

Plug-and-Play product and process innovation for Energy-efficient building deep renovation

Project description:

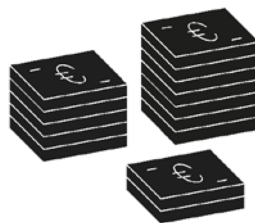
Upscaling EU-wide implementation of prefab Plug-and-Play (PnP) systems for deep renovation through 4M (Mapping – Modelling – Making – Monitoring) processes.

- 60% net primary energy saving through deep renovation
 - Implementation of PnP prefab solutions for retrofit of building envelopes and MEP systems
 - Energy label improvement through transformation from obsolete public buildings to dwellings
- 15% cost saving compared to traditional renovation techniques
 - Major labour cost reduction through PnP installations
 - Avoidance of construction failure or rework cost on-site thanks to validated PnP solutions
- 50% time saving and thereby reduction of disturbance during renovation
 - 50% faster from production to on-site assembly
 - PnP prefab solutions ready to be implemented without structural changes of the existing building



Key information

- Start date: 1 September 2016
- Duration: 48 months
- Partners: 16 (8 SME, 5 IND, 2 HES/RES, 1 PUB)
 - DK : Invela
 - DE : Lenze-Luig 3-L-Plan, Fermacell, Technische Universitaet Berlin
 - NL : DEMO Consultants, Huygen Installatie Adviseurs, PANplus Architectuur, Camelot Vastgoed
 - PL : Bergamo Technologie, Fasada, Mostostal Warszawa, Miasto Stoleczne Warszawa
 - IT : Becquerel Electric, SGR Servizi, D'Appolonia, Universita Politecnica Delle Marche



- EC funding (A): 4M€
- Private investment (B): 6M€
(1.3M€ project cost + 4.7M€ private investment on 10 demonstration buildings)
- Leverage factor (=B/A): 1.50



New systems, technologies and non-technological innovations

1. Integrating and optimising PnP prefab systems and on-site 3D technologies for deep renovation:

PnP prefab systems and on-site 3D technologies	PnP components for building envelopes
	PnP technical systems
	On-site 3D technologies



2. Implementing PnP and on-site 3D innovations through 4M modular processes and ICT tools:

Modular processes and ICT tools for deep renovation	4M modular processes: Mapping – Modelling – Making – Monitoring
	e-Marketplace value-chain integration & local factory for district logistics
	BIM-based lifecycle information management



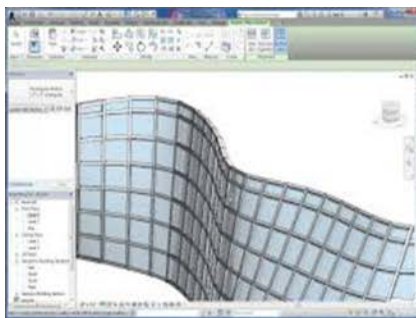
3. Demonstrating and upscaling the innovative products, processes and tools in real projects:

Evidence-based deep renovation solutions with performance monitoring	Deep renovation of public and historic buildings
	Deep renovation of residential buildings and districts
	Transformation of public and historic buildings to dwellings



New systems and technologies: example

- An example of P2ENDURE solution: Robotics for 3D printing on-site

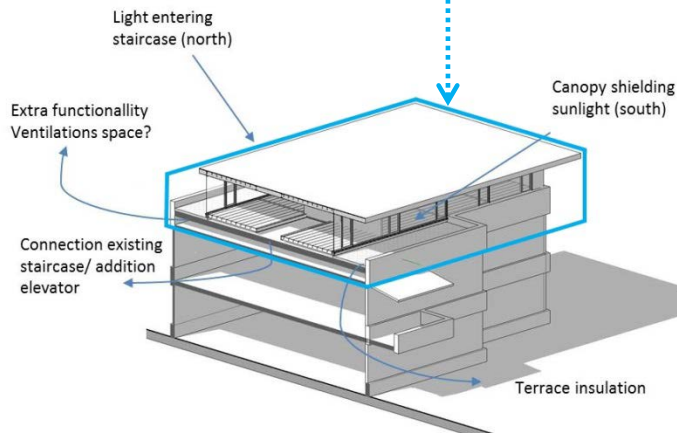
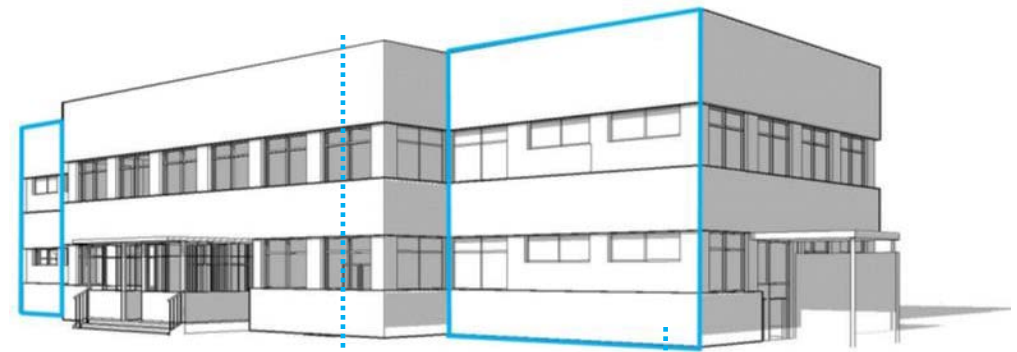


