

eurac research

Approcci innovativi alla riqualificazione energetica degli edifici

Roberto Lollini

25/1/2018, Klimahouse2018 Bolzano



Contesto

Policy framework: Smart and Clean Energy for All Europeans - Unlocking Europe's growth potential

- Putting **energy efficiency** first: consuming better, getting cleaner
- Achieving global leadership in **renewable energies**
- Providing a **fair deal** for consumers



All consumers across the EU will be entitled to generate electricity for either their own consumption, store it, share it, consume it or to sell it back to the market. These changes will make it easier for households and businesses to become more involved in the energy system, to better control their energy consumption and respond to price signals.

CLEAN ENERGY FOR ALL EUROPEANS

EPBD review: focus on buildings – for good reasons

FACTS



75% of the housing stock is energy inefficient, missing the benefits of increased renovation.



Renovation rates are too low and renovation depth is too shallow.



Need to accelerate and finance building renovation investments.



Tapping the potential of smart building technologies

Contesto

Policy framework: Smart and Clean Energy for All Europeans Unlocking Europe's growth potential: **what's new?**

Smartness indicator

CLEAN ENERGY FOR ALL EUROPEANS

Preparing the ground for smarter homes & buildings

Revision of the Energy Performance of Building Directive (EPBD)



New article 8(6) proposes introducing a Smart Readiness Indicator for buildings.

- Will characterize the ability of a building to manage itself,
- To interact with its occupants,
- And to take part in demand response and contribute to smooth, safe and optimal operation of connected energy assets.



Progress towards 'smarter' building systems can result in additional benefits for building users, energy consumers and future grids.



The **Smart Readiness Indicator** will support the uptake of technical innovation in the building sector

5 #EnergyUnion



Paula Rey Garcia, Team leader Buildings & Finance, European Commission- DG ENERGY, Energy Efficiency unit

Smart Finance

CLEAN ENERGY FOR ALL EUROPEANS

THE "SMART FINANCE FOR SMART BUILDINGS" INITIATIVE

MAJOR GOAL - improve investment climate for energy efficiency

More effective use of public funds

- Deploying **Financial Instruments** and flexible energy efficiency and renewable financing platforms
- Building on EFSI II blending with ESIF funds



Assistance and aggregation

- Supporting the project pipeline at EU and local level
- **Project Development Assistance** facilities
- "One-stop-shops"



De-risking

- Understanding the risks and benefits for financiers and investors
- The De-risking Energy Efficiency Platform
- Commonly accepted underwriting framework



7 #EnergyUnion



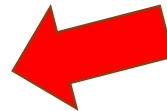
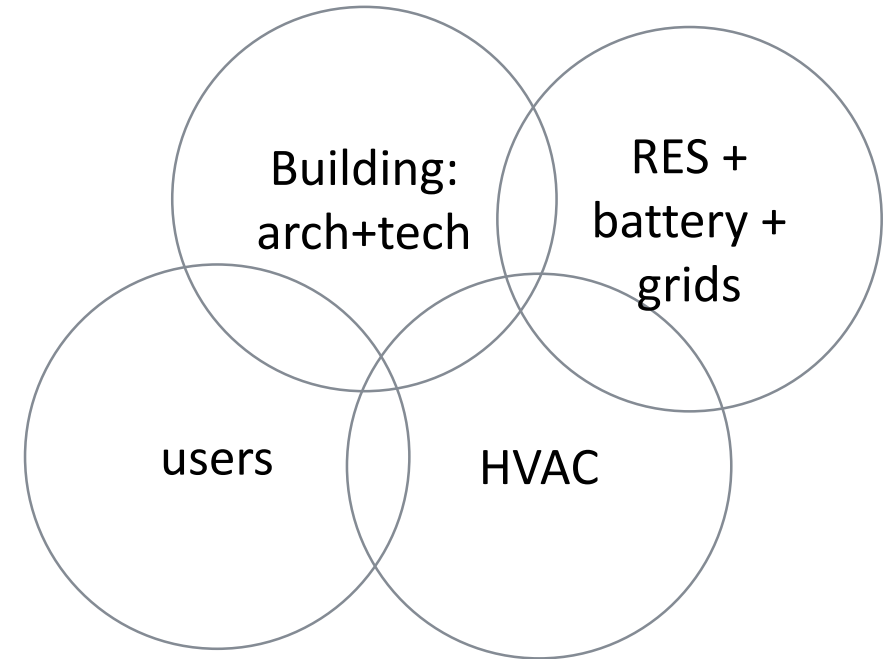
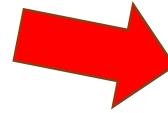
Topic: Energy Efficient Buildings

