21st European Week of Regions and Cities

Thriving Regions, Stronger Europe

#EURegionWeek

What is beyond energy efficiency?

The overlooked values of Sustainable Plus Energy Buildings and Neighbourhoods

11 OCTOBER 2023

SIDE EVENT

cultural E+

syn.ikia | Sustainable plus energy neighbourhoods

EXCESS

Cultural-E has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 870072.
Syn.ikia has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 869918.
EXCESS has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 870157.

#EURegionWeek

Important information for the participants online

Please turn off your microphone and camera.

If you would like to speak, please use the Zoom chat box or raise your hand and we will give you the floor.

We will use Sli.do for real-time polls & Q&A.

Further instructions will be given later.

cultural E+ syn.ikia Sustainable plus energy neighbourhoods EXCESS

This workshop will be recorded

cultural E+ | syn.ikia | Sustainable plus energy neighbourhoods | EXCESS

Agenda

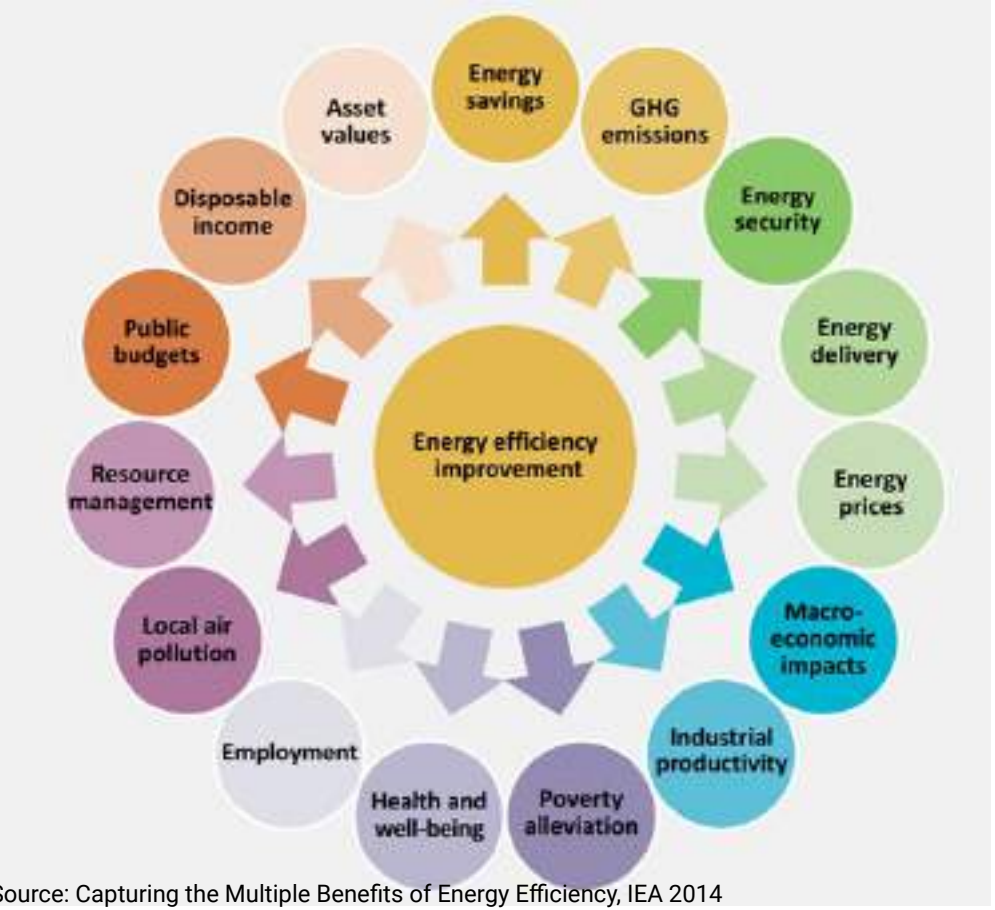
11:00 – 11:10	Welcome message	Niki Gaitani (Norwegian University of Science and Technology)
11:10 – 11:25	Identifying and quantifying the value of multiple benefits of SPENs for decision makers	Sheikh Zuhaib (Building Performance Institute Europe)
11:25 – 11:35	Effective communication towards different stakeholders: using multiple benefits of PEBs as a trigger for energy efficiency	Wilmer Pasut (University Ca' Foscari of Venice)
11:35 – 11:45	From multiple benefits to effective policy making: Policy recommendations	Joaquin Villar (Andalusian Energy Agency)
11:45 – 12:30	Open discussion	Facilitators: Wilmer Pasut (University Ca' Foscari of Venice), Niki Gaitani (Norwegian University of Science and Technology), Andreas Tuerk (Joanneum Research)
12:30 – 12:40	Wrap-up and conclusions	All participants

#EURegionWeek

Welcome to the Workshop ‘What is beyond energy efficiency?’

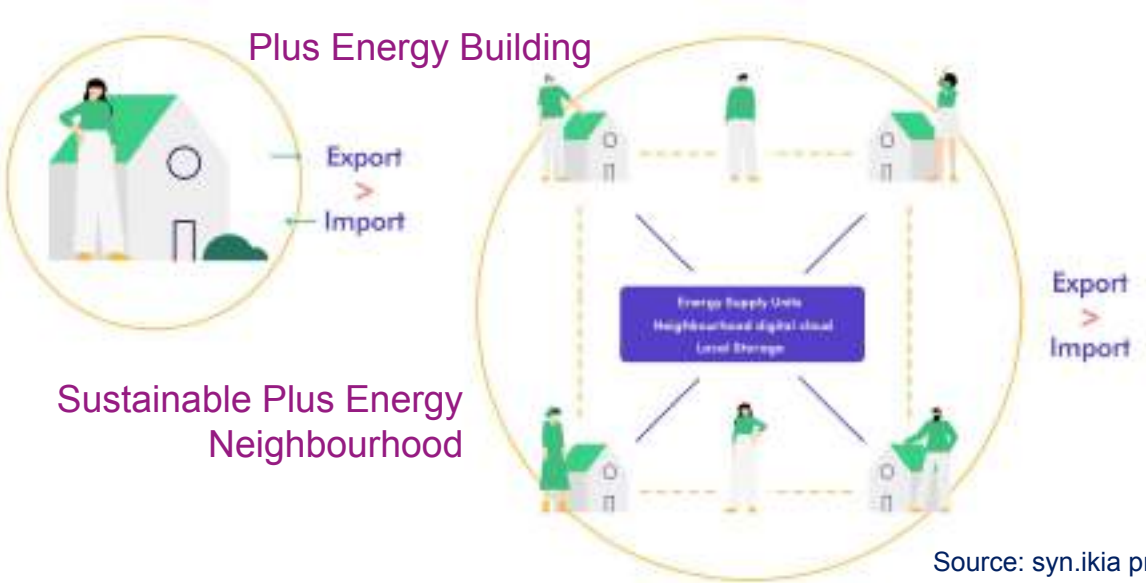
Side event of the European Week of Regions and Cities

Niki Gaitani, Assoc. Professor
syn.ikia Project Coordinator
Norwegian University of Science and Technology NTNU



Source: Capturing the Multiple Benefits of Energy Efficiency, IEA 2014

- Beside the direct benefits coming from the spread of PEBs and SPENs focused on energy performance and CO2 emissions' reduction, it is essential to acknowledge and address the indirect effects or extra impacts that can be achieved both at a household and a societal level.



Source: syn.ikia project

- What multiple benefits are closely associated with PEBs and SPENs?
- Do neighbourhoods yield new types of benefits that we'd need to conceptualize?

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Active poll
12
Where are you based?
Berlin
Bolzano (Italy)
Brussels
Dalarna
Sweden
Valladolid (Spain)
Norway
Rome
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Active poll

16

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What is your professional profile?

Active poll

18

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Are you familiar with the Cultural-E, syn.ikia and EXCESS projects?

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Sustainable plus energy neighbourhoods

- Duration 2020-2024
- Budget 7 435 279 €
- Partners 15
- Countries 7
- Project Leader Niki Gaitani NTNU

NTNU | Norwegian University of Science and Technology

This project has received funding fro
the European Union's Horizon 2020
Research and Innovation programm
under Grant Aareement N 869918.

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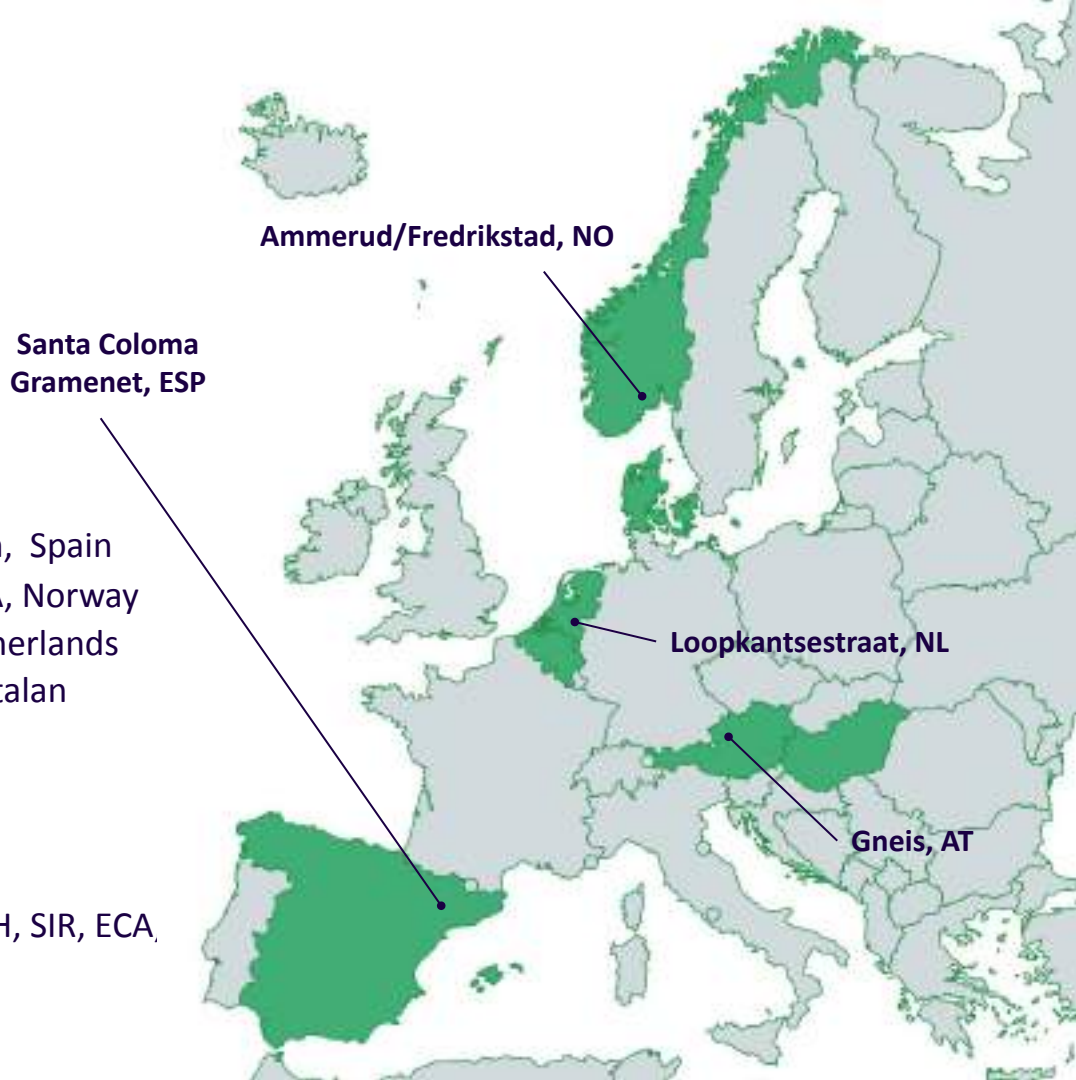
Consortium

1. **Coordinator** – NTNU, Norway
2. DTU, Denmark
3. BPIE, Belgium
4. SINTEF, Norway
5. HOUSING EUROPE, Belgium
6. IREC, Catalonia Institute for Energy Research, Spain
7. **Demo Neighbourhood** – OBOS/ ARCA NOVA, Norway
8. **Demo Neighbourhood**– AREA WOVEN, Netherlands
9. **Demo Neighbourhood**– INCASOL – Land Catalan Institute, Spain
10. TNO, Netherlands
11. ENFOR, Denmark
12. ABUD, Hungary
13. **Demo Neighbourhood** – HEIMAT OSTERRICH, SIR, ECA, Austria



UDEN

230 HOUSING UNITS

Energy sharing with the neighboor buildings
Smart home technology
Integrated energy systems and low temperature microgrid
Renovation incentives
Participatory design
User behaviour assessment

marine

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Sustainable plus energy neighbourhoods

mediterranean

BARCELONA

38 HOUSING UNITS

District heating network
Energy sharing with the neighbour buildings
Energy manager and visualisation
Renewable energy generation is beyond the requirements of building code
Innovative public procurement with sustainable and environmental requirements

56 HOUSING UNITS

Establishing a neighbourhood energy system
Architecturally integrated PV
Smart house technology
Smart charging of electric vehicles
Low carbon design, largely wood based construction, prefab elements
Use of recycled materials
Social sustainability with emphasis on shared spaces and IT platform for energy awareness

FREDRIKSTAD

subartic

continental

SALZBURG

39 HOUSING UNITS

Digital twins at neighbourhood scale
Integrating sensors (HVAC) allowing smart controls and diagnostics
Load balancing at building & neighbourhood level
Tenant enrollment for enhanced user satisfaction
Performance guarantee
Social beautiful concept

Mission

Increase the s**hare of sustainable neighbourhoods with surplus renewable energy** in different contexts, climates and markets in Europe.

