SUSTAINABLE PLACES 2024

Navigating the Shades of Industrialized Deep Energy Retrofit: Strategies for a Sustainable EU Building Stock

Luxembourg 25 September 2024

Chair: Tatiana Loureiro



1. Cutting edge approaches for Retrofitting, combining digital and physical technologies

KPI CATEGORY	KPIs	PROJECT
Time and Cost Efficiency	 Time for installation Upfront cost Lifecycle cost Cost efficiency 	PLURAL BuildUPspeed GreeNest INFINITE GigaRegio Factory
Long-term Impact	Long-term costLCA tools	ENSNARE PLURAL GreeNest
Level of Standardization	Level of standardizationCompatibility of systems	INFINITE GigaRegio Factory One Click Reno
Customization and Flexibility	Customization flexibilityModular solution adaptability	ENSNARE INFINITE GigaRegio Factory
Disturbance During Installation	• Level of disturbance while working	INFINITE GigaRegio Factory
Innovation in Prefabrication	 Prefabrication steps: automation, robotization 	BuildUPspeed

2. Collaborative Approaches and Regional Adaptation

KPI CATEGORY	KPIs	PROJECT		
Regional and Local Adaptation	 # of local supply chains created Local pop-up factories Networks and regional engagement 	OneClickReno BuildUPspeed INFINITE GigaRegio Factory		
Collaborative Tools and Networks	 Availability of decision-making tools with local characteristics Collaborative tools for stakeholders 	ENSNARE INFINITE GigaRegio Factory		
Training and Knowledge Sharing	 Local and international training kits Structured information exchange 	ENSNARE INFINITE GigaRegio Factory		

3. Market Activation and Policy Implications

KPI CATEGORY	KPIs	PROJECT
Business Models and Financial Instruments	 Validated business models Financial instruments to overcome upfront costs 	INFINITE GigaRegio Factory OneClickReno ENSNARE
Policy and Legislative Impact	 Legislative documents or strategies influenced New procurement standards Government support for local portfolios 	GigaRegio Factory INFINITE PLURAL GreeNest BuildUPspeed

ENSNARE ENvelope meSh aNd digitAl framework for building REnovation

Thaleia Konstantinou - TUDELFT Peru Elguezabal - Tecnalia

Sustainable Places 2024 Luxembourg – 25/09/2024





This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement n° 958445. This document reflects only the author's views and the Commission is not responsible for any use that may be made of the information it contains.

ENSNARE - Approach

Main contribution of **ENSNARE** is to **provide a systemic methodology** combining **products**, **systems** and **solutions**.



Overview

The main goal of ENSNARE is to:

- Boost implementation of NZEB renovation on residential buildings
- Foster adoption of energy efficiency systems, products and building solutions
- Demonstrating the increase of the efficiency, habitability and performance of the European building stock
- Promote the integration of the main actors into a common framework



- **19 Partners**: 11 SMEs, 6 RTD from 11 countries
- **9.97 M€** Budget (7.99 M€ EU Grant)
- 55 Months
- Started on 1st January 2021

Actual Status

Modules development and pilot application





Digital tools and interoperability in a platform







www.ensnare.eu

Actual Status







Cutting edge approaches for Retrofitting

- 1. Industrialization as a catalyst to bring high-technological solutions, while reduce complexity and costs.
- 2. Standardization but with of versatility. Design tools to support designers in the process, determining the limits of prefabricated solutions.
- 3. Long-term view with LCA tools . Holistic approach considering not just upfront costs but also long-term benefits, energy savings, and environmental impacts.
- 4. Cost reduction in manufacturing and process optimisation









<u>www.ensnare.eu</u>

Collaborative Approaches and Regional Adaptation

- 1. Collaborative tools necessary for effective interaction between stakeholders
- 2. Well established value chain, incorporating key roles.
- 3. Information exchange clearly structured assuring good coordination, avoiding errors and facilitating collaboration.
- 4. Local, national and European level networks to share knowledge.





Market Activation and Policy Implications

- Standards for:

 highly industrialized concepts
 Facade integrated solutions
- Market reluctant to innovative concepts. Promote demo cases to provide real experiences. Variety of use cases.
- 2. Financial instruments, such as energy performance contracts, to overcome the high upfront costs of deep renovation.
- 3. Follow up of those exemplary cases beyond the end of the R&D Project.







