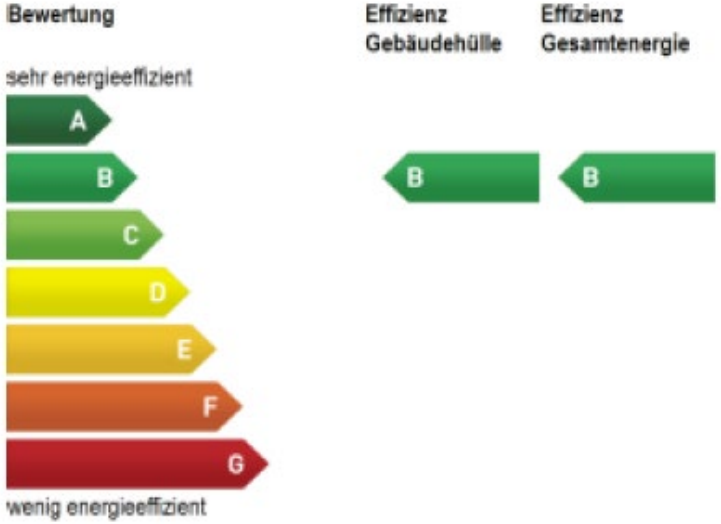
Characterization of building envelopes with energy performance certificates



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	
Wände gegen aussen / ≤ 2 m im Erdreich 	Aussenw einer Aus Die Auss ausgespa		

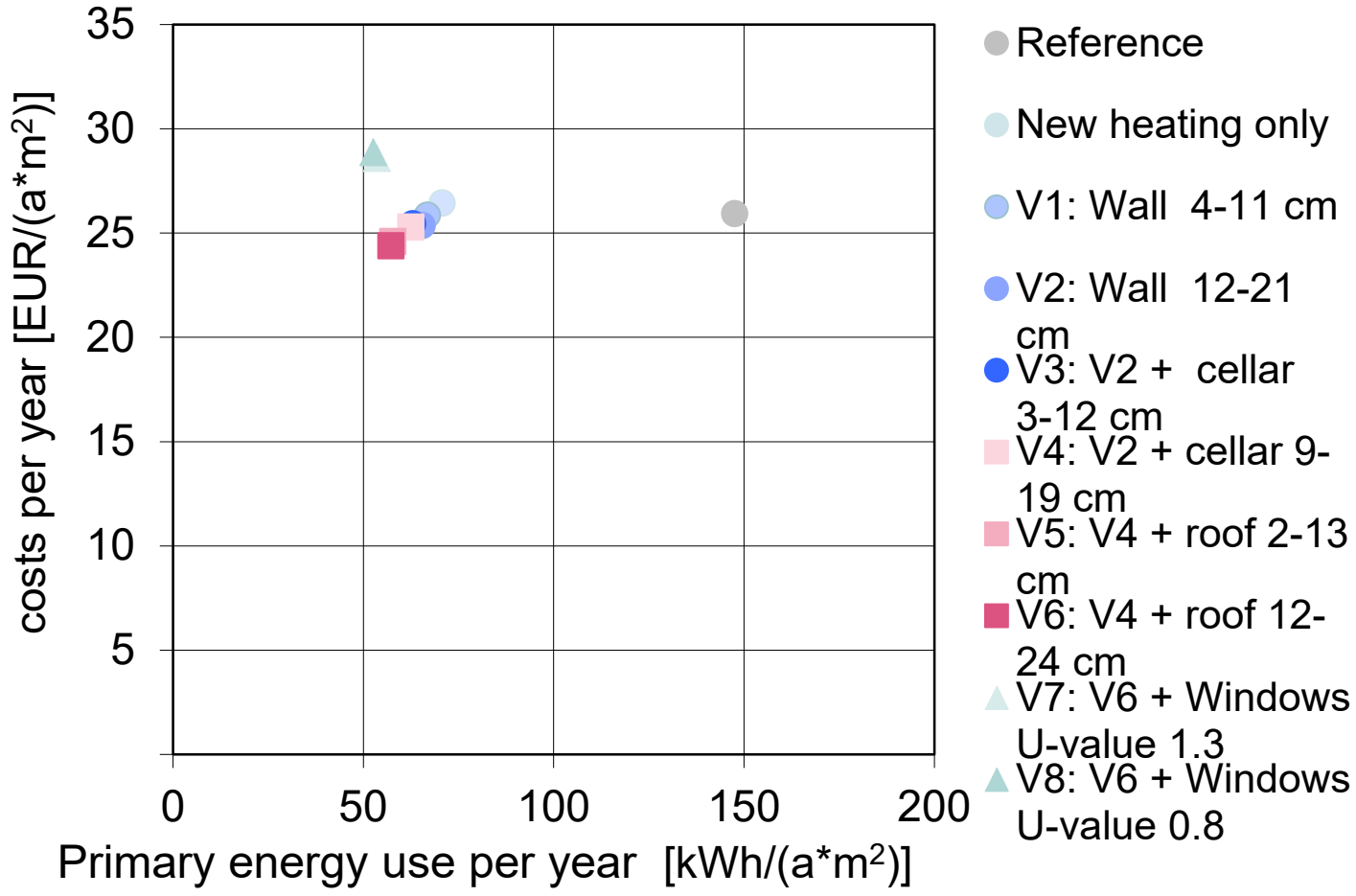
		Dämmung kann im Zuge einer anstehenden Sanierung angezeigt sein.	
Übrige Wände*	Wände im EG gegen Keller und Nebenräume sind minim gedämmt	Bei einer Sanierung Dämmung auf heutigen Standard ergänzen	
Fenster und Türen 	alte 2-fach Wärmeschutzverglasung in Kunststofffenstern	Fenstererersatz durch moderne 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