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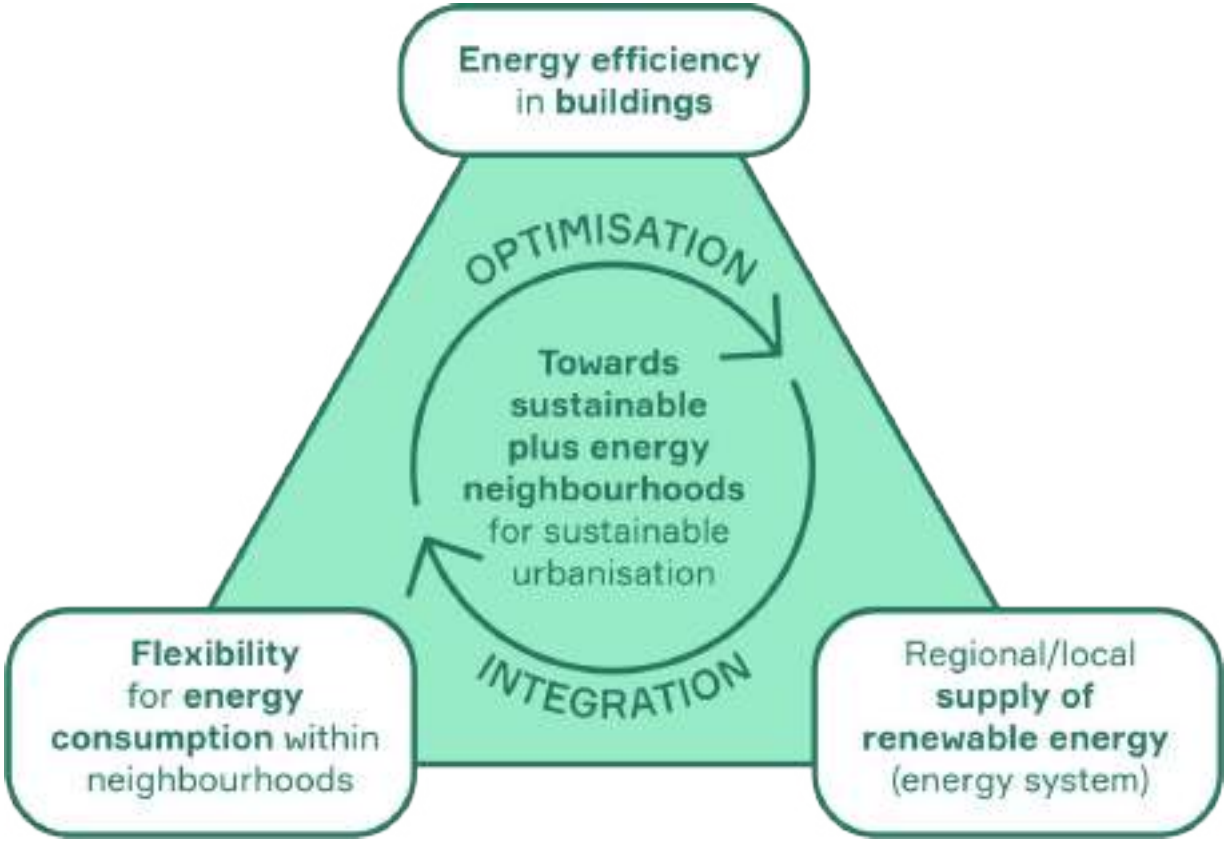
Sustainable plus energy neighbourhoods



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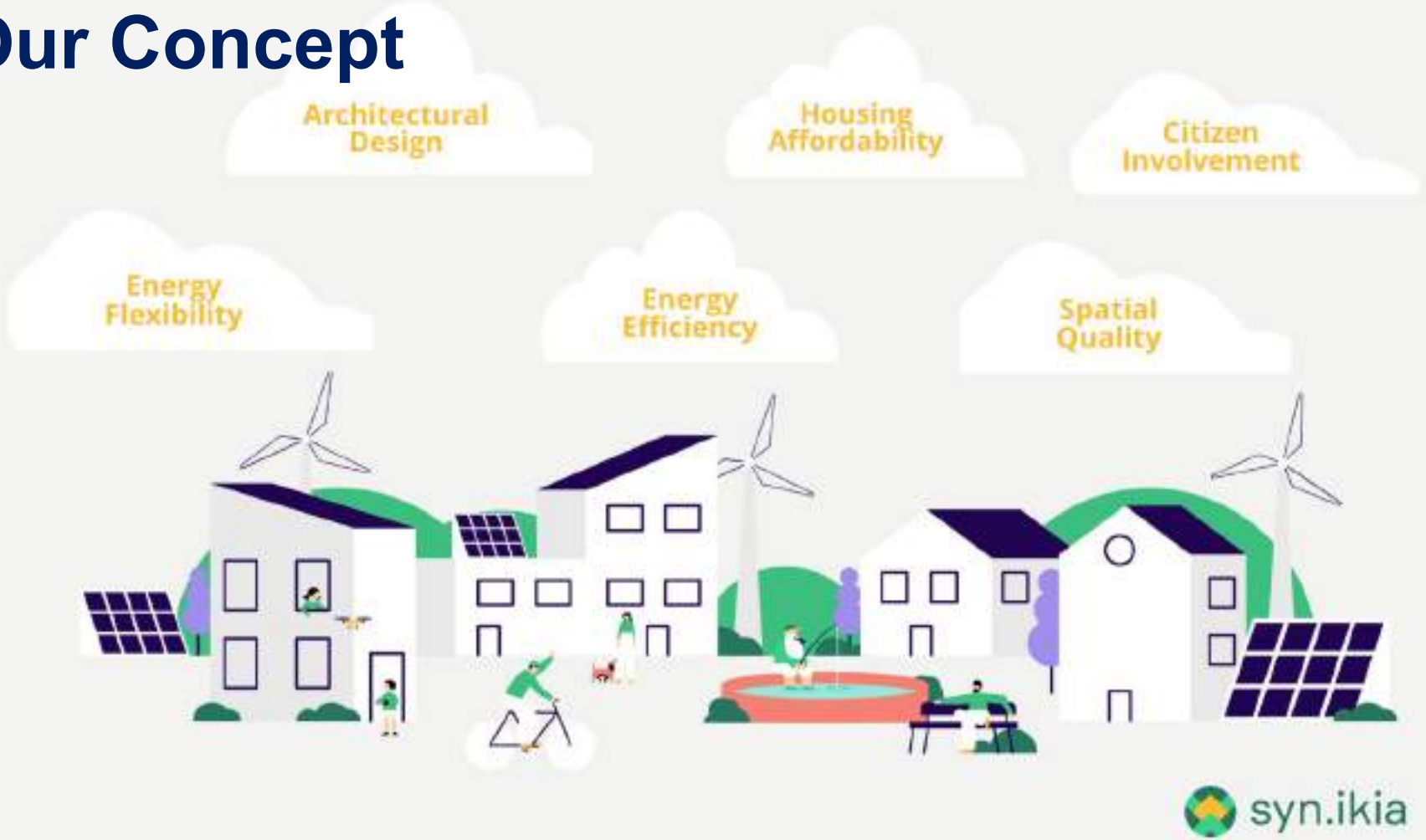
Our Concept



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LC-EEB-03-2019 New developments in plus energy houses

Grant agreement ID 870072

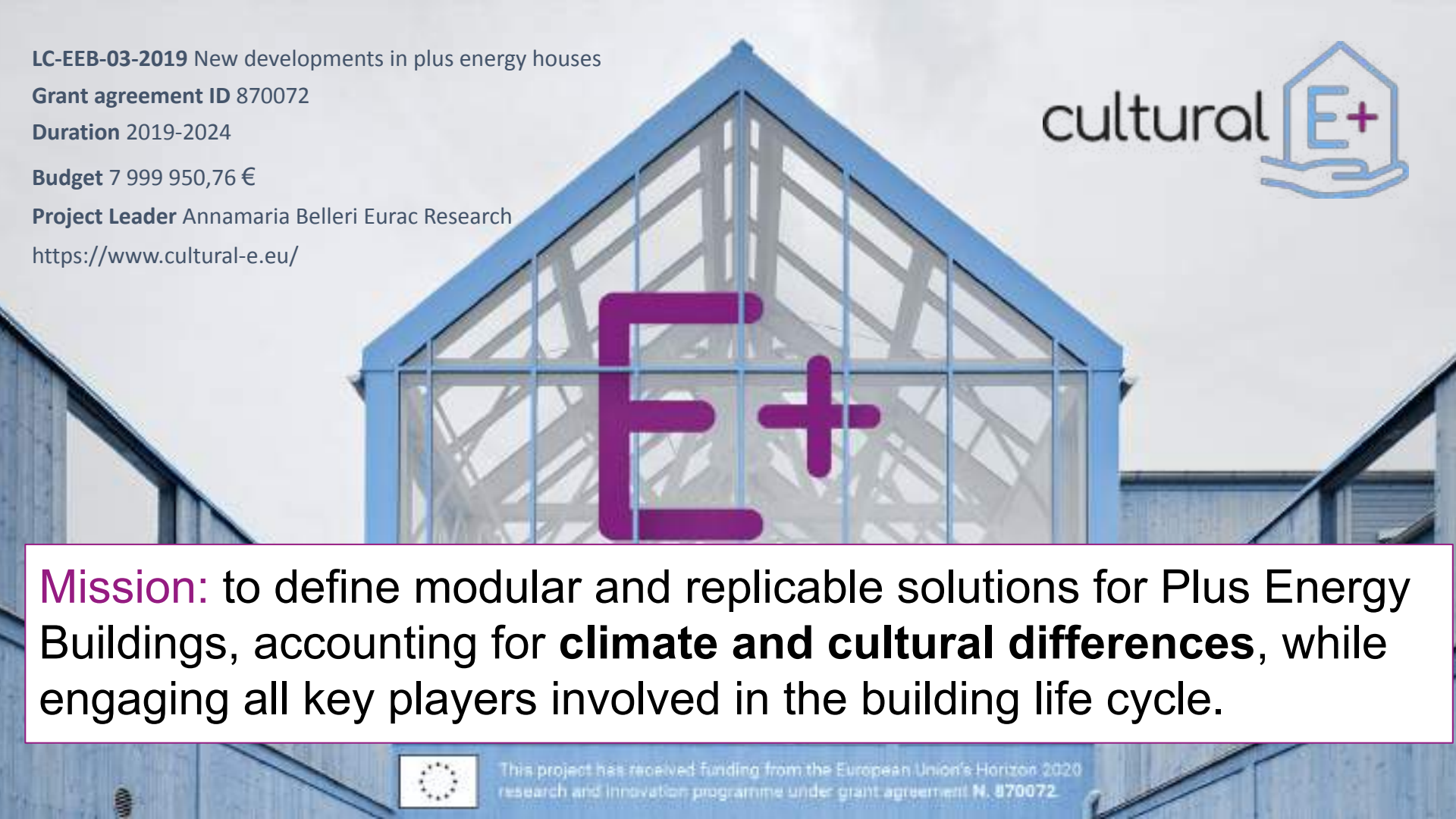
Duration 2019-2024

Budget 7 999 950,76 €

Project Leader Annamaria Belleri Eurac Research

https://www.cultural-e.eu/

cultural E+



Mission: to define modular and replicable solutions for Plus Energy Buildings, accounting for **climate and cultural differences**, while engaging all key players involved in the building life cycle.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 870072