Objectives:

- ✓ User centred buildings
- ✓ Exploiting climate potential
- ✓ Robust, resilient and cost-effective solutions
- ✓ Optimal integration among flexible buildings and local infrastructure

Expected impacts

- ✓ Healthy indoor environment
- ✓ Reduce energy demand (low energy bld)
- ✓ Increase share of RES (low carbon bld)



TOOLS

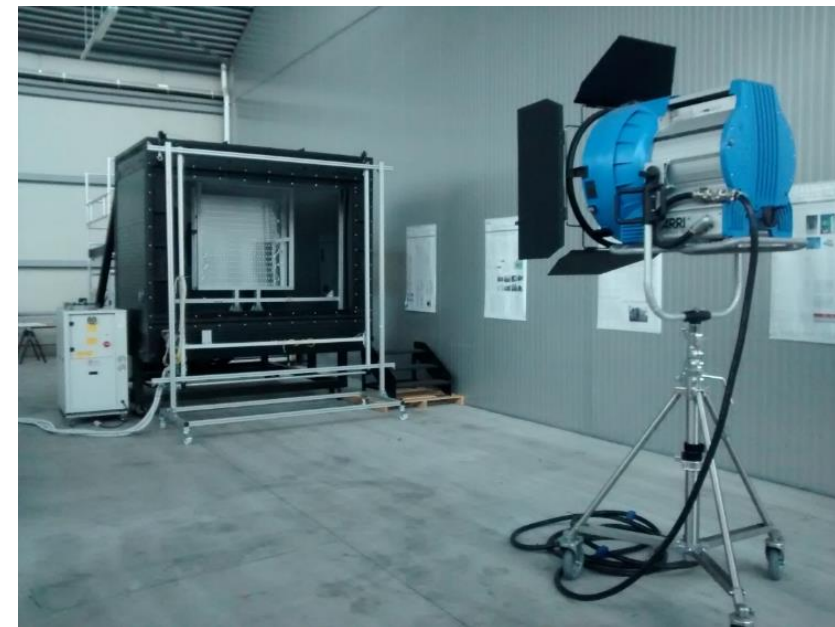
Modelling
Test
Analytics

INDOOR

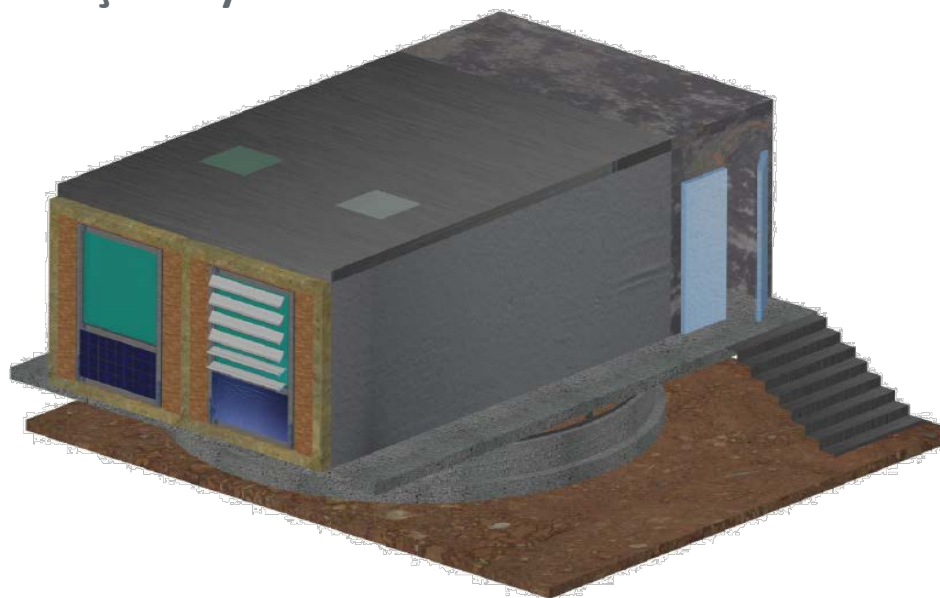
Multifunctional Facade Lab



g-value measurement



Façade systems interactions lab



OUTDOOR

Flexi BIPV



Le sfide della riqualificazione energetica

Parole chiave usate dalla Commissione Europea

Involucro multifunzionale → Adattivo e accumuli energetici

Cost-effective → LCC approach

Prefabbricazione → Industrializzazione

Approccio olistico → Sistemico



Soluzioni tecnologiche e strumenti adattabili, di facile impiego, durabili, che agevolino

Le sfide della riqualificazione energetica

Se un proprietario di casa decide di intraprendere una «**riqualificazione profonda**» (**deep renovation**) per una riduzione drastica dei consumi, molto spesso questo integra misure che spaziano dalla struttura all'involucro alle finiture, dal sistema elettrico al sistema idraulico:

- Altamente invasivo
- Richiede molto tempo
- È complesso per gli installatori (approccio multidisciplinare)
- Di conseguenza rischioso e costoso (valore netto attualizzato positivo, ma con payback alto se si considerano i soli risparmi energetici)

Approccio
tradizionale

Le sfide della riqualificazione energetica

La complessità intrinseca nell'approccio **multidisciplinare** può essere spostata dal **cantiere** verso **siti industriali** dove può essere gestita e risolta da professionisti formati rispetto a soluzioni standardizzate

- Altamente invasivo → sistemi e installazioni in facciata
- Richiede molto tempo → audit e progettazione dettagliata (che includa O&M) e prefabbricazione
- È complesso per gli installatori → prodotti plug&play
- Molto costoso → riduzione dei tempi di installazione e costi legati a scorretta esecuzione + spostamento del rischio e del payback dal proprietario verso investitori (es. ESCO)