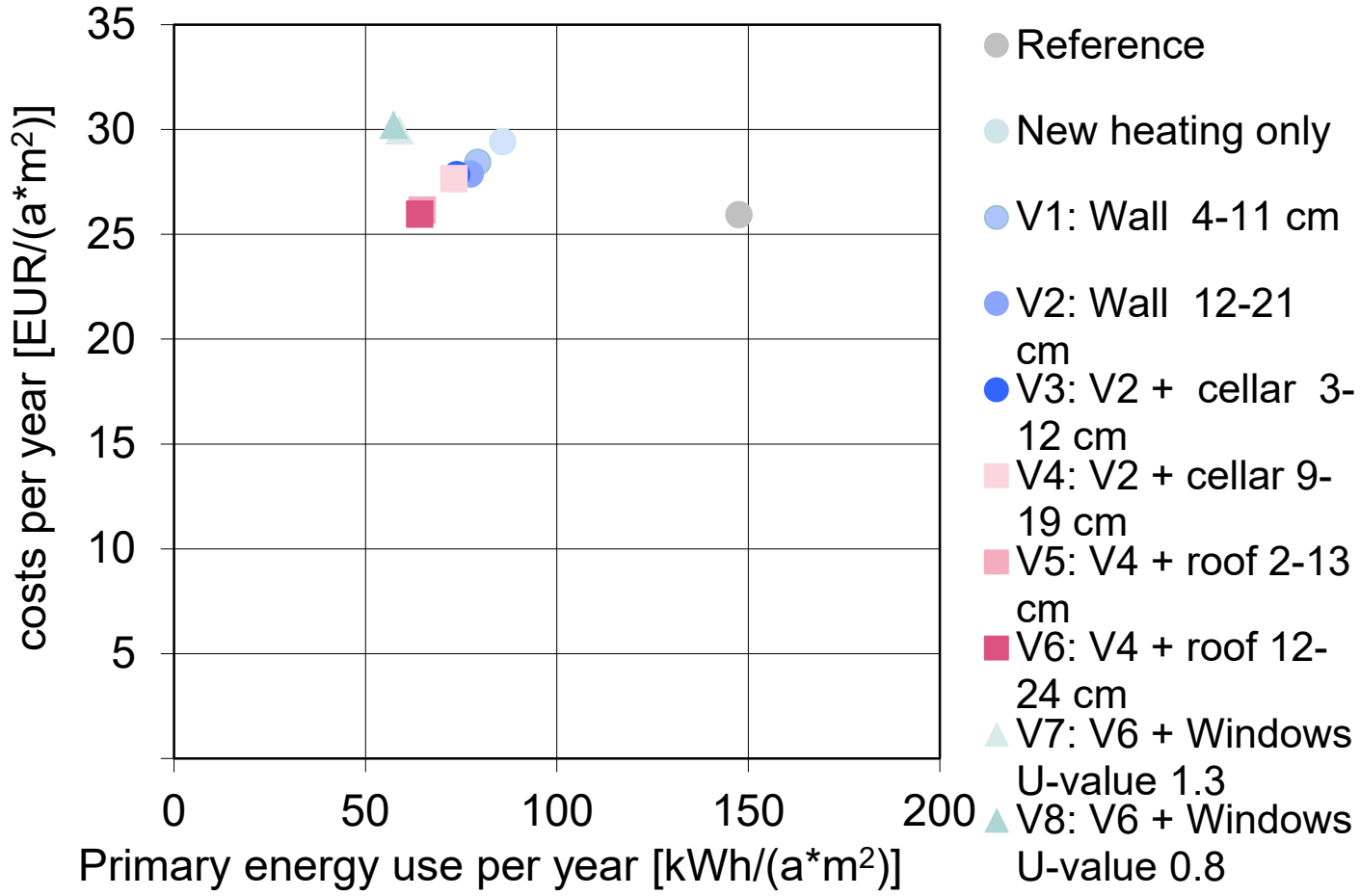
Renovation package	Scope of included energy efficiency measures
Reference	Refurbish wall/roof + windows; or wall, roof an windows, without improving energy efficiency
V1	Insulation of exterior wall with 4 – 11 cm rock wool
V2	Insulation of exterior wall with 12 – 21 cm rock wool
V3	V2 + insulation of 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	Gas- und Ölheizungen
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

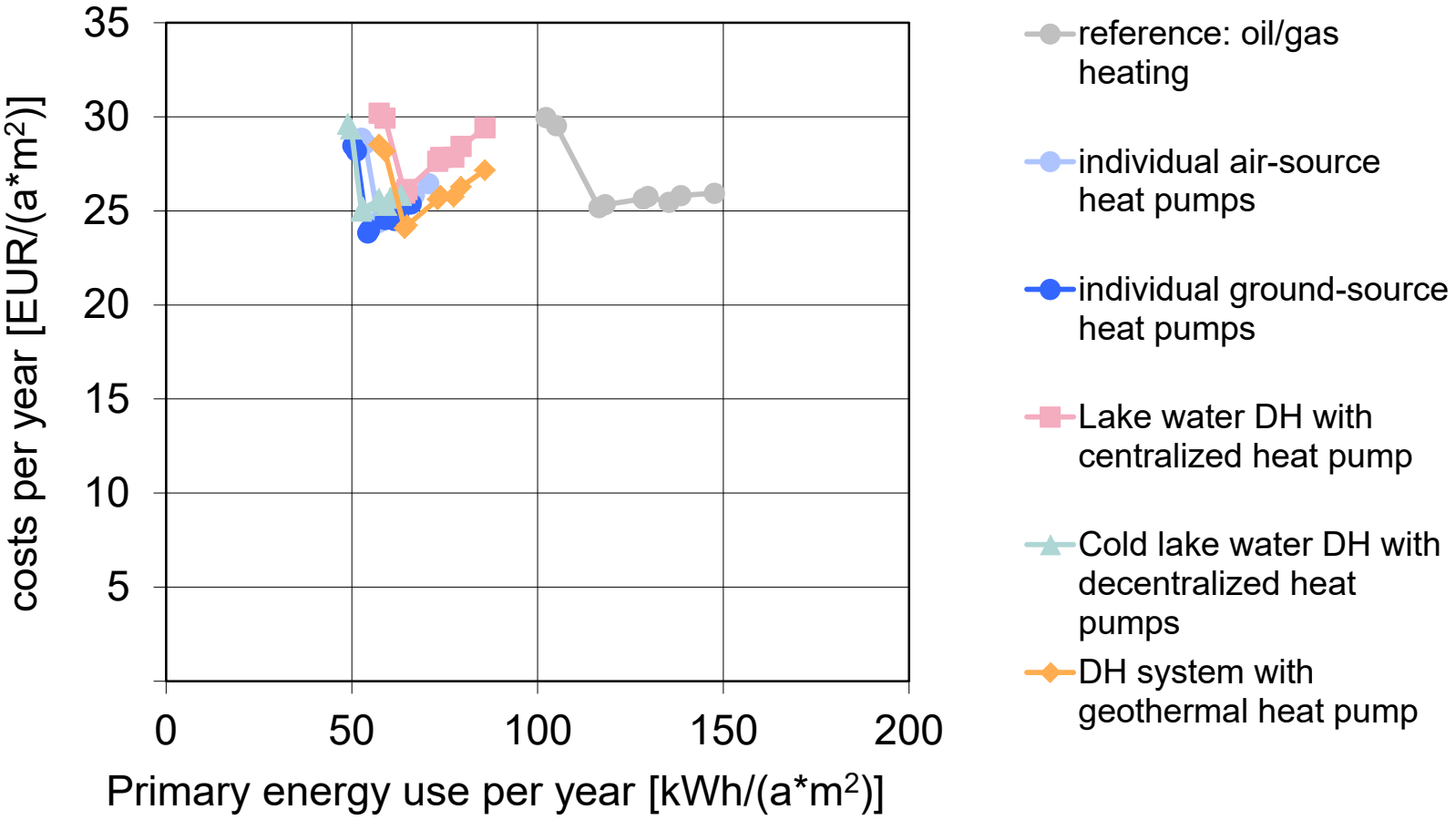
Efficiency measures on building envelopes with air-source heat pumps