Consortium as a whole

RTD PARTNERS

SOCIAL AND CULTURAL CLUSTERING — RMIT UNIVERSITY

CO-BENEFITS AND USER-BUILDING INTERACTION — Università Ca'Foscari Venezia, cmcc

LCA AND SOCIAL-ENVIRONMENTAL IMPACT — Universität Stuttgart

PROJECT COORDINATION, PLUS ENERGY BUILDING CONCEPT AND SOLUTION SE — eurac research

STORAGE SYSTEM AND CONTROL — Brunel University London

TECHNOLOGY PROVIDERS

HOUSE MANAGEMENT SYSTEM — advanticsys

PACKED HEAT PUMP SYSTEM — ventive, naturally intelligent ventilation

ACTIVE WINDOW — EURO FIRE GLASS

SMART AIR MOVEMENT — VORTICE

COMMUNICATION AND DISSEMINATION — ARCHITECTS' COUNCIL OF EUROPE, CONSEIL DES ARCHITECTES D'EUROPE

PROJECT ADVISORS + DEMO OWNERS

DEFINITION OF SOLUTION SETS FOR PEBs — eurac research, Abitcoop

SUPERVISING TECHNOLOGY DEVELOPMENTS — Nobatek INEF4, vilogia

SOLUTIONS FOR BUILDING FLEXIBILITY — SINTEF, BÆRUM KOMMUNE

ECONOMIC ANALYSIS AND BUSINESS MODE — stw, wohnbau Studio

What is a Plus Energy Building (PEB)?

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A Plus Energy Building is an energy efficient building that produces more final energy than it uses via locally available renewable sources over a time span of one year*.

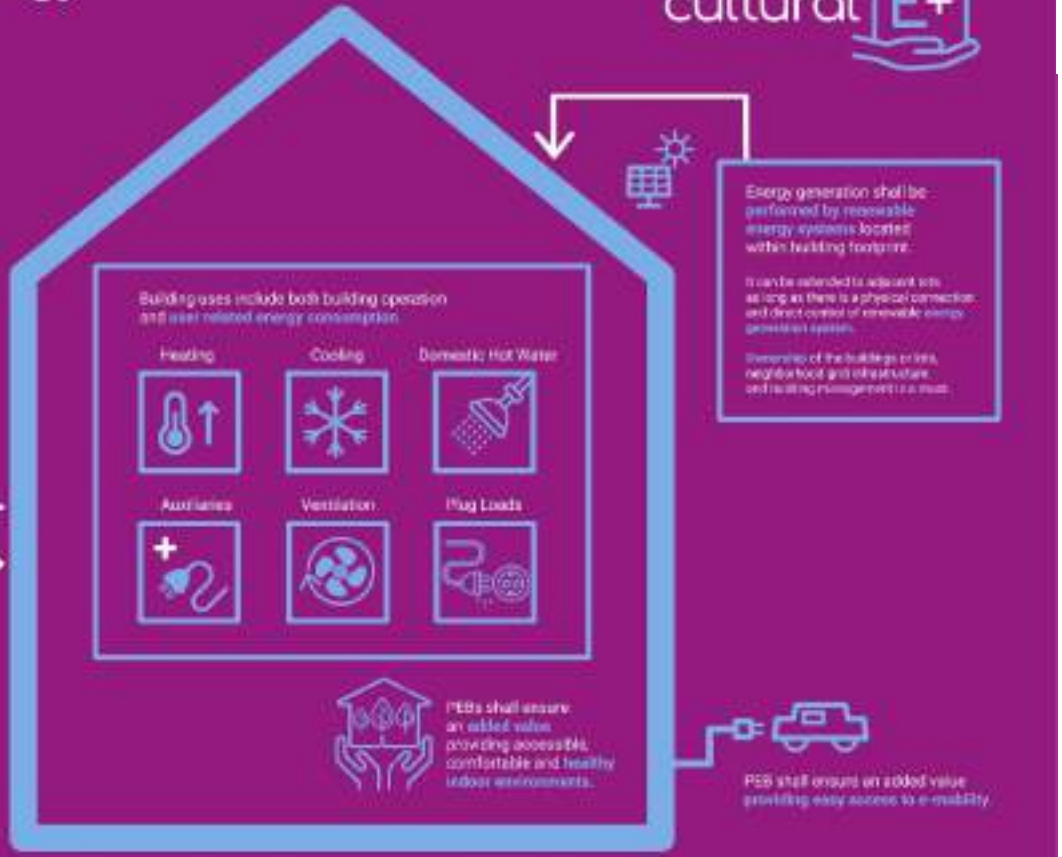
Positive balance reached by ensuring a good dynamic matching between load and generation providing building flexibility.

+ generation

− load

Positive balance reached by ensuring the lowest greenhouse gas emissions.

*The definition applies to all electric buildings and the energy balance is based on measured or predicted final energy between load and generation. In case of new buildings electrification is an inevitable process. In case other renewable energy vectors are used in the building (i.e. biomass, biogas...), final energy balance shall be zero.



Energy generation shall be performed by renewable energy systems located within building footprint.

It can be extended to adjacent sites as long as there is a physical connection and direct control of renewable energy generation systems.

Ownership of the buildings or the neighborhood grid infrastructure and building management is a must.

PEB shall ensure an added value providing easy access to e-mobility.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 870072

www.cultural-e.eu

https://www.cultural-e.eu/peb-definition/

Our concept

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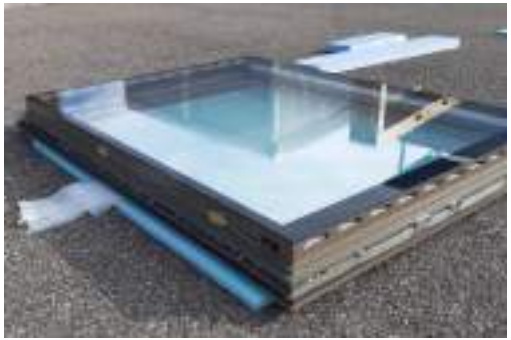
Cloud-based House Management System

Packed heat pump system

Active Window System



Smart air movement

Demonstrate PEB

Elgfaret 80-82
Apartment building for assisted living

Private social housing

Private real estate

Private cooperative

Project results

https://www.cultural-e.eu/reports-and-publications/

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Project overview

Andreas Türk , Joanneum Research

11.10.2023

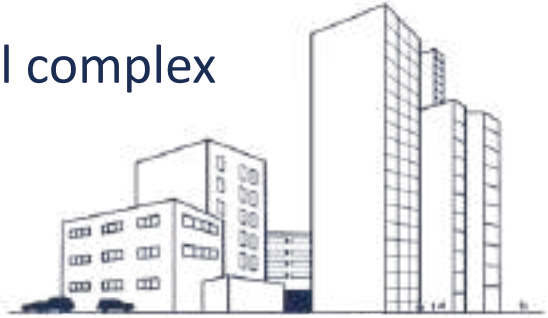
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 870157. This document reflects only the author's view and the Commission is not responsible for any use that may be made of the information it contains.

Background: EXCESS-project

- EXCESS is about FleXible user-CEntric Energy poSitive houseS
- How nearly-zero energy buildings can be transformed into positive energy buildings (PEBs)?
- Five years, starting in 2019
- 21 partners from 8 countries
- 4 demos in 4 climate zones

EXCESS Demos

- Former industrial complex in Graz, Austria



- Apartment building in Helsinki, Finland

- Social housing complex in Hasselt, Belgium

- Multi-apartment block in Granada, Spain

Identifying and quantifying the value of multiple benefits of SPENs for decision makers

Quantification and Monetisation

Dr. Sheikh Zuhaib
Buildings Performance Institute Europe (BPIE)

11.10.2023

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Contents

- Definition of multiple benefits
- General concepts & Key challenges
- Identification of SPEN multiple benefits
- Quantification & Monetisation
- What's next?

Definition 

What are multiple benefits?

'A broader range of outcomes that contribute to the human ambition to improve welfare and wealth. These benefits include various macroeconomic benefits (e.g. shifts in energy trade balances and employment), increased access to energy and improved affordability of energy services, reduced air pollution, and fiscal improvements for national and sub-national entities.' -IEA

'Multiple Benefits is an approach to quantify and communicate the strategic impacts of investments that enhance energy performance': - mbenefits project

Most definitions are limited to non-energy impacts of energy efficiency improvements.

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Multiple benefits of the building sector

Building's owner and occupant

- Health and comfort improvement
- Operation and maintenance due to improved building systems
- Affordability due to reduced bills
- Asset value, quality, and safety

Society (EU or national)

- Employment in green jobs in building sector
- Investments providing macro-economic benefits
- Energy and emissions reduction
- Environmental pollution and resource consumption reduction

Cities and regions

- Economic development through industrial productivity
- Energy poverty reduction through increased affordability
- Local pollution reduction
- Climate change resilience through improved durability of buildings

Industry

- Competitiveness and quality production
- Increased productivity and value creation
- Compliance with environmental regulations and targets
- Improved operation and reduced maintenance

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Source adapted: IEA 2019

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General concepts

Individual (micro) & Societal level (macro) MB

Individual level multiple benefits

User-well being

- Thermal comfort
- Natural lighting and contact with the outside
- Indoor air quality
- Internal and external noise
- Reduced health costs
- Ease of installation and reduced annoyance

Economic

- Reduced exposure to energy price fluctuations
- Low operation and maintenance costs

Building quality

- Building physics
- Ease of use and control by user
- Aesthetics and architectural integration
- Useful building areas
- Safety (intrusion and accidents)

Wider societal multiple benefits

Environment

- Reduction of air pollution
- Reduction of GHGs
- Energy savings
- Resource management (whole-life carbon)
- Climate change mitigation

Economic

- Lower energy prices
- Innovation and competitiveness
- Employment effects (Job creation)
- Increase in GDP
- Reduced public budget
- Energy supply security
- Reduced health care costs
- Reduced investment pressure on renewable energy generation, transmission and distribution

Social

- Reduced mortality
- Reduced morbidity
- Fuel poverty impacts
- Improved productivity

Source: S. Schnapp et. Al 2020

Key challenges 

- **Use of different terms** makes it challenging to use common benchmarks, KPIs and set industry best practices.
- **Lack of data, standards measurement practices**, benefits not analysed in a consistent manner, little added value for financial institutions and no mechanisms to quantify the multiple benefits.
- **Coordination among building experts and financial institutions or investors**, due to which there is little awareness on the issues and exchange of data/information.
- **Impact categories and assessments** capturing social aspects are not well integrated in multiple benefits.
- Energy savings sometimes takes longer to repay deep renovation costs, it is necessary to **encompass all benefits for the homeowner** during the investment decision for energy renovation stage.

Currently no straightforward way to account for energy efficiency and wider benefits available for decision-makers in building sector.