Approccio
Industrializzato

Le sfide della riqualificazione energetica

È difficile giustificare un risanamento completo dell'edificio solo attraverso il payback basato sui risparmi energetici .

- L'aumento del **valore dell'immobile, riduzione delle spese di manutenzione e miglioramento della qualità ambientale interna** in un orizzonte temporale interessante per la proprietà devono essere considerati nelle analisi costi/benefici, e dovrebbero essere intraprese azioni per istituzionalizzare tale approccio.
- Servono **indicatori chiari e affidabili condivisi** tra gli attori del processo per monitorarne l'efficacia in ogni passaggio chiave del processo decisionale e dell'iter autorizzativo.
- Dovrebbero essere sviluppate **soluzioni tecnico-finanziarie** che spostino il **rischio** e il payback dall'investitore privato ad **investitori istituzionali**.

Le sfide della riqualificazione energetica

- Fasi di **audit**, **studio di fattibilità** e **progettazione** diventano **DECISIVE** (chiave del successo)
- Possibili strade per ridurre i costi nel ciclo di vita:
 - Ottimizzazione dei pacchetti di rinnovamento sulla base del contesto (eventualmente con la realizzazione di prototipi) con specifici target prestazionali e funzionali (O&M)
 - Raggruppare azioni di riqualificazione → massa critica
 - General contractor e catena fornitori in partnership
 - Schemi di finanziamento innovativi e sfruttamento degli incentivi



www.inspirefp7.eu

iNSPiRe – Systemic energy renovation of buildings



This project has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n. 608678



iNSPiRe – pacchetti prefabbricati



- Facade KIT = (Facciata prefabbricata legno con HP + VMC + Condotti)
- EnergyHub = (Controllo + Pompe + Valvole + HX)
- Distribution KIT = (Soffitto radiante + Luci)



iNSPiRe – pacchetti prefabbricati

Il risanamento di un piccolo condominio di 4 piani

Cavedio prefabbricato per il collegamento della distribuzione



www.inspirefp7.eu

- Il cavedio integra tubazioni e satelliti di utenza per il collegamento del sistema a pompa di calore agli appartamenti
- I regolamenti per la sicurezza al fuoco costituiscono la sfida principale