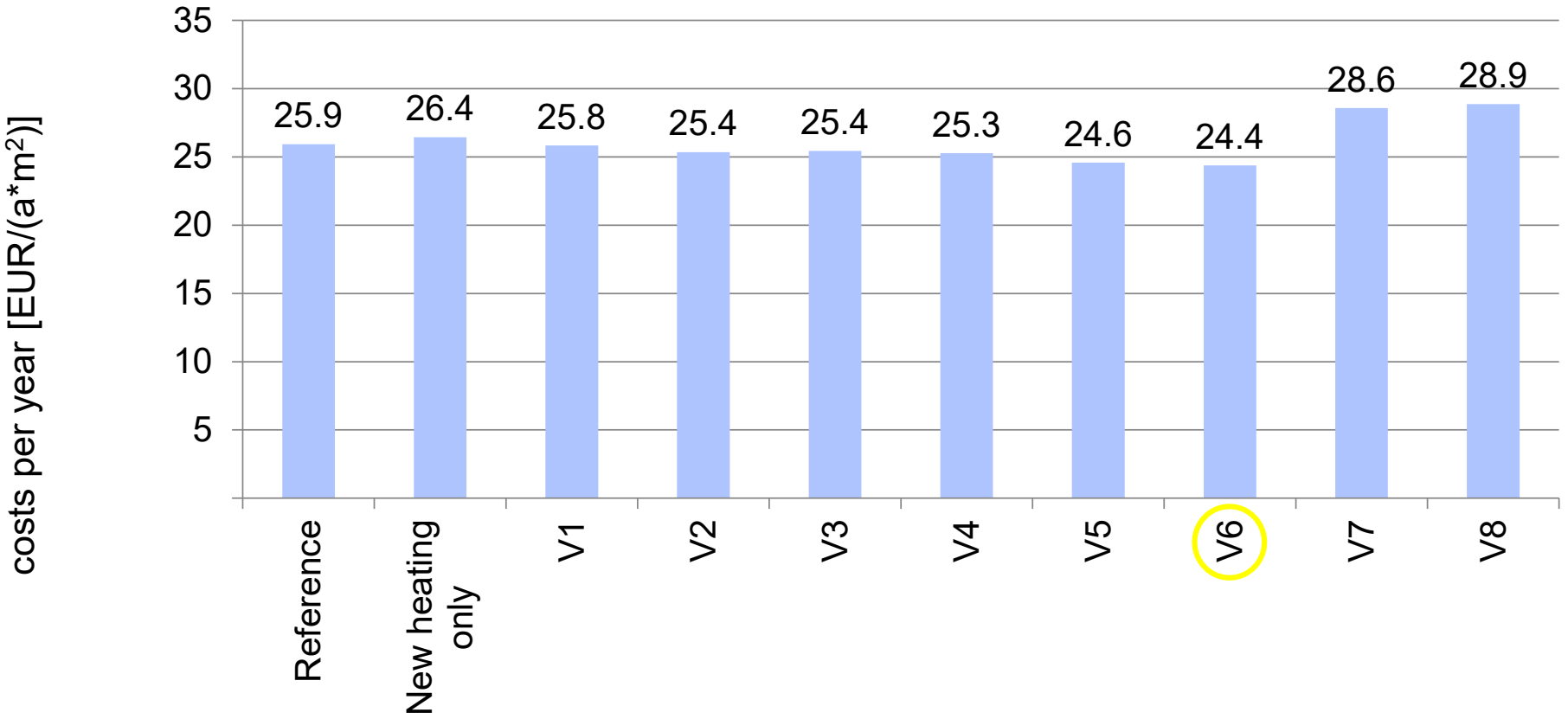
Efficiency measures on building envelopes with lake-water centralized heat pump



Efficiency measures on building envelopes with various heating systems

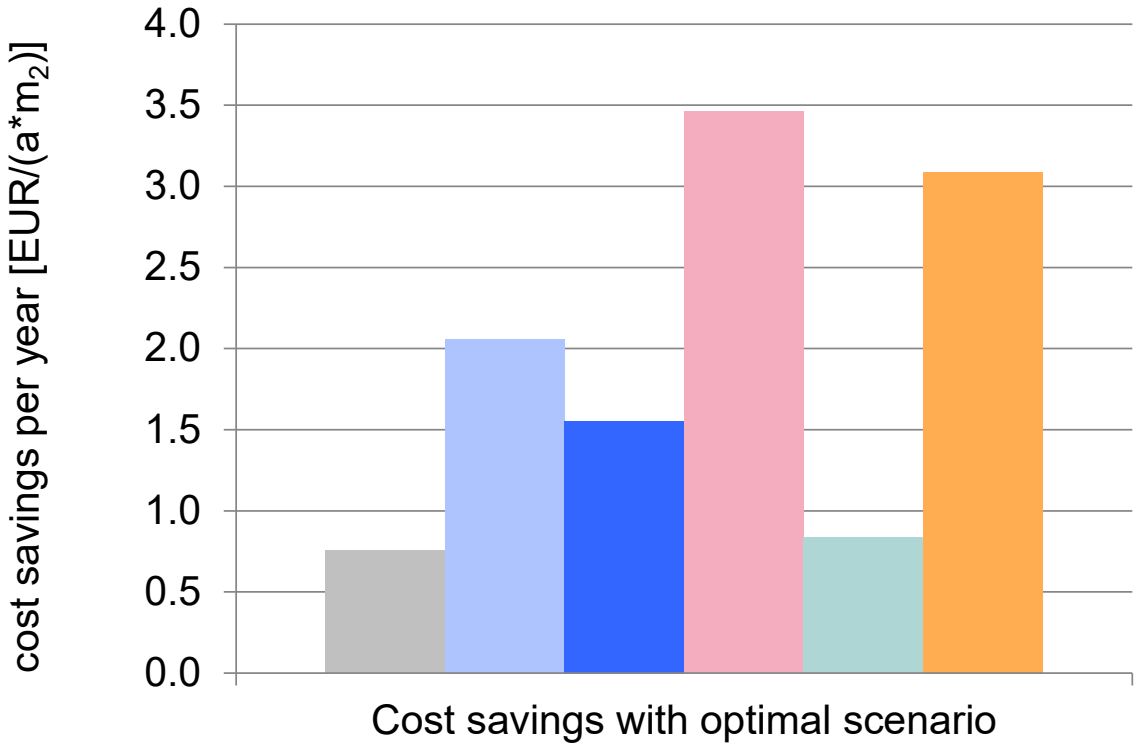


Efficiency measures on building envelopes with air-source heat pumps



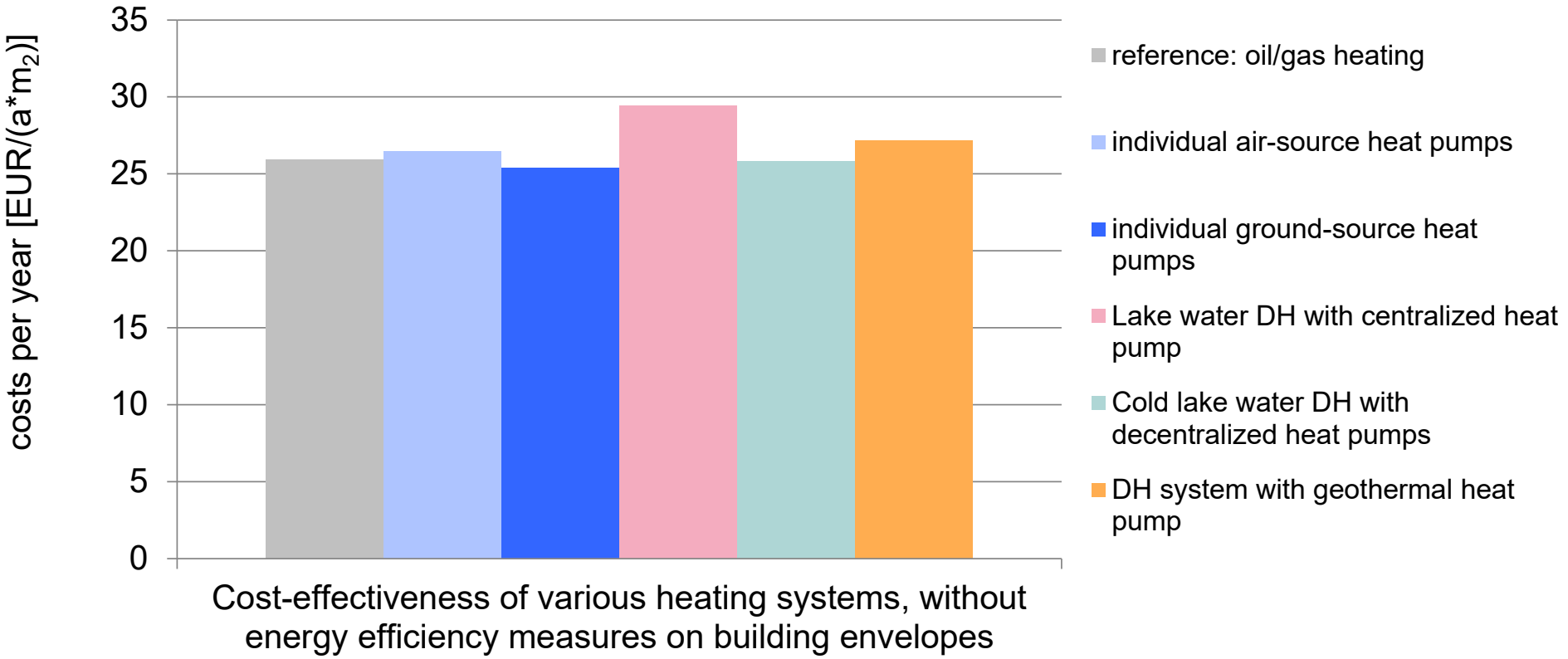
Efficiency measures on building envelopes with lake-water centralized heat pump