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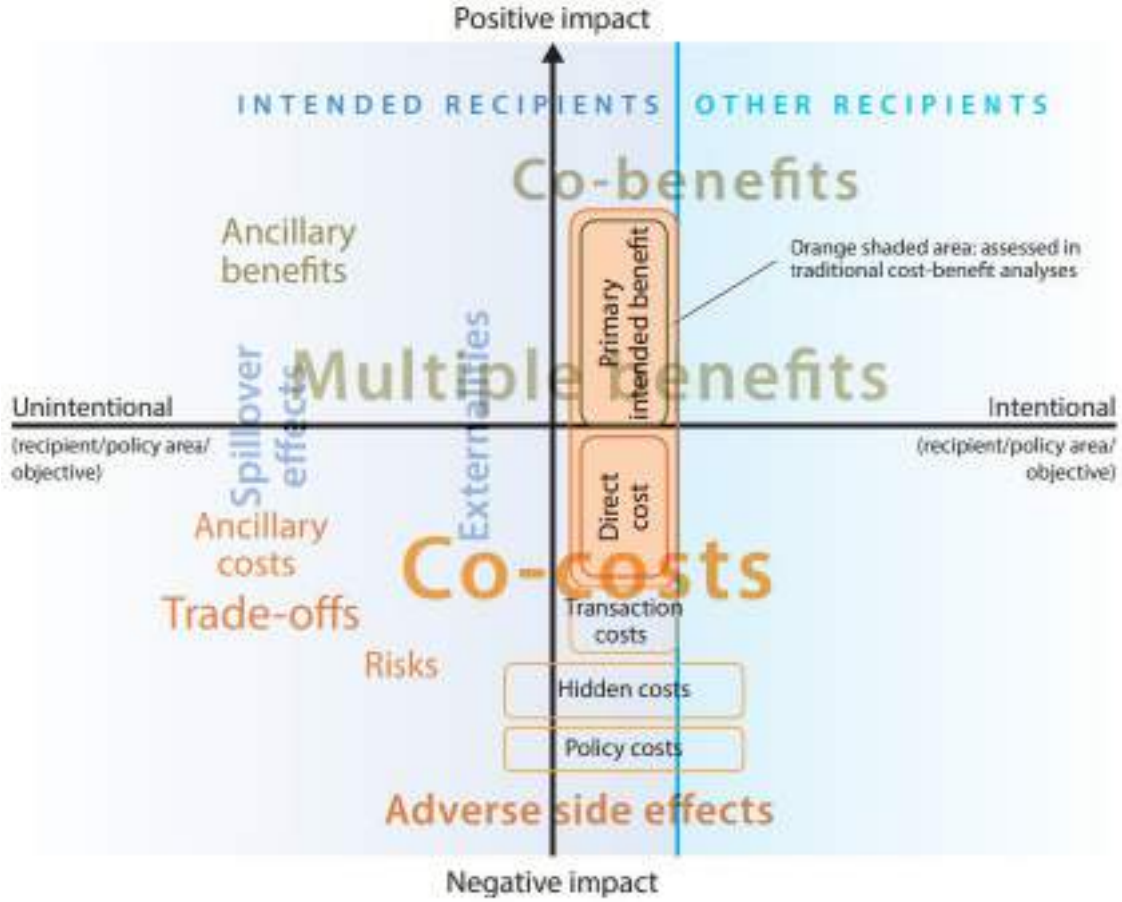
Taxonomy

of multiple benefits

How do we define?

Multiple benefits for Sustainable Plus Energy Neighbourhoods



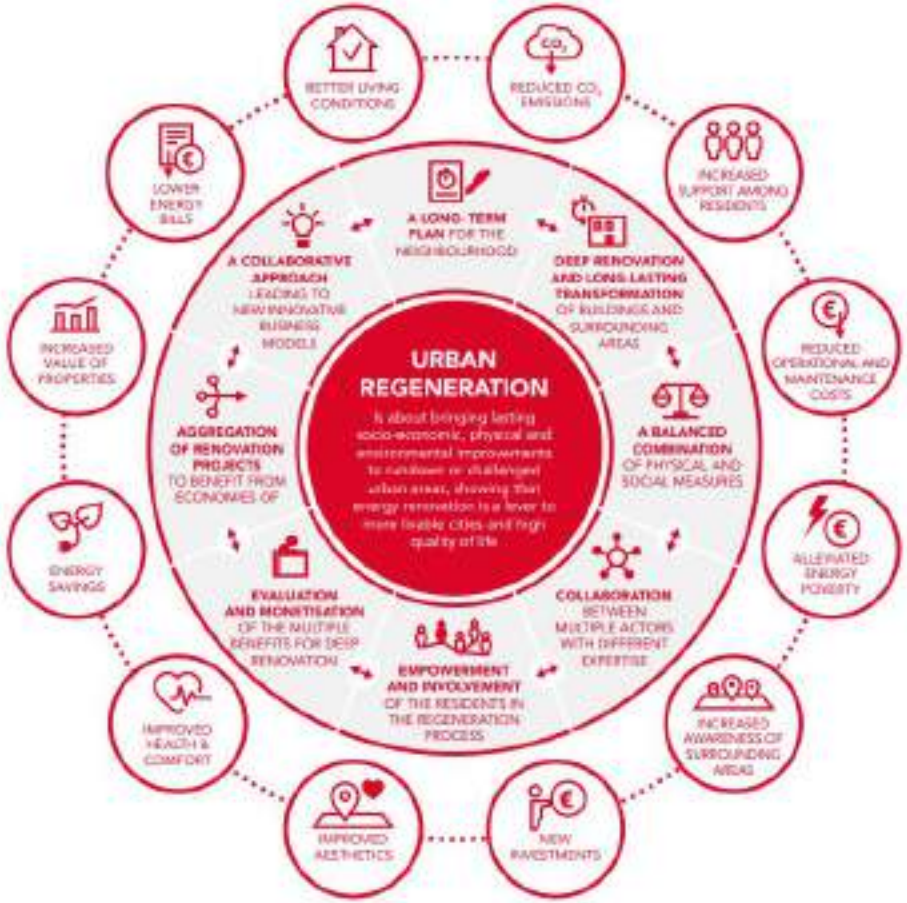
Source: D. Ürge-Vorsatz et. al. 2014

Urban regeneration

Multiple benefits at urban level

Urban regeneration initiatives underscore the importance of co-design, social support, community engagement.

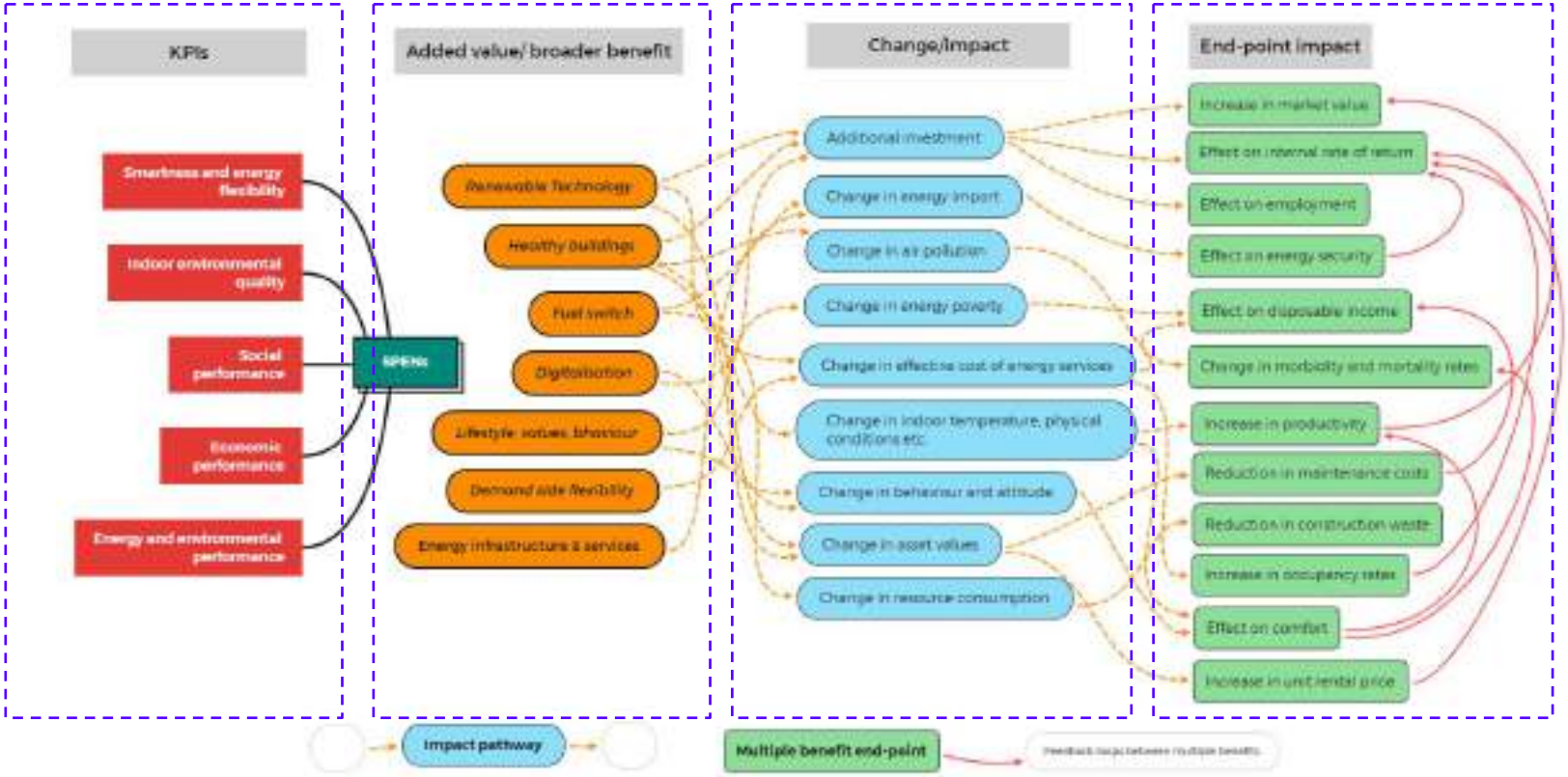
SPENs share similar vision of engaging the community in incorporating new developments into existing contexts/districts or by renovation of existing buildings through their transformation.



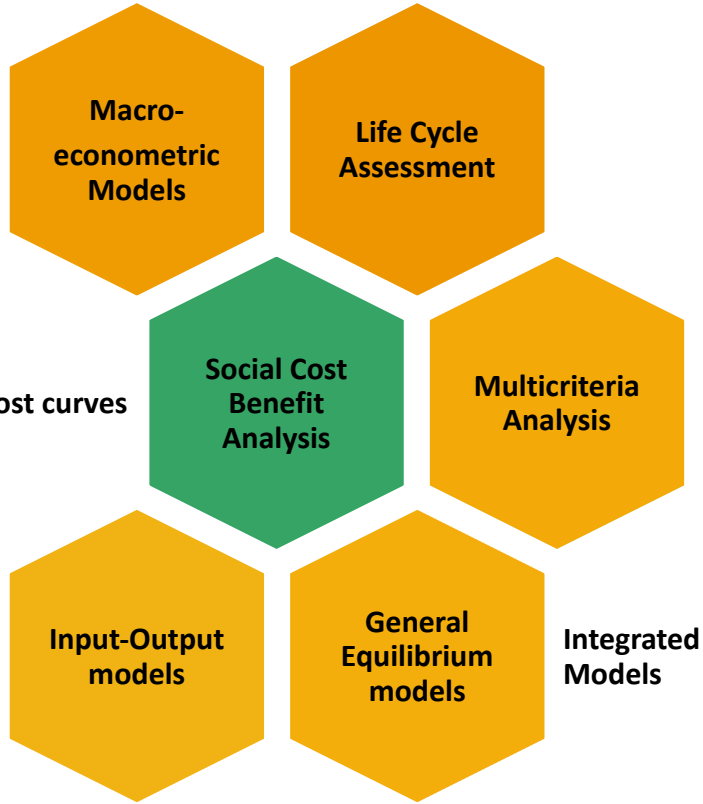
Source: BPIE 2018

SPEN impact pathway

Identification of neighbourhood benefits



Methods of quantification



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Social Cost-Benefit Analysis 

CBA is an application of welfare economics principles around investment choices.

- assessment of changes in welfare benefits and costs, expressing them all in the common currency of monetary values
- calculate the net effect on the total economic wellbeing of society.

Broad purpose of S-CBA is to help social decision-making and to increase social value or, more technically, to improve allocative efficiency.