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1. KPIs of EDST

- Cost parameters (adquistion, O&M, EoL...)
- Energy parameters (savings, renewables contribution, primary...)
- Comfort parameters (temperature and discomfort)
- 1. KPIs of impact part in the proposal
- Time reduction
- Cost reduction
- Waste reduction
- Safety increase
- Improve LCA standards

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Cutting edge approaches for Retrofitting

1.Industrialization : This recommendation matches with the idea of standardization and simplification of deep renovation processes, which can help reduce complexity and costs.

- **2.Modular solution with adaptability** : This aligns with the idea of developing modular and prefabricated solutions to simplify deep renovation processes and make them more efficient.
- **3.Design tools for versatility** : This recommendation supports the idea of capacity building and training, as well as the need for tools and methods to help professionals navigate the complexities of deep renovation.

4.Long-term view with LCA tools : This recommendation matches with the idea of promoting a more holistic approach to deep renovation, considering not just upfront costs but also long-term benefits, energy savings, and environmental impacts. It also supports the idea of raising awareness among stakeholders about the benefits with the promote of the same stakeholders.eu



costs of deep renovation. **3.Capacity building and training**: Provide capacity-building programs for professionals architects, engineers, and contractors, to de necessary skills for deep renovation.

- **4.Risk mitigation strategies** : Develop and risk mitigation strategies, such as performar guarantees, warranties, and insurance prod address risk aversion and lack of trust.
- **5.Standardization and simplification** : Standardization and simplify deep renovation processes, include velopment of modular and prefabricated simplify complexity and costs.
- 6.Information and awareness : Raise awar among building owners, occupants, and sta





Slide 0 <u>Cover</u> •project branding •speaker's name	Slide 1 <u>Project ID</u> •name, •duration •objectives and •status	Slide 2 <u>Point 1</u> : Cutting edge approaches for Retrofitting •Main achievements of the project •Main challenges or barriers
Slide 3 <u>Point 2</u> : Collaborative Approaches and Regional Adaptation •Main achievements of the project •Main challenges or barriers	Slide 4 <u>Point 3</u> : Market Activation and Policy <i>Implications</i> •Main achievements of the project •Main challenges or barriers	Slide 5 <u>Ending</u> or " <u>Extra</u> " (Just in case you need to expand any of the previous topics, remembering the time frame of 5 minutes)





BuildUPspeed

Speeding up industrialised Building renovation by introducing the Local Pop-up Factory concept John van Oorschot - Zuyd



The BuildUPSpeed project

> 3 years project: Start date: November 2022 - End date: November 2025

> Funded by EU LIFE programme (LIFE21-CET-BUILDRENO-BuildUPspeed)

> 18 partners from EU countries representing 5 different ecosystems



SCAN ME https://buildupspeed.eu/



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CONSTRUCCIONES ACR SA

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INSTITUTO VALENCIANO DE LA EDIFICACION FUNDACION

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INTEGRAL BOIS SYSTEM

ACCADEMIA EUROPEA DI BOLZANO

ENER2CROWD SRL SB

DEMO CONSULTANTS BV

STICHTING ZUYD HOGESCHOOL

TIMMERFABRIEK WEBO BV

EDERA SRL IMPRESA SOCIALE



Cutting edge approaches for Retrofitting

- We are running out of time in reducing the environmental impact of our building stock!
- We need to find a **sustainable and scalable way to accelerate the decarbonization** of our communities
- A wealth of knowledge and drive is already available from recent European projects on industrialized renovation level to make deep renovation more attractive for consumers and investors (from the public and private sectors)
- The success of the approach and legacy of several chapters of the 'Energiesprong' can be scalable and applicable to more EU countries



EU project More Connect project demo



Cutting edge approaches for Retrofitting



Lessons learned in general on industrialized prefabrication so far (from H2020 projects on deep renovation):

- Industrialization of the construction process is in fact the decomposition of a building in different standardized elements (**step1**).
- These elements can be produced and pre-fabricated off site and installed on-site with standardized plug-and-play connections (**step 2**).
- The next steps in prefabrication are:
 - Step 3: industrializing
 - Step 4: automizing
 - Step 5: roboting

However...at this moment, the *average industrialization maturity level* is not much further then step 2. In some H2020 projects we could also address the steps 3 and 4 (but not mainstreamed yet).