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

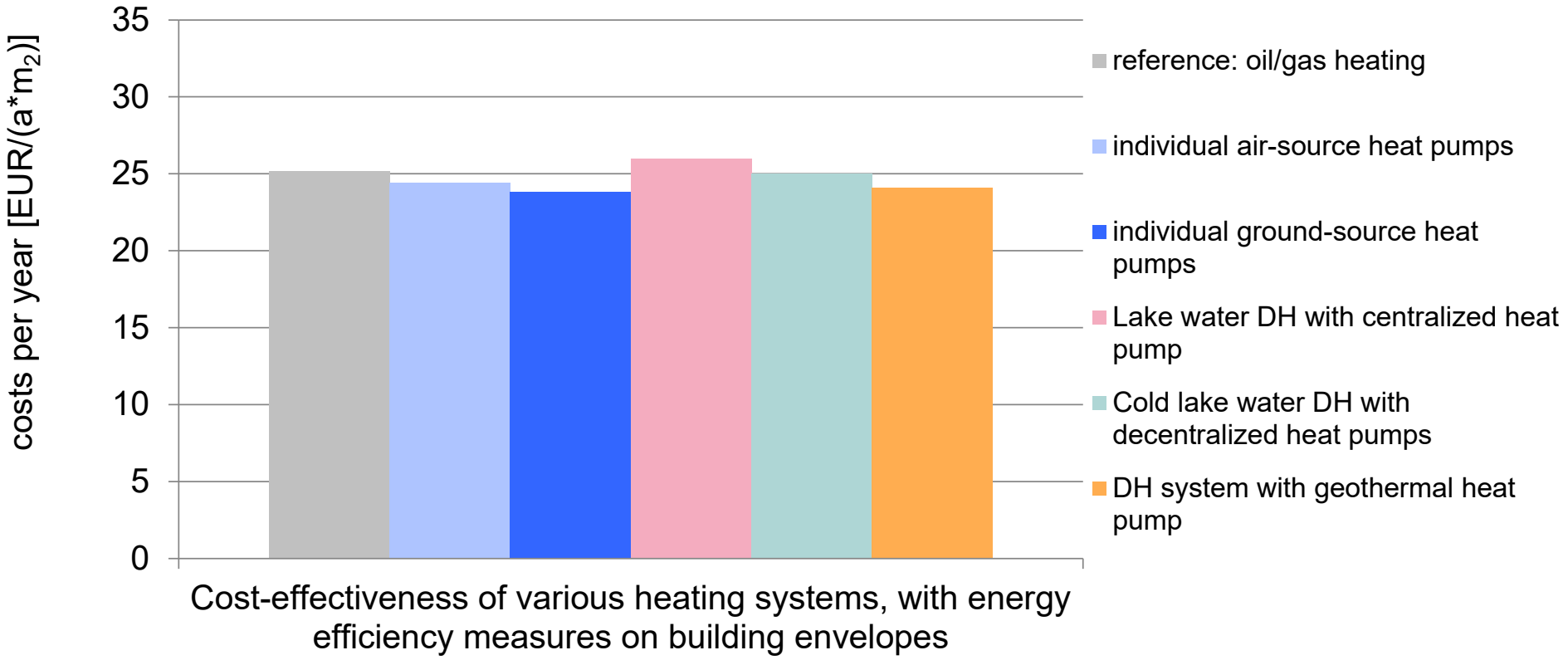


- reference: oil/gas heating
- individual air-source heat pumps
- individual ground-source heat pumps
- Lake water DH with centralized heat pump
- Cold lake water DH with decentralized heat pumps
- DH system with geothermal heat pump

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



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



Conclusions based on case study in Luzern

- 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

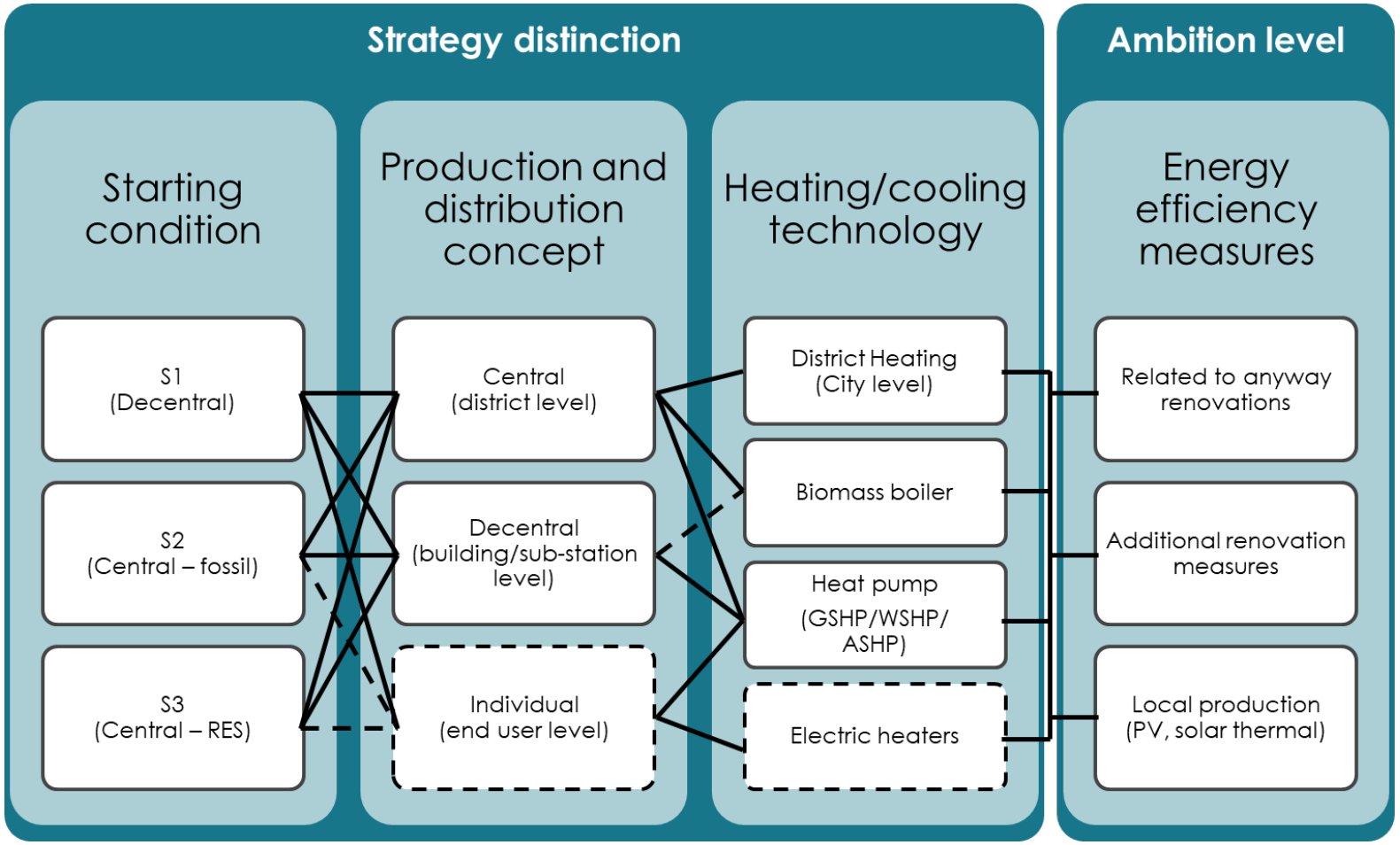
Conclusions from various case studies (I)