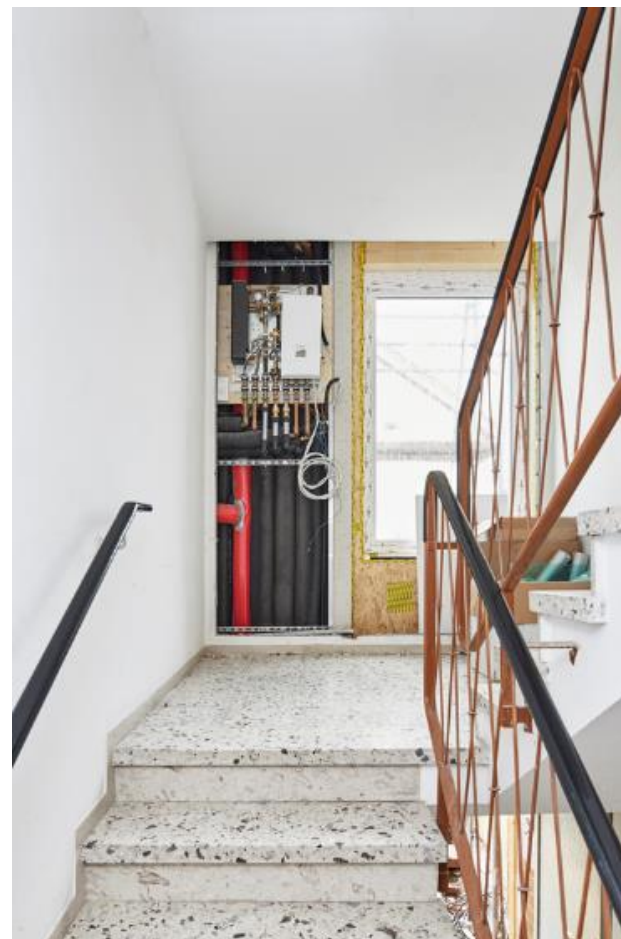
Fonte: Gump & Maier, Vaillant



iNSPiRe – pacchetti prefabbricati

Il risanamento di un piccolo condominio di 4 piani

Impianto di riscaldamento e ACS centralizzato



www.inspirefp7.eu

- Le connessioni idrauliche e tutti i component che richiedono manutenzione sono accessibili dalle scale
- I collegamenti ai radiatori e ai sanitari sono eseguiti in facciata

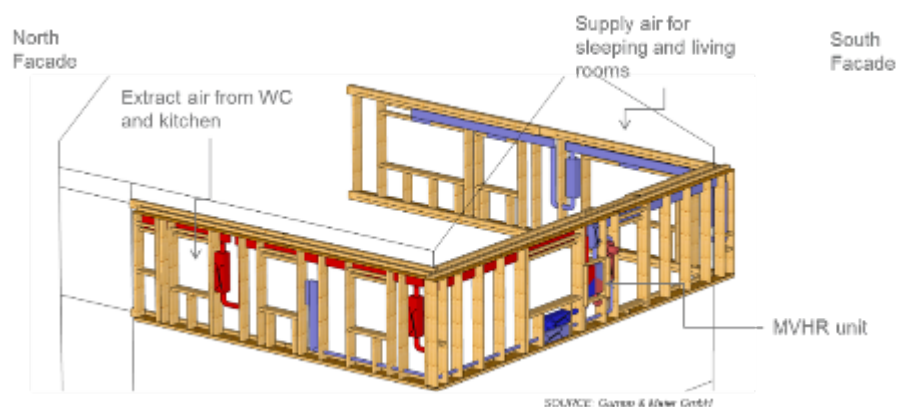
Fonte: Gumpp & Maier, Vaillant

iNSPiRe – pacchetti prefabbricati

Il risanamento di un piccolo condominio di 4 piani

Sistema di ventilazione meccanica di appartamento

- Unità di ventilazione e condotti sono installati direttamente nei moduli di facciata
- Le unità sono accessibili da terra o dai balconi
- Il collegamento dei condotti tra moduli di facciata è una sfida