□ Question/challenge for BuildUPspeed: To which extend can we accelerate and establish now the steps 3 – 5? What are the preconditions to achieve this?





Collaborative Approaches & Regional Adaptation



A factory in the district itself for the time of the district retrofitting program. The factory will develop and assemble industrialized prefab building components that will be installed in the retrofitting projects.

Some of the key advantages:

- 1. Megatrend Sustainability: reduction of transport and therefore CO2 emissions
- 2. Rising logistics costs: reduce physical transports
- 3. Individuality and mass customization: individual products
- 4. Democratization of Design and Open Innovation: Involvement of the customer in product development
- 5. Proximity to the market and point of consumption: Just-In-Time delivery and shorter delivery times
- 6. Production at the place of critical resources: e.g. raw materials or highly qualified human resources
- 7. Regionalism and authenticity: Authenticity in special cases



BuildUPspeed

Market Activation and Policy Implications



Market Activation Platform

A comprehensive online platform where diverse stakeholders—companies, developers, municipalities, technology providers, subcontractors, and more—can converge to share best practices, discover funding opportunities, and engage with the renovation ecosystem stakeholders, ultimately accelerating the pace of deep renovation projects.



BuildUPspeed

Thank you for your attention!

COLOFON:

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KPIs



KPIs for decarbonization

- 1. KPIs cutting edge approach:
 - financially (revenue increase to 8%/dwelling in contrast to the traditional 1-3%)
- 2. KPIs Collaborative Approaches and Regional Adaptation:
 - based on portfolio's being created at *geographical scale:* 350-500units/neighourhood and at *eco-efficiency scale* 15,000 units/factory
- 3. Market Activation and Policy Implications:
 - number of 'facilitated' local portfolios with local governmental support (government as facilitating change agent)

BuildUPspeed: KPIs (cost advantage)





Basically the same functions: producing power and heat

BuildUPspeed: KPIs (cost advantage)







Aanjagen van buurten en herontwikkelen bestaande gebouwen (renda.nl)

https://resolver.tno.nl/uuid:9dc61d55-bafe-4f09-b229-f0e9c838f17f

The BuildUPspeed workplan











TWO GOALS – COMMON CHALLENGES:

The PLURAL and GreeNest projects: Innovative prefabricated envelop solutions for Zero Energy and Zero Emission Buildings

Maria Founti, National Technical University of Athens, Greece
e-mail: mfou@central.ntua.gr

PLURAL PLURAL: Plug-and-use Renovation with adaptable lightweight Systems

ZR

Agència de l'Habitatge de Catalunge de l'Habitatge de Catalunge de l'Habitatge de

 Funding: H2020 - LC-EEB-04-2020:- Industrialisation of building envelope kits

 Duration: 01/10/2020 - 30/09/2024

 Project Website: https://www.plural-renovation.eu/

GreeNest GreeNest: NEST InGrained ecosystem foR zEro EmissioN buildings

Funding: HORIZON-CL5-2023-D4-01-01: Innovative cost-efficient solutions for zero-emission buildings **Duration:** 01/01/2024 – 31/12/2027

Project Website: https://www.greenest-ecosystem.eu/







SPF

DEN VEL DPS

ITeC

IREC









Functions of the prefabricated wood frame modules (attached to the existing facade): Heating element (replaces radiator inside building) Decentralized ventilation with heat recovery

New window (pre-mounted in module)

hermal insulation

Optional: building integrated photovoltaic





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Key Objectives

Sustainable Places 2024

Industrialized Deep Energy Retrofit

 Near zero energy consumption of buildings renovated with Plug-and-Use (PnU) kits
 Fast-track renovation
 Cost-effective renovation
 Environmentally-friendlier deep