Two main principles:

- demonstrating an investment will be worthwhile and deliver benefits of **greater value than its costs**
- comparing the efficiency of an investment against that of other projects/policies and ranking them by their **benefit-cost ratio (BCR).**

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Attaching value to multiple benefits (monetisation)

Willingness to pay (WTP)

WTP measures the maximum amount people would be willing to pay to gain outcomes that they view as desirable.

Revealed preferences		Stated preferences	
Hedonic pricing	Travel cost method	Contingent valuation method	Choice modelling method

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Total economic value

The monetary measure of a change in an individual's well-being due to a change in environmental quality is called the total economic value of the change.

total economic value = **use values** + **non-use values**

the benefits derived from the goods and services

the well-being caused to other individuals

externalities have to be 'internalised', i.e. valued in monetary terms and brought into the economic analysis of the project/policy

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Multiple benefits quantification and monetisation tool

- What? WEB- APPLICATION TOOL
- Who? POLICY MAKERS, INVESTORS, DEVELOPERS, PROFESSIONALS etc.
- When? LAUNCH 2024
- Where? DEDICATED SYNIKIA EVENT

Stay tuned!

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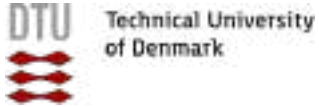


Thank you!

email: sheikh.zuhaib@bpie.eu

Effective communication towards different stakeholders

Using multiple benefits of PEBs as a trigger for energy efficiency

Wilmer Pasut - University Ca' Foscari of Venice, Cultural-E partner

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870072

Ca' Foscari University of Venice

Users and Built Environment (UBE) Group

Toward a user-centred design and control of the built environment

Wilmer Pasut

Professor of building physics

Laura Carnieletto

Assistant professor

Alberto Saugo

Researcher

Rigoberto Arambula

Researcher

Topics:

IEQ assessment, Technology for the built environment, User-technology interaction, IEQ control, Energy modelling, Resilient buildings

Ca' Foscari University of Venice

UNIVE and CMCC

Francesco Bosello

Associate Professor of Economic analysis, climate impacts and policies

Valentina Giannini

Researcher

Andrea Bigano

Researcher

Why?

energies

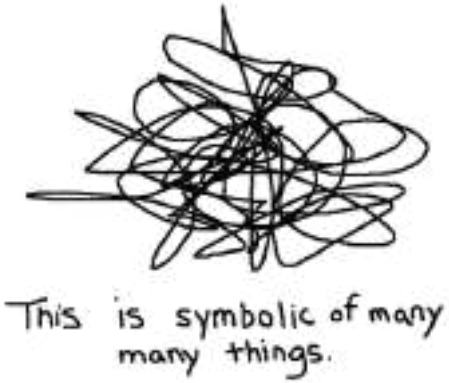
Review

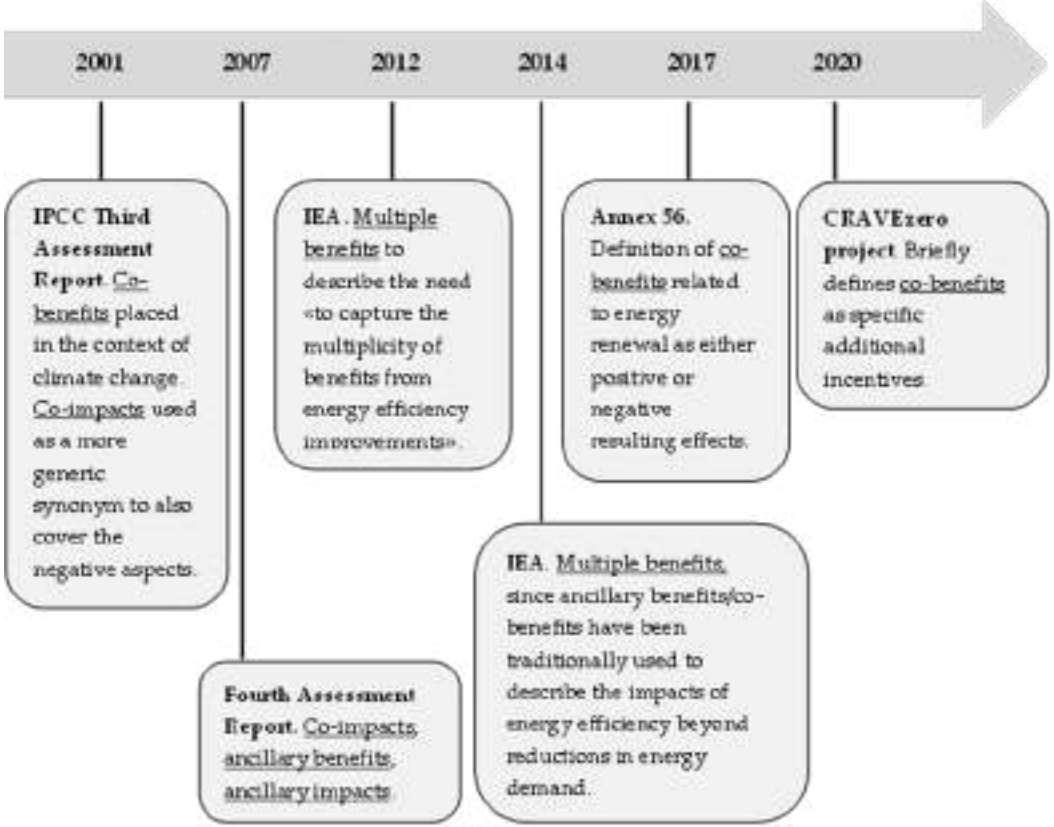
Indirect Effects of High-Performance Buildings at Household and Community Level: A Systematic Literature Review

Lorenza Pistore [1], Francesca Tintinaglia [2], Roberta Pernetti [3], Pietro Stivanello [1] and Wilmer Pasut [1,4,*]

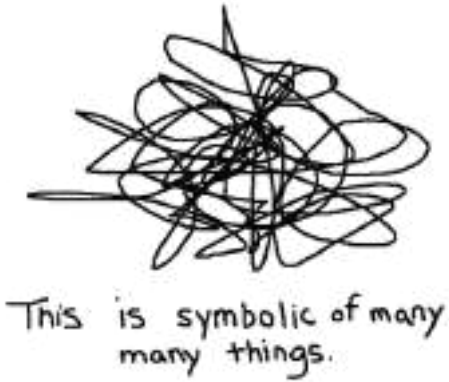
1 Department of Environmental Sciences, Informatics and Statistics, Ca' Foscari University of Venice, 30172 Venice, Italy
2 Department of Engineering and Architecture, University of Trieste, 56126 Trieste, Italy
3 Department of Public Health, Experimental and Forensic Medicine, University of Pavia, 27100 Pavia, Italy
4 Department of Architecture, Korea University, Seoul 02841, Republic of Korea
* Correspondence: wilmer.pasut@unive.it

Unsure even in the name





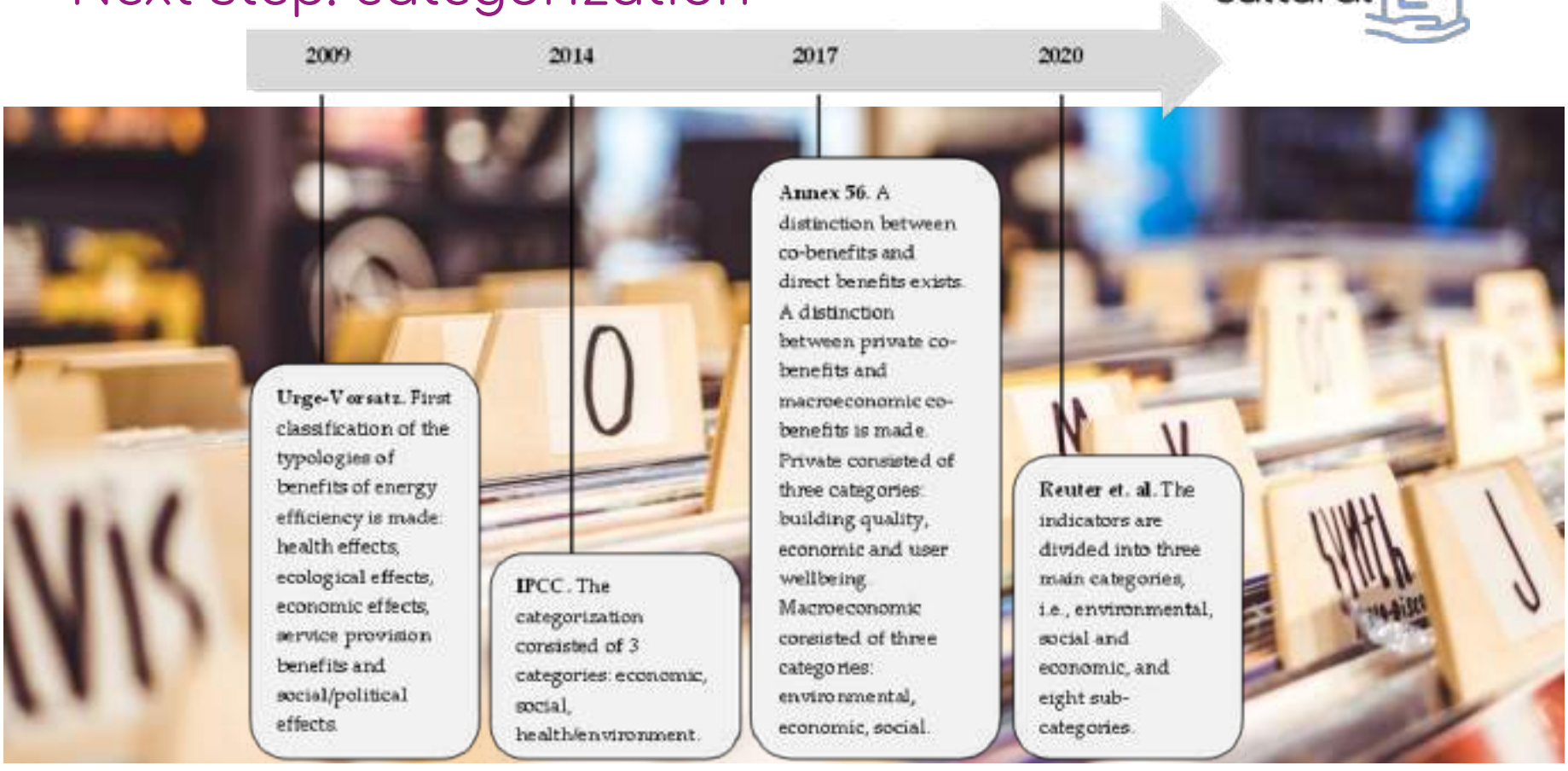
A fundamental point: a proper definition



Co-impacts *are the added positive and negative values, other than the direct and measurable impacts, which derive from high-energy efficient building and related technologies.*

Co-impacts can be household co-impacts if they have an effect on the user's well-being and household economy, or community co-impacts if they have wider economic, social and environmental effects

Next step: categorization



A fine categorization to include the full spectrum of co-benefits

HOUSEHOLD LEVEL		COMMUNITY LEVEL	
Direct effects	Co-impacts	Direct effects	Co-impacts
Reduction of energy consumptions	Thermal comfort	Reduction of CO2 emissions	Incentives for the construction sector --> more private investment
Reduction of energy consumption costs	Acoustic comfort	Reduction of energy consumption	Lower energy costs
Building life-cycle cost reduction	Visual comfort	Reduction of dependence on fossil fuels --> reduction of import costs and greater country tax stability	New business opportunities
	IAQ indoor air quality		Mitigation of climate change
	Building Physics		Reduction of atmospheric pollution
	Health improvement		Reduction of construction / demolition waste
	Easy of use		Biodiversity protection
	Safety		Environmental resource protection
	Aesthetics of the building		Reduction of water consumption and waste water production
	Improvement of health conditions / Reduction of work leave (smart working)		Conservation of ecosystems
	Reduction of psychological effects		Improvement of social welfare
	Resilience to climate change		Aesthetics of the building - neighbourhood enhancement
	Increase in productivity (smart working)		Mortality / morbidity reduction
	Lower cost of energy		Urban heat island mitigation
	Less need for energy subsidies		Reduction of outdoor air pollution
	Easier to sell / rent at higher real estate prices		Energy security
	Lower maintenance costs		
	Increase in the value of the building		