www.inspirefp7.eu



Fonte: Gump & Maier

iNSPiRe – pacchetti prefabbricati

Il risanamento di un piccolo condominio di 4 piani



Il condominio prima del risanamento



Il condominio dopo il risanamento



www.inspirefp7.eu

iNSPiRe – pacchetti prefabbricati

Il risanamento di un condominio di 10 appartamenti su 5 piani

Sistema prefabbricato per la distribuzione di acqua calda e fredda (EURAC, Manens-Tifs)



www.inspirefp7.eu



Fonte: EURAC

iNSPiRe – pacchetti prefabbricati

Il risanamento di un condominio di 10 appartamenti su 5 piani



www.inspirefp7.eu

- Sistema prefabbricato distribuzione radiante e illuminazione (TRIPAN, Bartenbach, EURAC)



iNSPiRe – pacchetti prefabbricati

Il risanamento di un condominio di 10 appartamenti su 5 piani



www.inspirefp7.eu
www.inspirefp7.eu

Il condominio prima del risanamento



Il condominio dopo il risanamento



Fonte: EMVS



www.sinfonia-smartcities.eu

FP7 Sinfonia Low Carbon Cities for Better Living



This project has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n. 609019



Prefabricated timber-frame facades

FP7 Sinfonia



www.sinfonia-smartcities.eu



Su disegni di Arch: Alberto Sasso, Paolo Sobrino, Giorgio Sandrone, Andrea Cagni, Manuel Benedikter, Gerhard Kopeinig