PLURAL







Sustainable Places 2024

Industrialized Deep Energy Retrofit

THE GreeNest OBJECTIVES/TARGETS



- 1) 100% carbon free construction through the application of biogenic materials that store carbon.
- 2) Reduction of embodied emissions by 50% with respect to NZEB standard.
- 3) NZEB status minimizing the energy need and covering it via renewable energy sources with remaining primary energy consumption less than 30-40 kWh/m2. Reduction of GHG emissions by 60%.
- 4) Increased productivity by >30% based on local value chains using digitized, time efficient, prefabricated design, manufacturing, construction methods for timber, reused timber and prefabricated earthen components
- 5) Support to the circular economy through the development of circular construction elements based on waste wood with reversible connections/ that can be reused or recycled at the end of life. Targets: Use of recycled components (55%), improved recyclability (85%).





Industrialized Deep Energy Retrofit

Sustainable Places 2024

Key Objectives

THE GreeNest STANDARDIZED PACKAGES (SPS)



Embodied & End of life carbon				Upfront carbon				Operational & Use stage carbon		
Material		IoT & Digital Design Tools		Design / Construction /Productivity Schemes			nvelope Systems	Technical Systems		
SP	# Name	SP#	Name	SP#	Name	SP#	SP# Name		P# Name	
1	KARZ	4 Gre	eNPLUGIN	7 De	esignByInventory	9 10	SmartWall GreenWall EcoTechWal	14	Eco-BIPV/PV	
2	processing	5	ZeBIM			11	Heat-Harvest	15	CASCADE	
3	Earth screed for WDLT-Slab	6 AS	SSESS-DST	8	DeltaSmart	12 13	Window (HHW) Rotating Window	16	NestControl	

- SP1: Insulation panel based on coffee bean wastes SP2: Waste-wood material processing
- SP3: Waste Dowel Laminated Timber (WDLT-slab with waste-wood and earth-based screed
- SP4: GreeNest BIM objects and database.
- SP5: Digital design-monitoring tool
- SP6: Digital platform including Decision Support tool.
- SP7: Design scheme with limited material access SP8: Modular building construction method Sustainable Places 2024

- SP9: Multifunctional wall incorporating HVAC components SP10: Vertical Garden integrated into a prefab façade /
- SP 10. Vertical Garden integrated into a prefab laçade
- SP11: Prefab, circular wall from waste wood, natural fibres
- SP12: Window with ventilation system with heat recovery
- SP13: Window that rotates with low-E glass.
- SP14: PVs with low carbon footprint
- SP15: Heating/cooling energy production system eco-friendly refrigerants.
- SP16: BMS tool for IAQ sensors and centralized control.





THE GreeNest DEMONSTRATORS













Earth screed -earth based floors and slabs, laminated and recycled timber

Lightweight clay modules





Sustainable Places 2024 Industrialized Deep Energy Retrofit

CUTTING EDGE APPROACHES FOR RETROFITTING

Main achievements of the projects

- The PLURAL project has demonstrated that fully prefabricated plug and play façade solutions can achieve net zero energy operation of the building after renovation.
- Successful integration in the prefabrication of RES (such as PVs), solar thermal systems, heat pumps, ventilation, air-handling systems, hydronic systems). At the same time considerable savings in installation times and costs were achieved.
- Storage (thermal, electrical) and low carbon footprint materials and components could be part of the prefabrication. Flexible solution for retrofitting including EV-charging
- GreeNest: Effective "integrated" solutions for decarbonised, adaptative and regenerative Built Environment

Main challenges / barriers

- "Performance-based" building design and architectural concepts need to be developed to allow the design of the prefabricated facades and the selection of RES technology to be adapted to building characteristics.
- The further development of digital platforms to better control and monitor renovation with prefabricated solutions will help to eliminate current design and manufacturing uncertainties.
- The plug and play solutions of PLURAL can be extended to achieve zero emission buildings when circular economy principles and nature-based materials are considered.
- Properties of construction products that use nature-based materials are not yet fully understood.