Legend for categories: USER WELLBEING | ECONOMIC | ENVIRONMENTAL | SOCIAL

https://doi.org/10.3390/en16052499

Methodologies for quantification

Household level

Choice-experiments

by means of survey questionnaires to users

→ Willingness to Pay

Society / community level

Quantification

by means of WHO indicators basing on reduction of GHG emissions reduction and other pollutants

→ Morbidity/Hospitalization and Mortality incidence

Direct Costing of co-benefits

Identification and quantification of co-benefits at the community level

Identified indicators
that need to be «priced»

Total use of renewable primary energy resources (PERT)
Total use of non renewable primary energy resource (PENRT)
Global warming potential (GWP)
Abiotic depletion potential for fossil resources (ADPF)
Renewable primary energy as energy carrier (PERE)
Non renewable primary energy as energy carrier (PENRE)
Input of secondary material (SM)

OTHER:

- Depletion potential of the stratospheric ozone layer (ODP)
- Acidification potential (AP)
- Eutrophication potential (EP)
- Formation potential of tropospheric ozone photochemical oxidants (POCP)
- Abiotic depletion potential for non fossil resources (ADPE)
- Material for Energy Recovery (MER)
- Materials for recycling (MFR)
- Components for re-use (CRU)
- Radioactive waste disposed (RWD)
- Non hazardous waste dispose (NHWD)
- Hazardous waste disposed (HWD)
- Use of net fresh water (FW)
- Use of non renewable secondary fuels (NRSF)
- Use of renewable secondary fuels (RSF)
- Primary energy resources used as raw materials (PERM)
- Non renewable primary energy as material utilization (PENRM)
- Exported electrical energy (EEE)
- Exported thermal energy (EET)

Demo case: ITALY

Demo case: GERMANY

Direct Costing

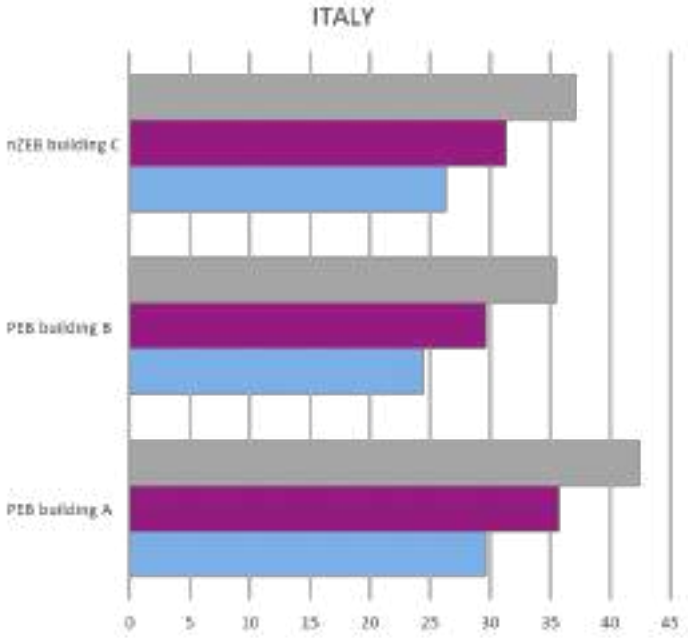
- At the moment, we have applied the methods to the LCA datasets of Italian and German Demo cases
- Building A and Building B (only IT) are the Plus Energy Buildings (PEB)
- Building C, the reference, is a nearly Zero Energy Building (nZEB)
- When possible, low – medium – high cost ranges have been taken into account to consider sensitivity/uncertainty
- Cost in € / m²*yr

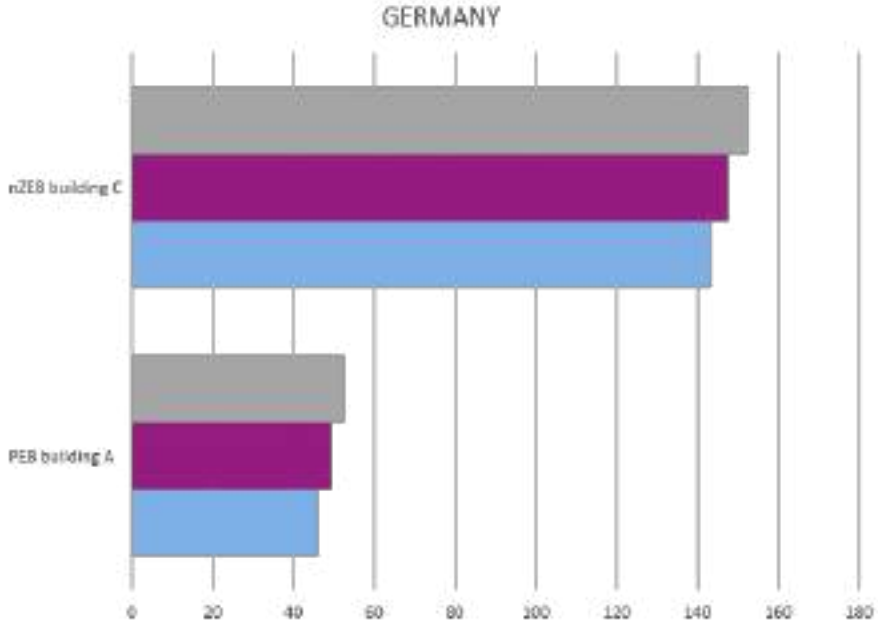
We are working on the FINAL VERSION OF THE DATA

ITALY	unit cost (€)			PEB Building A				PEB Building B				nZEB Building C					
Indicator	low	medium	high	impact/m²*y	low	medium	high	impact/m²*y	low	medium	high	impact/m²*y	low	medium	high	impact Unit	Price Unit
PERT	0.02	0.03	0.05	38.20	0.69	1.24	1.79	38.36	0.69	1.24	1.80	47.46	0.85	1.54	2.22	MJ	€/MJ
PENRT	0.01	0.01	0.01	188.45	2.58	2.62	2.66	155.14	2.13	2.16	2.19	176.90	2.42	2.46	2.49	MJ	€/MJ
GWP	0.04	0.28	0.53	18.17	0.73	5.13	9.54	14.61	0.58	4.13	7.67	13.41	0.54	3.79	7.04	kg CO2-Eq	$2022/kg CO2
ADPF	0.00	0.00	0.01	174.89	0.00	0.23	1.19	145.56	0.00	0.19	0.99	171.85	0.00	0.22	1.17	MJ	€2018/MJ
PERE	0.02	0.03	0.05	37.95	0.68	1.23	1.78	38.27	0.69	1.24	1.79	35.73	0.64	1.16	1.67	MJ	€/MJ
PENRE	0.01	0.01	0.01	175.06	2.40	2.43	2.47	142.11	1.95	1.98	2.00	140.84	1.93	1.96	1.99	MJ	€/MJ
SM	2.83	2.83	2.83	7.80	22.07	22.07	22.07	6.24	17.67	17.67	17.67	6.61	18.71	18.71	18.71	kg	€/kg
(other)					0.54	0.80	0.95		0.75	1.11	1.37		1.24	1.53	1.85		
TOTAL (€/m2*y)					29.69	35.76	42.44		24.45	29.70	35.47		26.34	31.36	37.14		
GERMANY	unit cost (€)			PEB Building A								nZEB Building C					
Indicator	low	medium	high	impact/m²*y	low	medium	high					impact/m²*y	low	medium	high	impact Unit	Price Unit
MFR	2.83	2.83	2.83	9.54	26.99	26.99	26.99					45.59	128.98	128.98	128.98	kg	€/kg
NHWD	0.03	0.03	0.03	8.20	0.26	0.26	0.26					24.77	0.78	0.78	0.78	kg	€/kg
SM	2.83	2.83	2.83	5.74	16.23	16.23	16.23					3.06	8.66	8.66	8.66	kg	€/kg
(other)					2.67	5.98	9.19						4.92	9.36	14.18		
TOTAL (€/m2*y)					46.15	49.46	52.67					73.42	143.35	147.79	152.61		

Direct Costing

- total costs for the buildings [€/m2*y]
- for the cost range (low, medium, high)





Co-benefits

We are working with the FINAL VERSION OF THE DATA

- green highlights where we have positive co-benefit in PEB (costs < 0 wrt nZEB)