- Facciata prefabbricata in legno con VMC & finestra



- Facciata prefabbricata in legno con VMC & finestra & PV+Batteria



Prefabricated timber-frame facades

Supporting activities for the municipality of Bolzano and the design team



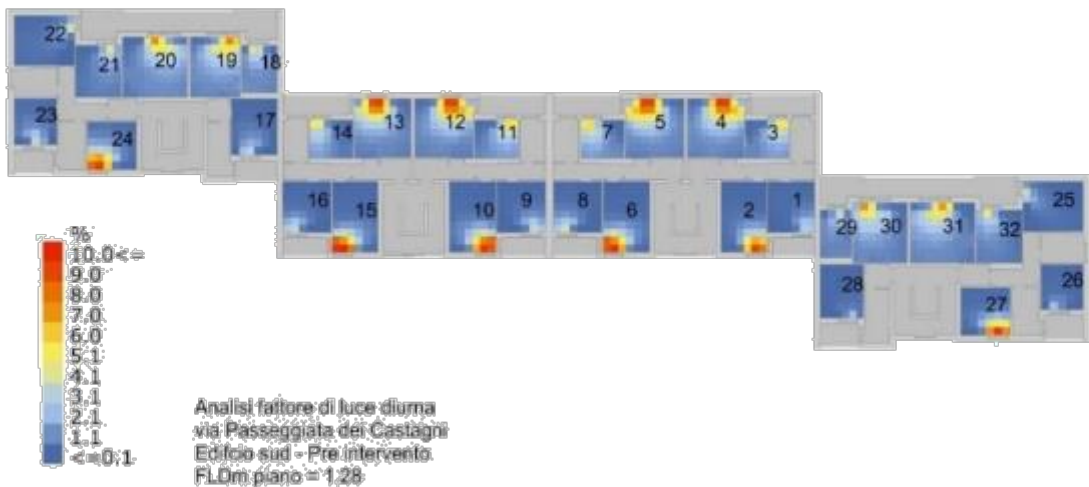
www.sinfonia-smartcities.eu

Modeling and simulation

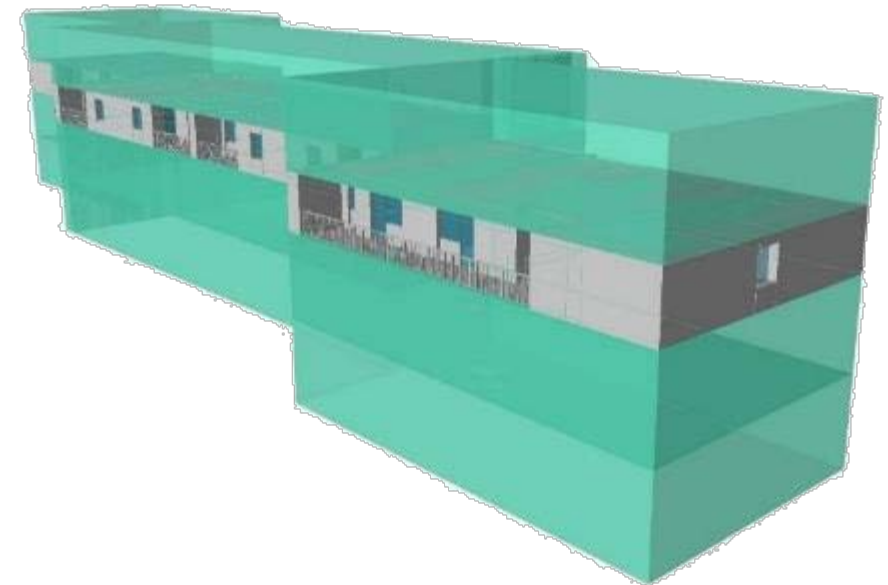
Solar potential exploitation aimed to identify solar technology installation scenarios

Free cooling

Daylight analysis



FLDm
Stanza 1: 0.49
Stanza 2: 1.25
Stanza 3: 1.69
Stanza 4: 2.36
Stanza 5: 2.34
Stanza 6: 1.42
Stanza 7: 1.77
Stanza 8: 0.57
Stanza 9: 0.54
Stanza 10: 1.43
Stanza 11: 1.74
Stanza 12: 2.13
Stanza 13: 2.12
Stanza 14: 1.51
Stanza 15: 1.45
Stanza 16: 0.5
Stanza 17: 0.5
Stanza 18: 1.36
Stanza 19: 2.04
Stanza 20: 1.7
Stanza 21: 1.83
Stanza 22: 0.53
Stanza 23: 0.66
Stanza 24: 1.03
Stanza 25: 0.49
Stanza 26: 0.3
Stanza 27: 1.49
Stanza 28: 0.25
Stanza 29: 1.13
Stanza 30: 1.66
Stanza 31: 1.65
Stanza 32: 1.09