Sustainable Places 2024 Industrialized Deep Energy Retrofit





ADAPTATION

Main achievements of the project

- Improvement of living conditions, energy performance
- Benefits for residents (thermal, air quality, humidity, noise)
- Renovation without disturbing tenants
- Nature-based materials can offer new pathways for greening the construction sector

Main challenges/or barriers

- Industrialization, component integration as part of the manufacturing: new business models
- Value Chains are still fragmented and not fully organized
- Need for new approaches that could transform already industrialized prefabricated systems into "green construction products".
- Need for new methods for circular design involving all stakeholders







MARKET ACTIVATION AND POLICY IMPLICATIONS

Main achievements of the projects:

- Enhance existing building utilization and user comfort.
- Multi-disciplinary approaches to support the EU building product industry
- New fully validated construction products

Main challenges/barriers

- Need for whole-life cycle approach when assessing strategies to decarbonize the built environment
- Update of EPBD to include prefabricated systems.
- industrialization is currently hindered due to limited organization of circular value chains addressing local-regional but also global requirements
- Acceptance (industrial, end-user and social): Restricted due to lack of large-scale demonstrations, long-term performance evaluation, harmonized standards, economies of scale to reduce costs
- Lack of regulatory framework for active building façade components





KPIS PER CATEGORY

Cutting edge approaches:

- ZEB versus ZeB
- Time
- Cost
- Accuracy

Market Activation and Policy:

- Procurement processes
- Financing models
- Business models

Collaborative Approaches:

- Participatory events
- Hands-on demonstrations







The projects have received funding from the European Union's Horizon 2020 and HORIZON research and innovation programmes

THANK YOU FOR THE ATTENTION!

SPECIAL THANKS TO ALL THE PLURAL AND GREENEST PARTNERS FOR CONSTRUCTIVE WORK and OUR COLABORATION!





Industrialized Deep Energy Retrofit & Staged Renovation Plans

Ana Sanchis Huertas (IVE)





January 2024

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One Click Reno

2.

Discussion points

Outputs & Metrics







One click Reno



One Click Reno

The aim of One Click Reno is to contribute to the transition towards a zero-emission building stock accelerating the volume and depth of building renovations in the EU by making visible and tangible the benefits of

Itineraries, to ease the short-term implementation with a long-term view of results, based on users' interests (renovation strategy). **Owner-friendly long-term** renovation road map to plan building renovation step-by-step, with corresponding economic figures for each individual intervention

d Non-regret solutions, being first stages fe stand-alone solutions that do not interfere D€ with subsequent stages, avoiding nt lock-in effects.

Robustness and quality results, through scenario simulation, professional validation, certified implementation and feedback looping for simulation improvement

Flexibility and adaptability to circumstances, by offering alternatives at the time of implementing next stage, according to real results reported, solutions that neighbors or comparable buildings are implementing, or their experiences and satisfaction









discussion points



1. Cutting edge approaches

- ▲ High upfront costs
- Findability, updateness
- Applicability

- Renovation plan **configurator** \Box flexibility
- Measures, objectives & timeframes
- A view on **aggregation** (BARRIO)

 Cost-efficiency



2.Collaborative Approaches & Regional Adaptation

- A Perception & trust
- A Renovation market tissue
- Transferability

- **5** pilots across EU
- Analysis of market
- Co-design with stakeholders
- Components & strategies common **definition**
- Products & roadmaps local adaptation



3.Market Activation & Policy Implications

- Awareness
- Organization
- Governance & support

- Automated starting point
 facilitating
- Aggregation of renovation roadmaps
 critical mass
- Assessment of policies, grant schemas, permits & processes requirements

 decision making
- Discussing strategies and policy frameworks to support the industrialization of deep energy retrofit









⊁

KPIs matrix

Challenges □ Approaches √	Un awareness	Upfront cost	Market tissue	Organiz ation	Trust	Applic ability	Transfer ability	Support
Innovative technologies	Compatibility	Long-term cost				Compatibility Critical mass		
Collaboration & adaptation	networks		networks	networks	networks		Regions Tools	
Activation & Policy				BBMM				Policies/ grants





Thank you









asanchis@five.es www.oneclickreno.eu



Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.