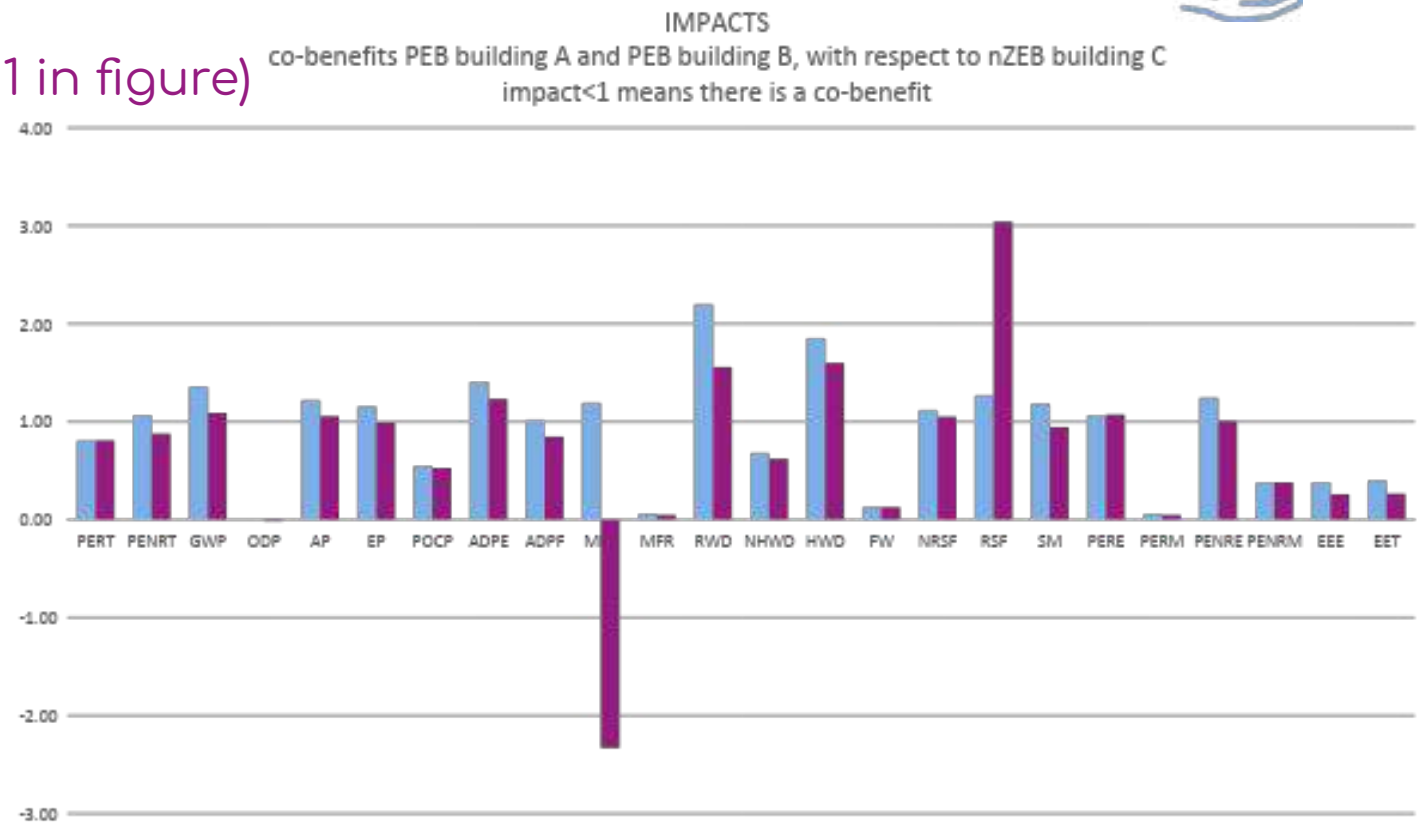
	ITALY						GERMANY		
	PEB building A - nZEB building C			PEB building B - nZEB building C			PEB building A - nZEB building C		
Indicator	A-C low	A-C medium	A-C high	B-C low	B-C medium	B-C high	A-C low	A-C medium	A-C high
Total use of renewable primary energy resources (PERT)	-0.17 €	-0.30 €	-0.43 €	-0.16 €	-0.29 €	-0.43 €	1.18 €	2.12 €	3.06 €
Total use of non renewable primary energy resource (PENRT)	0.16 €	0.16 €	0.16 €	-0.30 €	-0.30 €	-0.31 €	-1.30 €	-1.32 €	-1.34 €
Global warming potential (GWP)	0.19 €	1.35 €	2.50 €	0.05 €	0.34 €	0.63 €	-0.38 €	-2.68 €	-4.97 €
Depletion potential of the stratospheric ozone layer (ODP)	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €
Acidification potential (AP)	0.00 €	0.03 €	0.04 €	0.00 €	0.01 €	0.01 €	0.00 €	-0.02 €	-0.02 €
Eutrophication potential (EP)	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €
Formation potential of tropospheric ozone photochemical oxidants (POCP)	0.00 €	-0.01 €	-0.01 €	0.00 €	-0.01 €	-0.01 €	0.00 €	0.00 €	0.00 €
Abiotic depletion potential for non fossil resources (ADPE)	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €
Abiotic depletion potential for fossil resources (ADPF)	0.00 €	0.00 €	0.02 €	0.00 €	-0.03 €	-0.18 €	0.00 €	-0.10 €	-0.50 €
Material for Energy Recovery (MER)	-0.01 €	-0.01 €	-0.01 €	0.11 €	0.15 €	0.20 €	-1.79 €	-2.45 €	-3.13 €
Materials for recycling (MFR)	-0.07 €	-0.07 €	-0.07 €	-0.07 €	-0.07 €	-0.07 €	-101.99 €	-101.99 €	-101.99 €
Radioactive waste disposed (RWD)	0.01 €	0.01 €	0.01 €	0.01 €	0.01 €	0.01 €	-0.03 €	-0.03 €	-0.03 €
Non hazardous waste dispose (NHWD)	-0.02 €	-0.02 €	-0.02 €	-0.02 €	-0.02 €	-0.02 €	-0.52 €	-0.52 €	-0.52 €
Hazardous waste disposed (HWD)	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €
Use of net fresh water (FW)	0.00 €	0.00 €	-0.13 €	0.00 €	0.00 €	-0.13 €	0.00 €	0.00 €	-0.17 €
Use of non renewable secondary fuels (NRSF)	0.01 €	0.01 €	0.01 €	0.01 €	0.01 €	0.01 €	0.01 €	0.01 €	0.01 €
Use of renewable secondary fuels (RSF)	0.02 €	0.03 €	0.04 €	0.13 €	0.24 €	0.34 €	0.12 €	0.22 €	0.32 €
Input of secondary material (SM)	3.36 €	3.36 €	3.36 €	-1.04 €	-1.04 €	-1.04 €	7.57 €	7.57 €	7.57 €
Renewable primary energy as energy carrier (PERE)	0.04 €	0.07 €	0.10 €	0.05 €	0.08 €	0.12 €	1.18 €	2.12 €	3.06 €
Primary energy resources used as raw materials (PERM)	-0.16 €	-0.17 €	-0.17 €	-0.16 €	-0.17 €	-0.17 €	-0.02 €	-0.02 €	-0.02 €
Non renewable primary energy as energy carrier (PENRE)	0.47 €	0.48 €	0.48 €	0.02 €	0.02 €	0.02 €	-1.13 €	-1.15 €	-1.17 €
Non renewable primary energy as material utilization (PENRM)	-0.40 €	-0.41 €	-0.41 €	-0.40 €	-0.40 €	-0.41 €	-0.06 €	-0.07 €	-0.07 €
Exported electrical energy (EEE)	-0.02 €	-0.04 €	-0.06 €	-0.03 €	-0.05 €	-0.07 €	0.00 €	0.00 €	-0.01 €
Exported thermal energy (EET)	-0.05 €	-0.09 €	-0.13 €	-0.06 €	-0.11 €	-0.16 €	-0.01 €	-0.01 €	-0.02 €
TOTAL (€/m2*y)	3.36 €	4.40 €	5.30 €	-1.89 €	-1.66 €	-1.67 €	-97.20 €	-98.33 €	-99.94 €

Demo case: ITALY

Direct Costing: indicator performance (IT)
(nZEB indexed to 1 in figure)

Considering IMPACTS, **PEB building B has the best total performance**, in detail:

- **PEB building A** shows co-benefits for
  - **10** out of 24 indicators
  - PERT, ODP, POCP, MFR, NHWD, FW, PERM, PENRM, EEE, EET
- **PEB building B** shows co-benefits for
  - **15** out of 24 indicators
  - PERT, PENRT, ODP, EP, POCP, ADPF, MER, MFR, NHWD, FW, SM, PERM, PENRM, EEE, EET



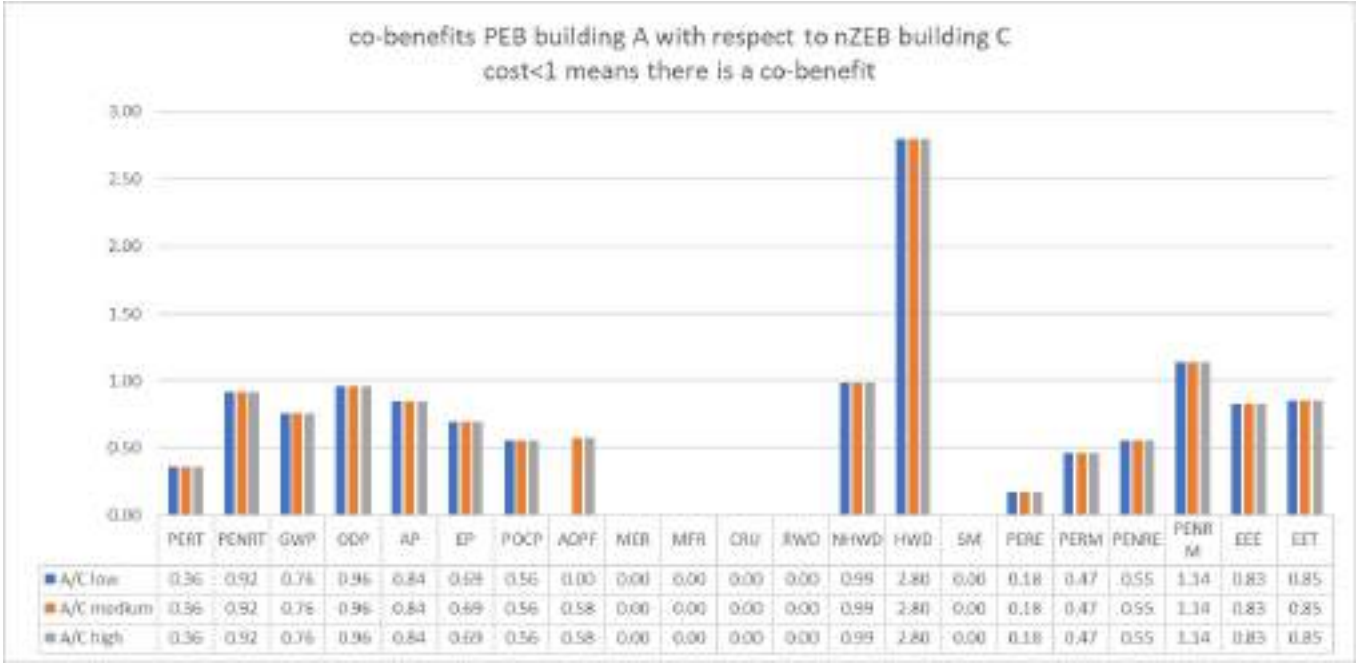
Demo case: GERMANY

Direct Costing: indicator performance (DE)

(nZEB indexed to 1 in figure)

Considering <u>costs</u>, despite the better total performance of nZEB building C:

- PEB building A shows co-benefits for
  - **14** out of 20 indicators
  - PERT, PENRT, GWP, ODP, AP, EP, POCP, ADPF, NHWD, PERE, PERM, PENRE, EEE, EET



Discrete choice experiments, stated preferences

- Two countries, France and Germany, to capture heterogeneity across EU building stocks (climate, fuels, average age, national energy efficiency policies)
- Two samples of 1000 respondents each;
- Selection of relevant co-benefits;
- Definition of the questionnaire;
- Questionnaire testing in one-on-one setting;
- Administration of the questionnaire by a reputable survey company using Computer Assisted Web Interviewing (CAWI) procedures;
- Econometric analysis of collected data and WTP estimation.

Crucial Issues

- We realised that, in order to come up with a credible set of questions for French and German responders, we need to reach a deep understanding of house ownership and house renting ma in FR and DE.

- **We needed to understand:**
  - The main features of the real estate market w.r.t. the role of energy use and energy efficiency
  - The differences in this matter between the rental market and the real estate market

- Checked the relevant literature and available information on the Internet
- Interviewed local partners and experts.
- We concluded that:
  - The German rental market is probably too complex in terms of variety of possible contracts, split incentives between renters and landlords, regulations, and political climate towards renovations to yield a credible WTP among German renters.
  - The situation in France is clearer, and more balanced between rental and ownership.
  - The safest course of action would be to interview homeowners only if sampling representativity allows it.

Updated questionnaire

- Includes all relevant socio-demographic and sampling quotas questions tailored to national situations
- Includes extensive section on attitudes and knowledge about energy use, energy renovations and highly efficient buildings
- Includes open-ended evaluation questions about the value of the dwelling with and without radical energy renovations
- Includes updated attribute list (extended to enhanced energy security and participation in energy communities)
- Includes follow-up questions on the relative relevance of attributes for the respondents
- Includes final consequentiality question, i.e., about how much, in the respondents' opinion, decision makers will take the survey result into account.

Thank you for you attention!

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Policy roadmap task and vision within EXCESS

Joaquin Villar

Junta de Andalucía
Consejería de Política Industrial y Energía
Agencia Andaluza de la Energía

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 870157. This document reflects only the author's view and the Commission is not responsible for any use that may be made of the information it contains.

Policy Roadmap for upscaling the PEB concept

The policy roadmap is aimed at providing to national/regional and local governments with **guidelines for the transition** from the current construction model to a sustainable one, in economic, social and environmental terms.

It includes **policy strategies, and instruments for upscaling the PEB concept, building on local to European strategies and processes** that are favourable and supportive to PEB concepts.

The document is the result of the **participation and collaboration of several actor** representing the construction sector, whose contribution is reflected throughout the different aspects addressed by the Policy Roadmap

Roadmap for upscaling the PEB concept. Scope

- Adapted to various socioeconomic contexts.
  - ❑ A data base is set up, including rural and urban settings, newly constructed and existing building stock, various climatic conditions, etc.
- From a building, district, city and regional level
- Local planning processes like Sustainable Energy and Climate Action Plans is addressed.