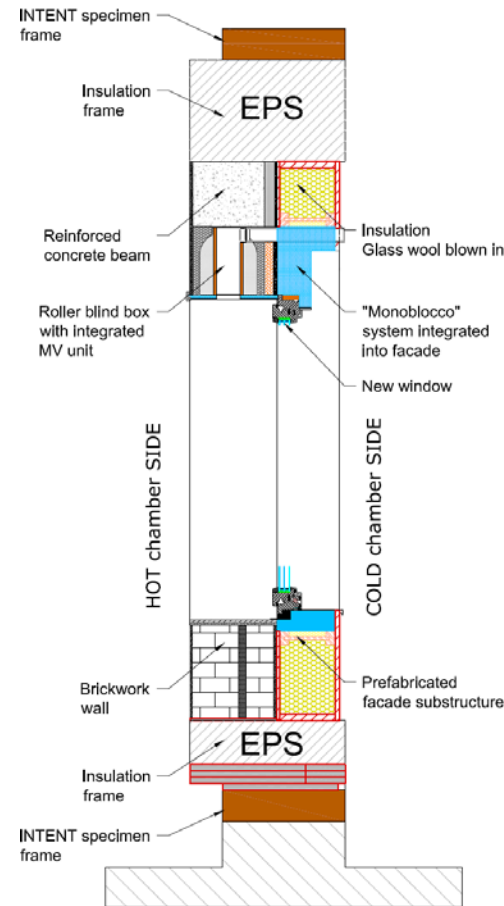
Source: Eurac

Prefabricated timber-frame facades

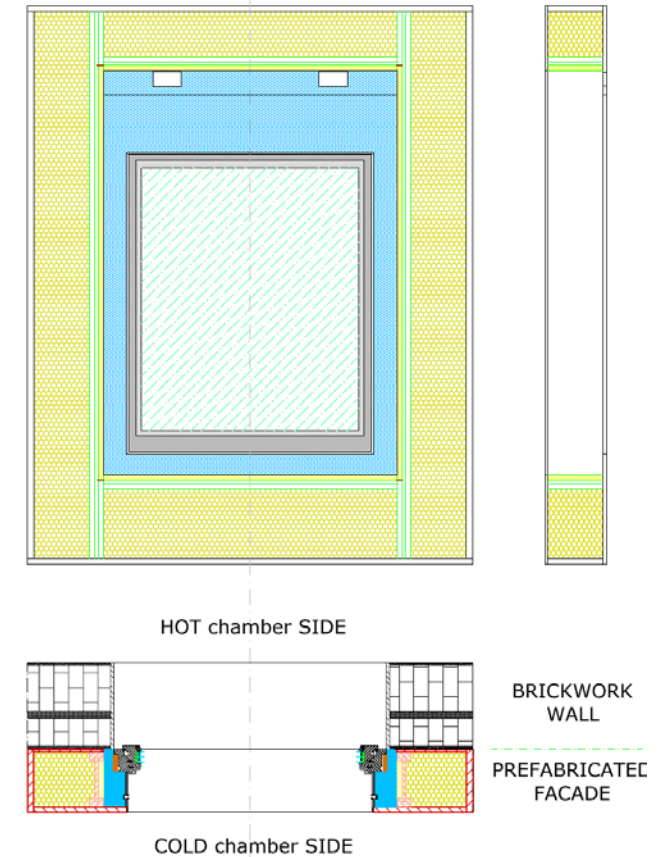
Conceptual and detailed design



www.sinfonia-smartcities.eu



Source: Eurac



Source: Eurac

Prefabricated timber-frame facades

Indoor testing – Thermal transmittance



www.sinfonia-smartcities.eu



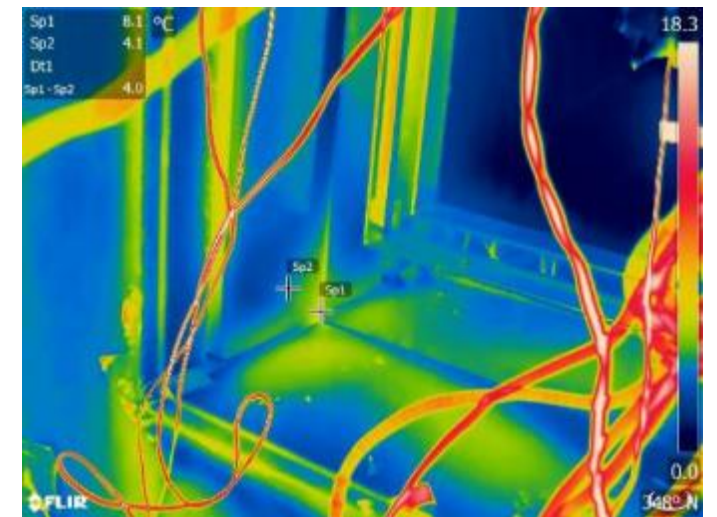
Source: Eurac

Prefabricated timber-frame facades

Indoor testing – Thermal transmittance



www.sinfonia-smartcities.eu



Source: Eurac



4RineU

ROBUST&RELIABLE TECHNOLOGY CONCEPTS AND BUSINESS
MODELS FOR TRIGGERING DEEP RENOVATION OF
RESIDENTIAL BUILDINGS IN EU

[HTTP ://4RINEU.EU/](http://4RINEU.EU/)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723829



Specific challenges:

- Inefficiency of the building stock
- Few buildings under deep renovation
- Viable business approach



Outcomes:

- Comprehensive deep renovation packages
- Reduction of time and cost of renovation

Expected impact:

- **60%** Net primary energy saving
- **15%** Cost reduction (compared with a typical renovation)
- **-50%** time for deep renovation

The project consortium

R&D

**eurac
research**

Applied Research Centres

SINTEF

Public institutions



BOLIGBYGG

Social housing
agency



**Agència de l'Habitatge
de Catalunya**

Consultancy



Manufacturer of H&C
systems integrating RES



Construction company



Research to market

AIGUASOL

Engineering companies



Technology partners

gumpp & maier
solutions made of timber

Manufacturer of
prefabricated timber
construction elements



Manufacturer of H&C
systems integrating RES



Software developers
(support to the
design&assessment)