INFINITE H2020 project

Chiara Stanghini, EDERA Sustainable Places, 25/09/24



4A



INFINITE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No **958397**

About INFINITE

CONSORTIUM: 6 partners from 9 countries **DURATION:** 66 months, from 2020 to 2026 **GOAL:** Develop, test, and uptake on the market prefab retrofit



Cutting edge approaches for retrofitting -



Cutting edge approaches for retrofitting – DIGITAL



Collaborative approaches and regional



Knowledge Hub

collecting projects and solutions to be integrated in a **interactive market potential map** proposing suitable

technologies for







Market activation and policy implications

Testing the KITs on **real pilot buildings** and on **real business models** to compare industrialized and traditional renovation approaches





Simplyfied LCC too	ol to co	ompar	e Ind	lustri	alized and Traditional Building Re	novat	ion		
"Industrialized deep retrofit" (nZEB)					"Deep traditional retrofit" (nZEB)				
HC/m attabution Profiles Nockate Nocka					Regreen verkland, spen locational housekon borectow				
Prefabricated - industrialized	€/sqm	¢	fonte	choose	Traditional Deep retrofit	€/sqm	¢	fonte	choose
preparatory works					preparatory works		1		
Cleaning facade and fixing system preparation	6	4.134 €	4.134 € stima inte 0		Cleaning facade		2.423 €	stima int	erna
movable crane for the facade installation (5 module a day)	86	5.642€	5.642 € Prezziario PAT		scaffolding	15	12.114 €	preventin	vo private
movable scaffolding/crane for the finishing	360 €	3.600€	3.600 € Prezziario PAT						
Main components					Main components				
Prefabricated facade passive module w/o external finishing	115	79.240 €	INFINITE	1	Insulation layer installed on facade till the membrane/base for plaster	80	20.502 €	preventie	vo privato
Prefabricated roof passive module w/o external finishing	105	44.625 €	INFINITE		Insulation layer installed on roof till the membrane	97	41.225 €	preventin	vo privato
Windows installed offsite (overall costs)	450	53.352€	da EF (-1	0%)	Windows installed onsite (overall costs)	500	59.280€	EF	
New prefabricated balconies	1000		INFINITE		Renew of balconies (new flooring, insulation, waterproofing)	165		INFINITE	
				_	Renew the roof structural part (wood roof)	125	53.125 €	preventin	vo privato
Energy system					Energy system				
Technical room with HP for H/C/DHW	5800	92.800€	INFINTE	EM	Technical room with HP for H/C/DHW	5800	92.800 €	INFINTE -	EM
Integration into the facade of VMU with ducts (H/C/Air)					Onsite works to install splits and all the works (distribution) from the				
	150	103.356€	INFINITE	-	technical room to each apartment	2600	41.600€	INPINTE -	EM
Micro-HP single room (H/C/Air)		- 6		-	changing radiators	200	12.800€	web -> ra	diatore 3







Thank you

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INFINITE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 958397



Chiara Stanghini, EDERA
 Sustainable Places, 25/09/2024



sprong

energie

giga regio factory

Project pitch



Co-funded by European Union Energiesprong wants to solve the CO2 problem of our buildings by developing a mass-market for scalable nearly zero-energy solutions for existing buildings High likeability Fast





through innovative design for serial refurbishment solutions as a complete product



About LIFE Giga Regio Factory

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DURATION: 3 years, 2022-2025 **CONSORTIUM:** 13 partners from 4 countries



Enable more group purchases of renovation, more efficient, in several regions of Europe

Massify the demand to give volume and visibility

2. Integration accelerator of industrial solutions

Helping construction companies to industrialize and develop their solution catalogs

→ Accompany the evolution of the market

- 3. Kit Giga Factory for industrialisation
- Helping manufacturers and solution providers scale up to meet the massive demand
 - → Develop industrial capacities



GOAL: Capitalize the first industrialized net-zero projects to support renovation scale up



Cutting edge approaches for retrofitti

Catalogue of solutions and **clusters** of buildings to assess their potential towards **industrialized** retrofit







single building aggregated buildings



5

Collaborative approaches and regional adaptation

Training of local actors in the supply chains (solution providers and general contractors)







Site visits, physical workshops, online modules and coaching on projects

personalized



Market activation and policy implications

Business plan assessment with a **total cost of ownership** approach to capitalize industrialized renovation **benefits and economies of scales** in different Countries







Thank you!

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