Roadmap for upscaling the PEB concept. Contents

- What is PEB and why include it in local and regional energy planning
- Legal framework in Europe
- Main Barriers
- Findings from PEB demos and stocktaking
- **Lines and axes of intervention**

Roadmap. Legal Framework

- **Energy Efficiency Directive 2023/1791**
- Energy Efficiency Directive 2012/27/EU, revised in 2019
- Energy Performance of Buildings Directive 2010/31/EU, revised in 2018
- Renewable Energy Directive (2009/28/EC), revised in 2018
- Waste Framework Directive and Environmental Product Declarations
- Renovation Wave Strategy, 2020
- Fit for 55 package, July 2021
- COM (2021) 802 final, on the energy performance of buildings, December 2021
- REPowerEU plan

Roadmap. Main Barriers

Technical

- Complexity of the PEB concept
- Lack of integrators and interdisciplinary teams
- Lack of actors providing services that cover the whole chain from planning to operation and maintenance.
- Constant emergence of new technologies and new ways of using them
- Lack of tools for the coordinated control and optimisation of the energy system
- Pronounced need to consider the local conditions in the planning of PEB

Regulatory

- Immaturity of regulations
- Fragmentation of energy regulation (different fields and governance levels)
- Inability of the regulations to handle different ownership structures and energy choices.
- Tight restrictions in historic buildings in combination with renewable installations

Roadmap. Main Barriers

Social

- Lack of public awareness
- Multi-owner decision making (in some countries)
- Affordability of PEBS

Financial

- Lack of existing examples of cost-benefit analyses of PEBS (life cycle)
- Typically, high investment costs of PEBS
- Wide range of design options > significant variation of the costs

Roadmap. Line and axes

1. Policy and regulation
2. Business model and financing
3. Technology and building
4. Social context and users

Roadmap. Line and axes. Policy and regulation

1. Development of **specific regulatory measures** aimed at promoting PEBS
2. Inclusion of PEB concept is **the energy efficiency targets** on national/regional/level level
3. The **life-cycle effects** should be made mandatory in the planning phase.
4. Facilitate the **interconnection of PEBS** with local thermal and electrical grids.
5. Reducing **administrative formalities** for the implementation of PEBS-associated projects.
6. Enhancement of **PEBS Observatories** as a diagnostic and monitoring tool for rehabilitative action
7. Development of **a code of good practice** for drafting of local legislation impact on the matter.
8. Development of an appropriate regulatory framework for local energy communities as a tool as a regulatory opportunity for PEBS: **promoting pilots maximizing the sharing energy from PEBs**
9. Promote PEBS in regional/locally owned buildings: public awareness, voluntary standards, innovative public procurement

Roadmap. Line and axes. Financing

1. Definition of an **innovative finance framework**, such as subsidies on interest rates
2. Definition of **tax instruments** that favour PEBS solutions, not only during the construction phase, but also during operation in the form of tax advantages.
3. Introducing **CO2 tax** or an environmental tax.
4. Implementation of other measures to facilitate access to **private finance** for businesses and individuals: agreements with financial institutions, energy as a service.
5. Develop **performance-based contracts** to also include the maintenance of PEBS systems, such as energy service companies (ESCOs).
6. Implementation of measures to facilitate the development of a **sector around PEBS**.

Roadmap. Line and axes. Technology and innovation

1. Reinforcement of the **“project management”** role
2. Facilitate the access to **training and certification schemes** to all stakeholders in the value chain
3. Promotion of **smart energy management tools** with user friendly applications
4. Create tools and processes for **peer-to-peer advice** and information provision
5. Prioritisation of **research efforts** at local and regional level around PEBS
6. Promoting **collaboration between different knowledge actors** at local and regional level working in the PEBS sector
7. Promotion of **innovative strategic projects, initial demonstration projects and pilot projects**, which accelerate the deployment of these solutions.
8. **Promotion of measures** aimed at providing advice, the organisation of training and information sessions, the identification of funding opportunities, and the incubation of project proposals
9. Support for **patents generation** and exploitation in the sector

Roadmap. Line and axes. Social context and users

1. **Improving society's knowledge of PEBS and implementable technologies**
2. **Improving the knowledge of PEBS to local decision-makers and prescribers**
3. **Specific means of boosting PEBS in vulnerable groups**
    1. Creation of a network of **energy ambassadors** in the context of social housing that attends to the communities and generally creating a new energy culture through information and training on energy in buildings.
    2. Promotion of **local energy communities** with the participation of vulnerable groups the reinforced new ways for cooperation in the neighbourhood
    3. Promotion of **demonstration and pilot projects**
    4. **Subsidize PEBs in groups more affected by energy poverty** to reach the entire collective.

Roadmap. Line and axes. Next steps

1. **Integration of the RESULTS derived from the analysis on PEBS**:
   - ❑ Cost-optimal solution in PEBs
   - ❑ Energy efficiency schemes
   - ❑ Business models for PEBs
   - ❑ Replication Plans
2. **Integration of the RESULTS derived from pilot projects**
3. **Consultation to EAB**
4. **Presentation in the final EXCESS meeting**

Roadmap. Questions

- Legal framework in Europe, is it enough at EU level? What else at national/regional or local level?
- Do you agree with the main barriers? What other barriers do you identify? Which measures could be proposed to overcome them?
- Do you agree with the main topics suggested? Other possible topics?

Thank you!

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 870157. This document reflects only the author's view and the Commission is not responsible for any use that may be made of the information it contains.

Let’s discuss

Niki Gaitani, syn.ikia project coordinator - NTNU, Jaume Salom - IREC
Wilmer Pasut, Cultural-E project partner - UniVe
Andreas Tuerk, EXCESS project coordinator - Joanneum Research

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Active poll

7

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#BeyondEE

Which technologies can be easily considered/applied by architects/designers/engineers when designing PEBs (Plus Energy Buildings)?

Anonymous
PV

Anonymous
PV

Anonymous
Shading technologies

Anonymous
PV

Anonymous
PV

Anonymous
Heat pumps

• • • 3 participants typing

9

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Which technologies can be easily considered/applied by architects/designers/engineers when designing PEBs (Plus Energy Buildings)?

Anonymous
Deep geothermal energy

Anonymous
Passive solutions

Anonymous
Envelopes, building management system, PVs

Anonymous
This depends on the climate zone. Prioritise RES solutions

Anonymous
Highly energy efficient wondows and building skins

Anonymous
Sufficiency design strategies

Active poll

10

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Which technologies can be easily considered/applied by architects/designers/engineers when designing PEBs (Plus Energy Buildings)?

Anonymous
Biobased materials

Anonymous
Trees 😊

Anonymous
BIM

Anonymous
Seasonal energy storage

Anonymous
Behavioural interventions

Anonymous
Pre-fab modular panels for renovation

• • 6 participants typing

5

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And which factors are the most relevant for urban planners when designing SPENs (Sustainable Plus Energy Neighbourhoods)?

Anonymous
Climatic factors

Anonymous
How "users" are going to use the building eventually

Anonymous
Mobility

Anonymous
Mixed-use

Anonymous
Land use

Anonymous
Site specific needs

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9

And which factors are the most relevant for urban planners when designing SPENs (Sustainable Plus Energy Neighbourhoods)?

Anonymous
Density of buildings

Anonymous
The availability of difftent types of RES and storage

Anonymous
Avalability of energy grids (gas? Heat? cold?)

Anonymous
Inclusive zoning % social housing

Anonymous
The social context

Anonymous
Climatic factors

Anonymous

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• • • 4 participants typing

11

And which factors are the most relevant for urban planners when designing SPENs (Sustainable Plus Energy Neighbourhoods)?

Anonymous
Mobility (less parking spots)

Anonymous
Regional Policies

Anonymous
Microclimatic aspects

Anonymous
Site specific needs

Anonymous
Density of buildings

Anonymous
The availability of difftent types of RES and storage

Anonymous

Active poll

12

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Do you have any professional experience in considering co-benefits when designing a project at architectural/urban scale?

Yes, partially

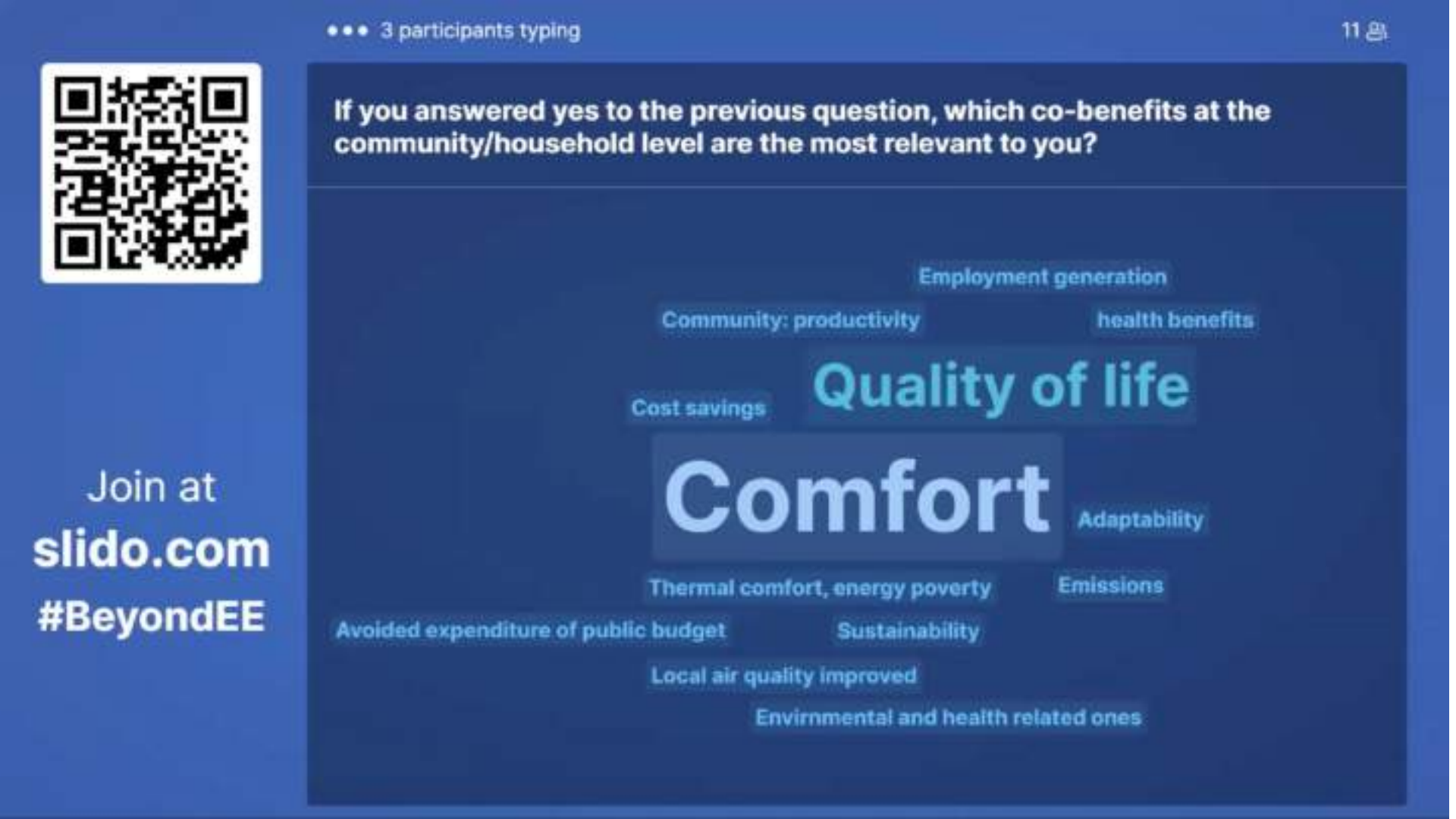
50%

Yes, totally

25%

No

25%


3 participants typing
11
If you answered yes to the previous question, which co-benefits at the community/household level are the most relevant to you?
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Employment generation
Community: productivity
health benefits
Quality of life
Cost savings
Comfort
Adaptability
Thermal comfort, energy poverty
Emissions
Avoided expenditure of public budget
Sustainability
Local air quality improved
Envirnmental and health related ones

Active poll

11

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And which co-benefits are relevant to you and were not mentioned today?

Active poll

10

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Do you think co-benefits improve the property value?

Yes

100%

No

0%

Not sure

0%

Active poll

13

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Do you think it is necessary to act at the policy level or at the housing market level (I.e. including co-benefits in the business models of real estate companies)?

• • • 1 participant typing

4

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What else is needed to take these co-benefits into account in the design process?

Anonymous
Make it simple

Anonymous
comprehensive and robust modeling tools

Anonymous
Regulations should be enabling rather then restricting.

Anonymous
regulations

Anonymous
Social justice and equity as mentioned before

Anonymous
Affordability

Any questions?

For our participants online, please use the Zoom chat box
or raise your hand and we will give you the floor

cultural E+ syn.ikia | Sustainable plus energy neighbourhoods EXCESS

Thank you for joining us today

More information can be found at

https://www.cultural-e.eu/

https://www.synikia.eu/

https://positive-energy-buildings.eu/

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