Hypothesis	AUT	ITA	NOR	POR	SPA	SUI	SWE	NED
1. «The cost-optimal level of the energy efficiency measures on building envelopes does not differ significantly when these measures are associated either with a district heating system based on renewable energy or with a decentralised individual heating system based on renewable energy.»	✓	✓	✓	−	✓	✓	✓	✗
2. «The cost-optimal level of the energy efficiency measures on building envelopes does not differ significantly when an existing district heating system based (fully or to a large extent) on fossil fuels is switched to a centralised heating system based on renewable energy.»	−	−	−	−	−	−	✗	−
3. «The cost-optimal level of the energy efficiency measures on building envelopes does not differ significantly when an existing district heating system based (fully or to a large extent) on fossil fuels is replaced by a decentralised heating system based on renewable energy.»	−	−	−	−	−	−	✗	−
4. «The cost-optimal level of the energy efficiency measures on building envelopes does not differ significantly when existing decentralised heating systems based on fossil fuels are replaced by a centralised heating system based on renewable energies.»	✓	✗	−	✗	✗	✓	✗	✗

Conclusions from various case studies (II)

Hypothesis	AUT	ITA	NOR	POR	SPA	SUI	SWE	NED
5. «The cost-optimal level of the energy efficiency measures on building envelopes does not differ significantly when existing decentralised heating systems based on fossil fuels are replaced by a low-temperature renewable energy-based district heating system associated with decentralised heat pumps.»	⊖	✗	⊖	⊖	✗	✓	✗	✗
6. «The cost-optimal level of the energy efficiency measures in building envelopes involves a lower level of insulation when an existing district heating system is switched centrally to renewables compared with a newly installed centralised heating system based on renewable energy, due to a lower potential of synergies between renewable energy measures and energy efficiency measures.»	⊖	⊖	⊖	⊖	⊖	⊖	✗	⊖
7. «In case the starting situation is a district with a low level of thermal insulation in the building envelopes, every optimal solution includes, to some extent, the implementation of energy efficiency measures in the building envelopes.»	✓	✓	⊖	✓	✗	✓	✓	⊖
8. «In case the starting situation is a district with a high level of thermal insulation in the building envelopes and a fossil fuel based heating system, every optimal solution includes at least a switch to renewable energy based heating systems»	⊖	⊖	⊖	⊖	⊖	⊖	✗	⊖

Strategy development



Main conclusions for strategy development

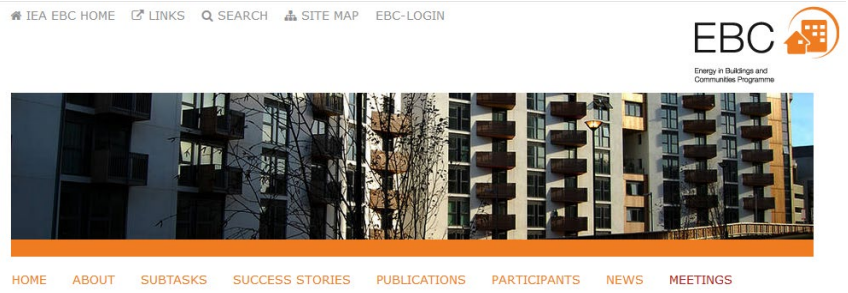
- The difference in cost-effectiveness between centralised and decentralised solutions from a life cycle perspective is often small; centralised systems benefit from economies of scale; however, they are associated with losses due to distribution. Furthermore, the temperature in the district heating system has to be higher than in individual heating systems, making heat pumps operate less efficiently. The scale of centralised solutions also brings the need for more planning. This brings both costs and risks. Accordingly, 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 those additional benefits, policy measures are necessary, because the market all by itself is unlikely to deliver district solutions to a large extent.

Main conclusions for strategy development

- Synergies between energy efficiency measures and renewable energy-based heating systems occur for all types of heating systems. There are even indications that such synergies are higher for district heating systems than for individual heating systems.
- An important factor concerning synergies between energy efficiency measures on building envelopes and renewable energy systems in district approaches is the possibility to lower the temperature of the grid due to energy efficiency measures on the building envelopes. This does require a solution how to generate hot water while maintaining its safety from a health perspective, even at lower temperatures. Such solutions exist, yet require careful examination.
- Significant energy efficiency measures are usually particularly cost-effective for building envelopes in poor condition. It is important to utilize the opportunity for energy efficiency measures on building envelopes when renovations are needed anyway.
- If a thermal network exists and is in good condition, it is usually most cost-effective to continue utilizing it.
- For decentralised solutions, heat pumps are a solution which is often cost-effective and widely available.

Further information

https://annex75.iea-ebc.org



EBC Annex 75 Tool:

https://annex75.bim.energy/

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EBC

Policy instruments for energy-efficient renovations at district level

Erwin Mlecnik, TU Delft, The Netherlands

SBE 2022 conference, Delft, The Netherlands, 12 October 2022

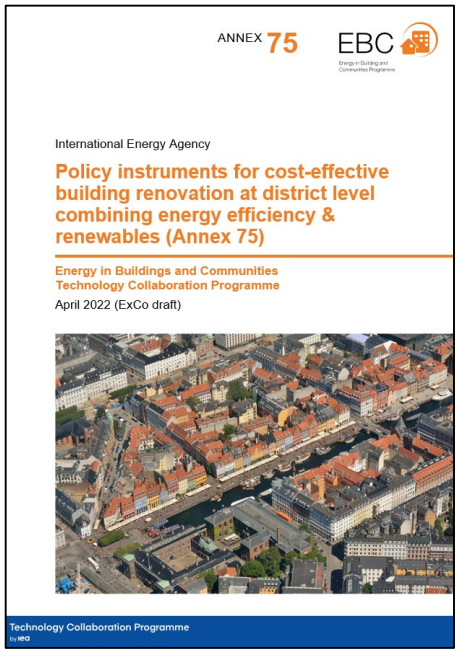
Introduction

The expected housing Renovation Wave requires breakthroughs in renovation at district level, particularly regarding policy instruments

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

Policy instruments can take various forms:

- ❑ **Regulation**
- ❑ **Incentives**
- ❑ **Communication**
- ❑ **Facilitation and organizing**



Local authority planning and tendering

Opportunities:

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

Information building owners

Professional top-down planning

Performance-based tendering

Basis for obligations to connect to district heating or to switch to other renewable energy system

Barriers:

Mentality change needed for various stakeholders

Possible resistance due to ineffective consultation or lack of options

Gentrification risk

Enforcement of minimum energy standards

Opportunities:

Necessary for activating worst performing segments

Acceleration of energy transition compatible with Paris Agreement

Feasible to integrate in land use agreements, contractual arrangements or concessions/permits

Barriers:

Local authorities are possibly not allowed to go beyond national or regional standards

Standards might only apply for major renovations.