New systems and technologies: example

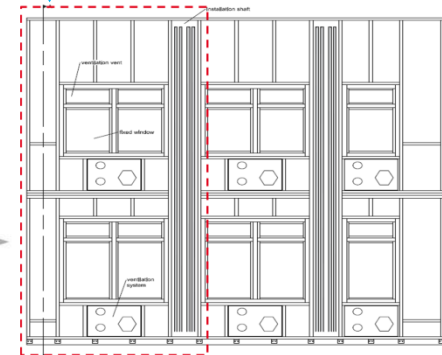
- One of P2ENDURE demonstrations: Deep renovation of nursery building in Warsaw, PL



3D Point Cloud from ext. and int. scanning



PnP rooftop retrofit solution



PnP facade retrofit solution



New systems and technologies

Short description of each new system and technology developed by the project & progress beyond the state of the art & how the innovation contributes to EeB cPPP objectives	Current TRL (May 2017)	TRL expected by the end of your project	Exploitation
Robotic technologies for 3D printing of façade layers with control software on mobile device	6	8	○ Commercial
Prefab lightweight rooftop retrofitting module	7	8	○ Commercial
Multifunctional prefabricated façade panel with integrated HVAC systems	6	8	○ Commercial

Non-technological innovations

Short description of each non-technological innovation	Progress beyond state of the art	Exploitation
4M (mapping – Modelling – Making – Monitoring) modular process methodology	A stepwise approach for preparing and implementing the deep renovation, followed by real monitoring of the results performance improvements.	○ Public
E-Marketplace value-chain integration & local factory for district logistics	Enlargement of the value-chain via integration of all partners into a new business model that helps to raise the profit of the partners by reducing construction errors and mistakes (e.g. the profit would raise if the costs of the failure removals are reduced). The integration of service -architects, engineers and other needed experts- is important to create a holistic offer.	○ Commercial
BIM-based energy calculation for building deep renovation	Calculation performed in 3 stages: <ul style="list-style-type: none"> • Before renovation: coherent energy audit of the existing situation/building • Deep renovation design: BIM-based computing and comparing of relevant PnP solutions • After renovation: monitoring actual energy performance including IEQ 	○ Scientific / Academic



Other P2ENDURE demonstrations



Transformation of university building to student housing in Enschede, NL



Transformation of historical monastery to a hotel in Tilburg, NL



Transformation of public spa building to dwellings in Hürth, DE



Deep renovation of public nursery building in Gdynia, PL



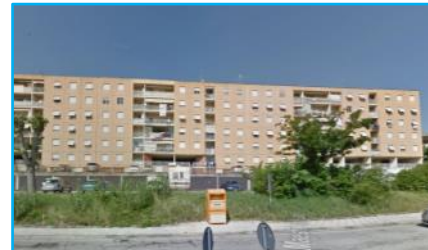
Transformation of school building to dwellings in Tilburg, NL



Deep renovation of historical nursery building in Genova, IT



Residential district renovation in Odense, DK



Deep renovation of residential building in Ancona, IT



Deep renovation of historic district in Palmanova, IT



Impact – KPIs (1/2)

Average reduction of the energy use due to the innovations



60%

Number of patent applications



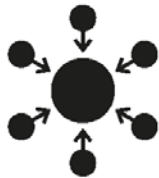
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Average reduction of waste due to the innovations



75%

Share of participation of SMEs



50%

Training and events



6

Full-scale demonstrators



12

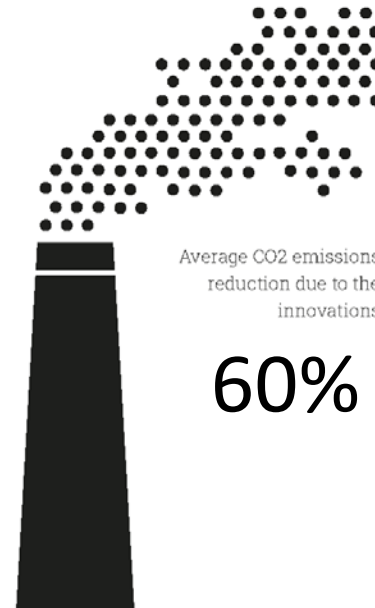
Number of people trained



300

(100 stakeholders + 200 online training participants)

Average CO2 emissions reduction due to the innovations



60%



Impact – KPIs (2/2)

- Other significant impacts (targeted)
 - Number of activities leading to standardisation: **4**
 - IFC BIM approach in P2ENDURE 4M modular processes
 - Joints for Plug-and-Play façade panels
 - Standardised deep renovation feasibility assessment
 - Plug-and-Play MEP system design for renovation
 - Participation and benefits for SMEs
 - Increase in turnover: **78%**
 - Increase in number of employees: **23**
 - Number of Spin-Offs and Start-Ups as result of your project: **2**
 - Dissemination
 - Professional and scientific publications: **20**
 - P2ENDURE website: **1000** visitors
 - Newsletter: **100** subscriptions
 - Platforms: **Build Up Portal, ECTP**
 - Communication, social media
 - Twitter: **1000** followers, **300** tweets, **100** retweets
 - LinkedIn: **200** group members
 - YouTube, SketchFab: **3** movies, **10** 3D models



LinkedIn

YouTube

Sketchfab



Contact

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