Inspections and audits

Opportunities:

Combining energy requirements with broader (social) housing quality checks

Strengthening control of building energy labels to raise awareness

Service for building owner to make sure construction is according to plans

Works best when coupled to an incentive, communication or support action

Barriers:

Large administrative burden for local authorities

Actions might lead to political unpopularity

Will not work well without attention for the specific characteristics of districts and the socio-economic context of citizens

Local authority financial incentives

Opportunities:

Incentives for stakeholders can directly impact performance

Collaboration opportunities with stakeholders, e.g. for establishing local funds

Development of local demand and supply networks, e.g. upscaling with cooperatives

Can be targeted to support specifically combination of energy efficiency and renewables

Barriers:

Continuously changing framework at various authority levels; difficult for local authorities to go beyond available incentives and to target districts

Various types of stakeholders need specific incentives that fit eliminating their barriers

Difficult to sustain and labor intensive

Advice services in districts

Opportunities:

Development of local home renovation services that unburden the homeowners

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

Good at awareness raising and providing easy access to solutions

Local authorities can form alliances with local actors

Barriers:

Possible legal and administrative barriers, experimental tendering processes, requires a lot of resources

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)

Local media development

Opportunities:

Information can reach a large population

Information can be targeted to customer segments and districts

Opportunities for developing e-services

Barriers:

Requires permanent attention: local authorities need to continuously monitor effects and couple actions with off-line activities and strategic plans

Communication is not necessarily district related

No guarantees that measures will be taken

Awareness raising events and demos

Opportunities:

Seeing examples on site increases interest and acceptance

Social connections promoted

Trust in common projects increased

Barriers:

Organizational efforts needed

Timing is important

Other emerging actions

Integrated Home Renovation Services

Professional education and training

Energy benchmarking of districts

Citizen contests

Energy labels for districts

Facilitation of citizen energy cooperatives

Energy demand side management in districts

Facilitation of trading of white, green and black certificates

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: innovation policy facilitates integrated renovation concepts

ES: policy for rehabilitation of rural areas

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

Conclusion

The 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 energy renovations

⇒ **Policy efforts need to make them locally, socially and economically attractive**

National policy can better support district action and empower Local Authorities

The IEA reports show promising policy, management and business opportunities for an integrated approach mastering different components of current urban transformation challenges

IEA EBC Annex 75 Subtask D:

Policy Instruments, Business Models & Stakeholder Dialogue

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28th June 2022

EBC

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

Annex 75, Report D2

Authors:
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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.

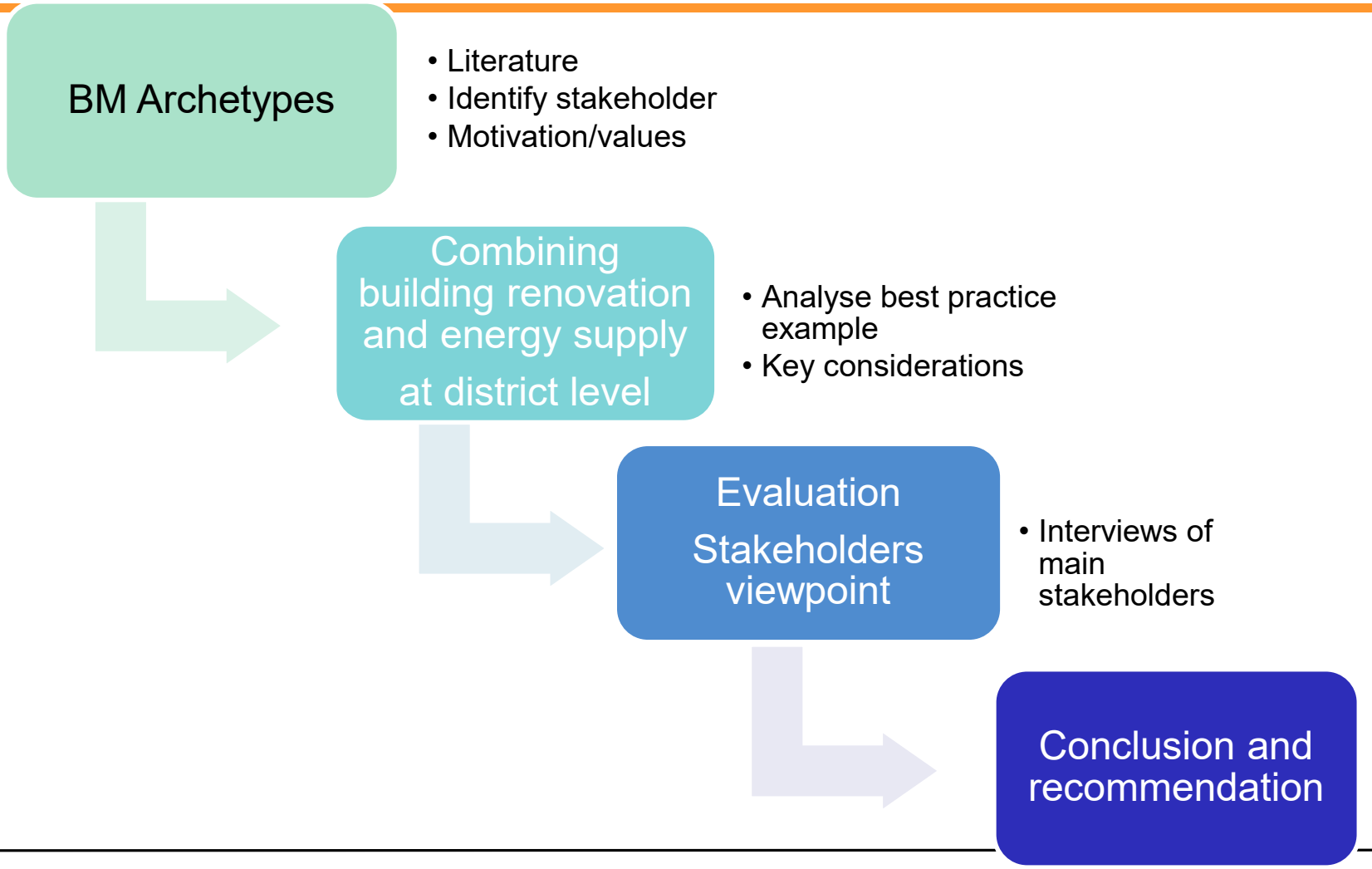
Research Approach Report D2

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?

Research Approach



BM Archetypes for Refurbishment

	Opportunities to overcome barriers
• **Atomised market**	• Awareness raising • **Financial incentives** for renovation
• **Market intermediation**	• Awareness raising • Financial incentives for renovation • Intermediary builds trusted relationships suppliers, to **provide integrated solutions**
• **One-stop-shop**	• Awareness raising and **coordinated renovation projects** • Development of **integrated, modular, scalable solutions.**
• **ESCO (Energy Service Company)**	• Financial **attractive for home-owners** • Overcome **initial cost** barrier

Summary of the Business Models archetypes, highlighting the barriers they pose to upscale to district, as well as opportunities to overcome those barriers

BM Archetypes for Energy Supply

	Opportunities to overcome barriers
District heating BM	• New generation of DH with low circulation temperatures • Incentives from policy makers • Including external costs (CO2 tax) • EPP including other sectors
Going Green models	
Building energy Communities BMs	• Heat storage opportunities
Lock-in oriented business models	• Obligations? • Combine RES and EE
Complementarities-oriented energy supply business models	• Establish incentives for grid stability services (Annex82) • Add time to value of energy (summer vs. winter) • Convert energy supply to energy balance services (incl. storage)
Efficiency-oriented energy business models	• Opportunities for new market participants • Active change management

Summary of the Business Models archetypes, highlighting the barriers they pose to upscale to district, as well as opportunities to overcome those barriers

Key findings

Catalogue of Business models (Chapter 2+3)

- Overview, barriers and opportunities

Key considerations in combining building renovation and energy supply business models (Chapter 4)

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

Stakeholders' views (Chapter 5)

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

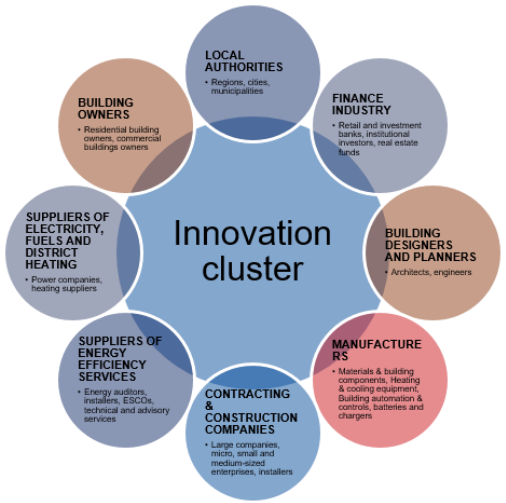


Figure 7: Illustration of a stakeholder mapping

Conclusion

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

- There are no specific business models for energy supply applied to renovation of districts → New possibilities for new players
- Large-scale renovation employing BM models that offers a single point of contact catering to all of the project's needs
- Renovation project are already applying RES, eg PVs, however the scale is small and is not always combined as a BM
- ESCOs that primarily use 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

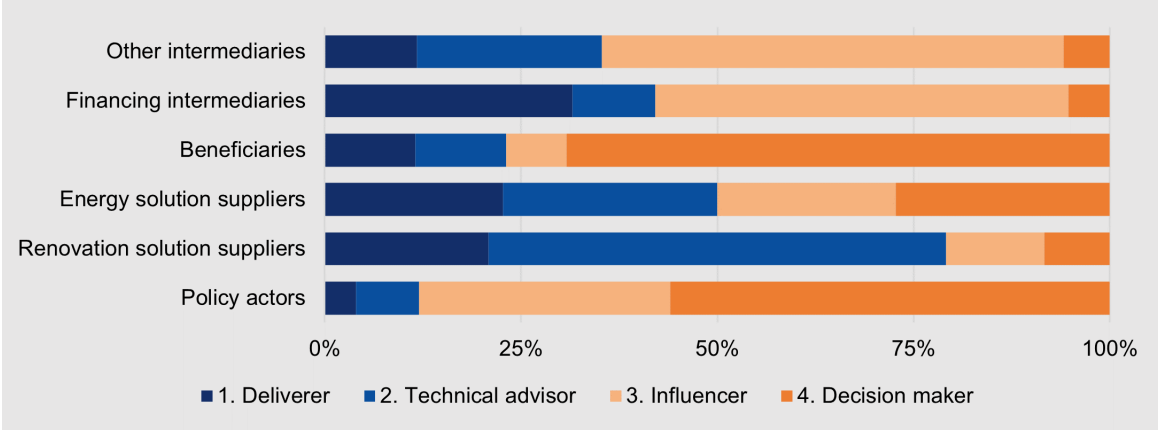


Figure 11. Role of the stakeholder types, obtained relative frequency distribution of all votes.

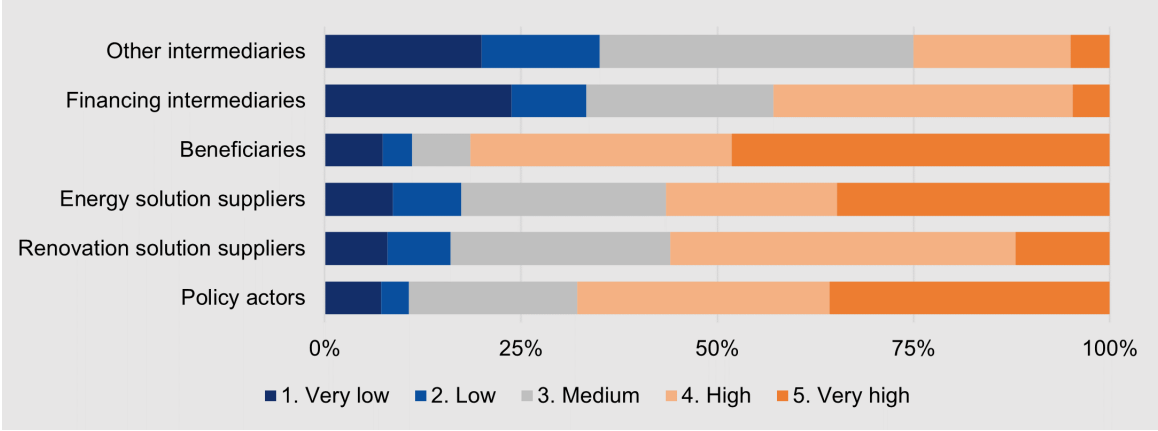
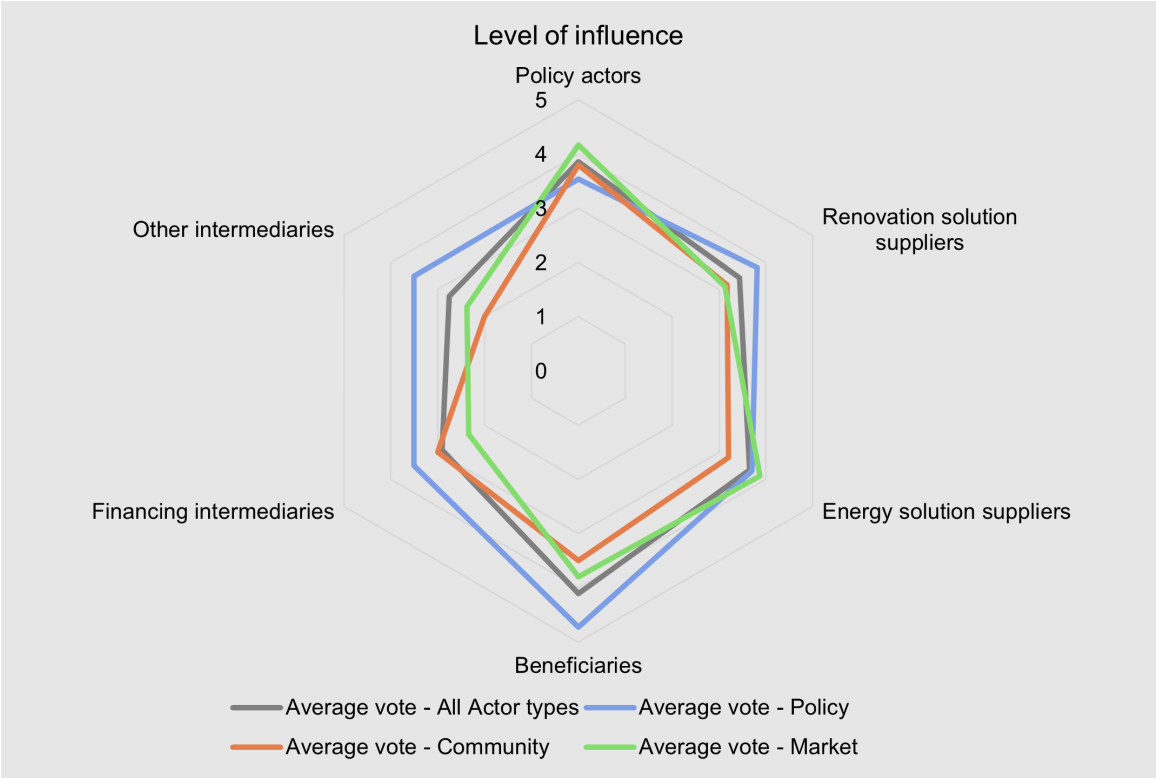


Figure 12 Perceived influence of the stakeholder types, obtained relative frequency distribution of all votes.

Conclusion

Main stakeholders and what is their role

- Policy actors see the beneficiaries as most influential
- Non-policy actors see the influence of policy actors as high to very high



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

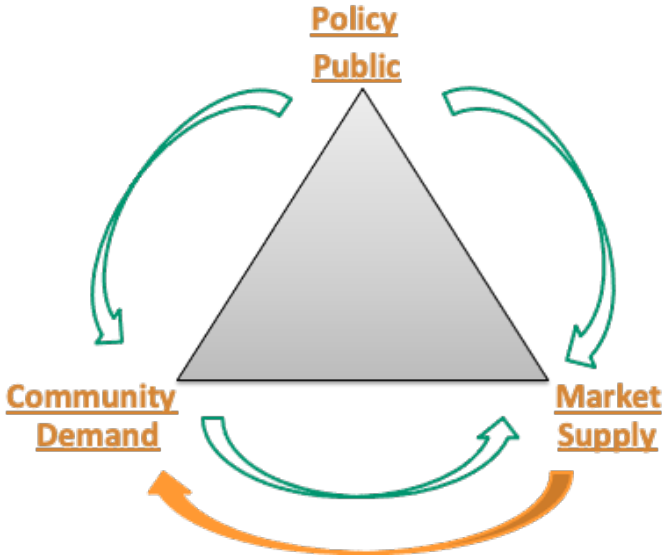
Recommendations for policy actors

Echo D1 recommedation, some more specific:

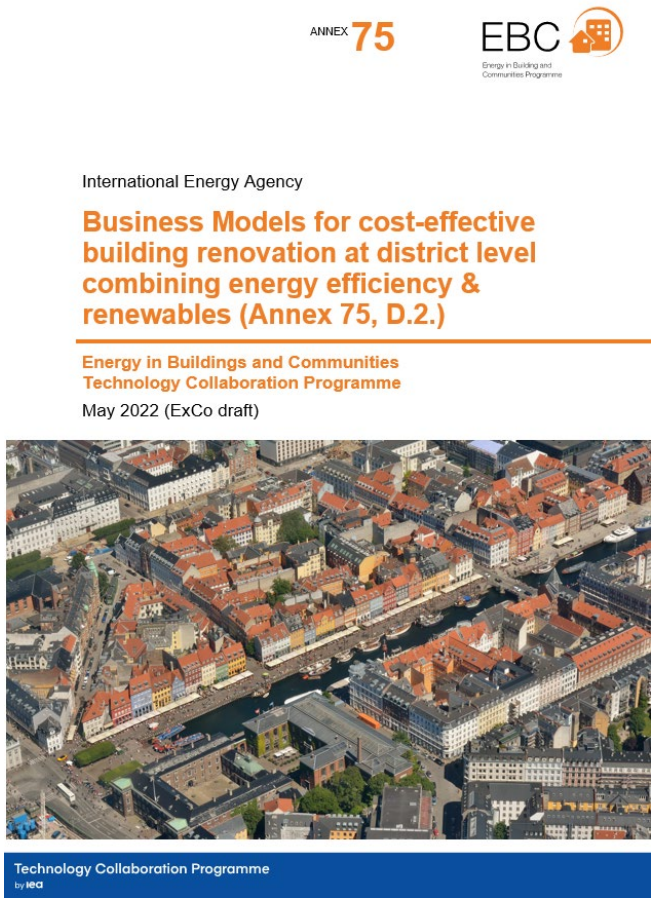
- Building renovation with the integration of energy supply and RES integral part of the city and district urban development and aligned w the policy actors objectives
- District heating often involves public interest and coordination/initiation by the municipality. Need to examine possibilities for combination with renovation
- Since renewable energy business models are highly dependent on the regulatory framework, policy-makers have direct influence on their future development
- Subsidies for integral solutions and funds to co-finance
- Municipalities can give guarantees and increase trust
- Policy partners need to be involved in the BM for those roles

Recommendations for investors ("non policy actors")

- Based on the most promising BM a possibility is to set up (or use existing) 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
- The role of policy actors, such as municipalities
- Actors for the dialogue AND partnership: Municipality, Owners, Investors, Suppliers
- Energy companies should be part of the dialogue



Overview report structure



1. **Introduction**
2. **Catalogue of Business Models for refurbishment**
   - **Financing mechanisms**
   - **Characteristics of the business model archetypes**
   - **Archetypes**
3. **Business models for energy supply companies**
   - **Heating (and cooling)**
   - **Electricity market**
   - **Characteristics of the of selected business model archetypes**
   - **District energy business model archetype**
   - **Electricity supply business model archetypes**
4. **Comparing and combining building renovation and energy supply**
   - **Success stories analysis**
   - **Categorisation success stories**
   - **Key considerations in combining building renovation & energy supply BM**
5. **Stakeholders' views on upscaling renovation to district scale**
   - **The role of the Stakeholders**
   - **Stakeholders' views on the BM characteristics for district renovation**
6. **Recommendation for business models and stakeholders' dialogue**

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EBC
Energy in Buildings and Communities Programme

Guidebook for Policy Makers, Investors and Decision Makers

The District as Action Level for Energy Renovation & Renewables:

Making Use of the Potentials!

Technology Collaboration Programme
by iea

ANNEX 75

EBC
Energy in Building and Communities Programme

2 target groups

Policy Makers

stakeholders/actors at all levels (national, international, local) which develop and/or implement instruments regarding building renovation or renewable energy projects

Investors and Decision Makers

stakeholders/actors which make investment decisions or which are involved in a decision process for building renovation or renewable energy projects (private owners, companies, intermediaries, …)

→**Broad definition of both target groups to provide general recommendations within a diverse context of districts and different local, regional and national framework conditions**

The Guidebook emphasizes:

- General potentials of the district level for energy renovation
- Techno-economical potentials of upscaling to the district level
- Strategy recommendations
- How new business models with more complex actor structures are needed for upscaling of energy renovation
- How the city can support upscaling of energy renovation through an integrated approach and integrated planning instruments
- The importance and methods of stakeholder dialogue and process organisation
- The importance and methods of district-oriented mobilization for energy renovation

There are no „one size fits all solutions“ given different starting and framework conditions.

→ analyze each case individually

But there are general recommendations, derived from the results of IEA EBC Annex 75, which can provide a useful base for individual analysis and the implementation of conditions in order to make use of the potentials of the district as action level for energy renovation and renewables.

IEA EBC Annex 75
Recommendations

- Adapt laws and regulations to stimulate building energy renovation at the district level
- Create a certification scheme also at the district level
- Make the implementation of RES mandatory whenever a heating system or district grid is replaced and when there are adequate conditions for renewables integration
- Promote a holistic approach linking buildings renovation to urban planning, energy grid development and carbon reduction goals
- Assure quality in procurement, design and execution by facilitating easy-to-use and reliable tools
- Provide a single point of contact offering integrated solutions and services
- Deploy financial measures and business models to promote zero-carbon renovations
- Create financial incentives and unburden local collectives to make RES and energy storage systems more accessible
- Facilitate specialised training for the whole chain of the building sector professionals, building owners and local administration staff
- Provide transparent communication