NEEDS

Technical

Credibility

Social

Financial

Do not allow the targeted 3% renovation rate

ANSWERS



**RELIABLE
BUSINESS MODELS**



Cost-Effective
Rating System



**USABLE
METHODOLOGIES**



Cost-optimal
energy audit



Collaborative design
platform



Deep renovation
implementation
management



**ROBUST
TECHNOLOGIES**



Sensible Data Handl



Early Reno



PPEH



Comfort Ceiling
Fan operation



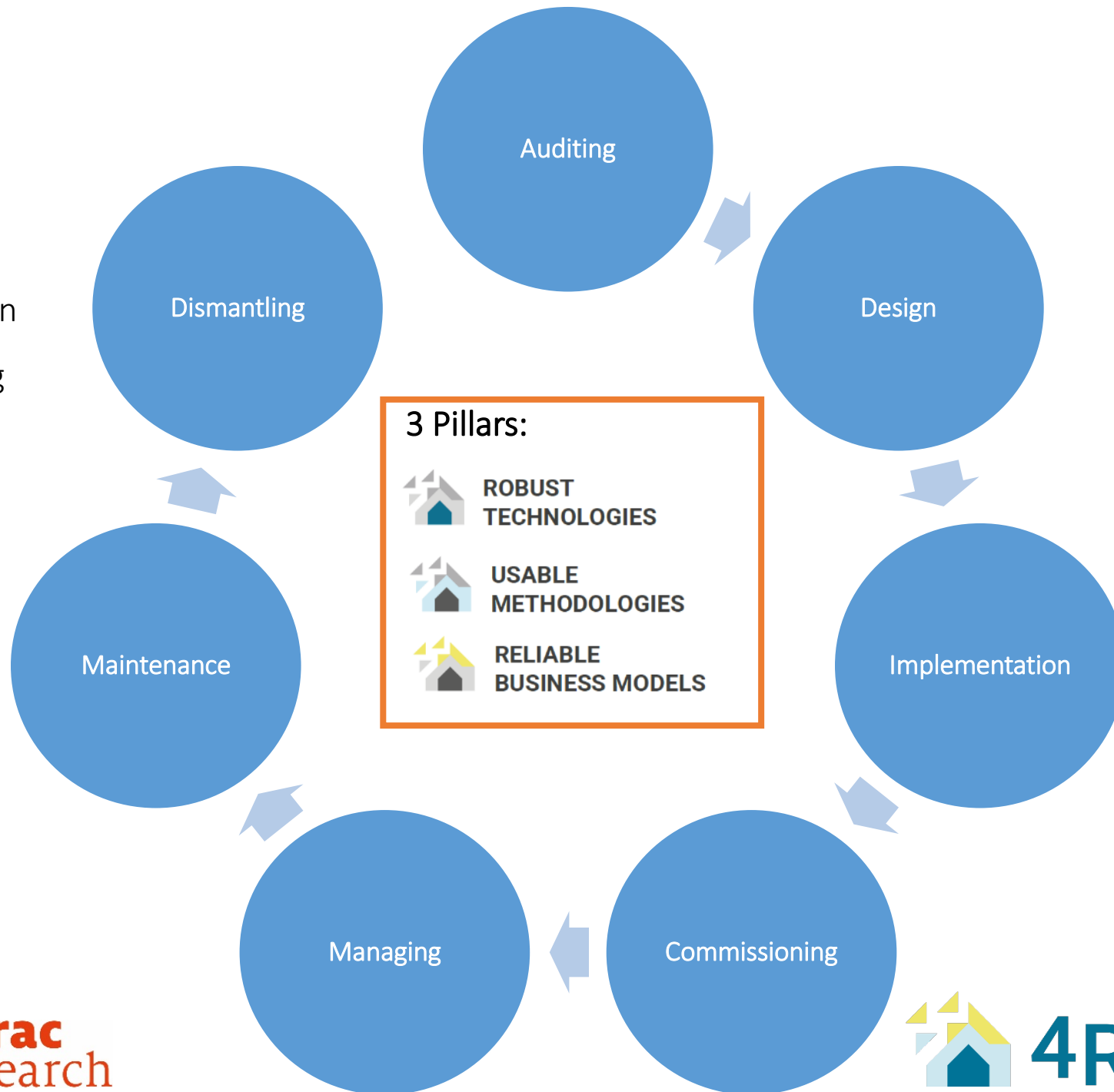
Strategies for
End of Life



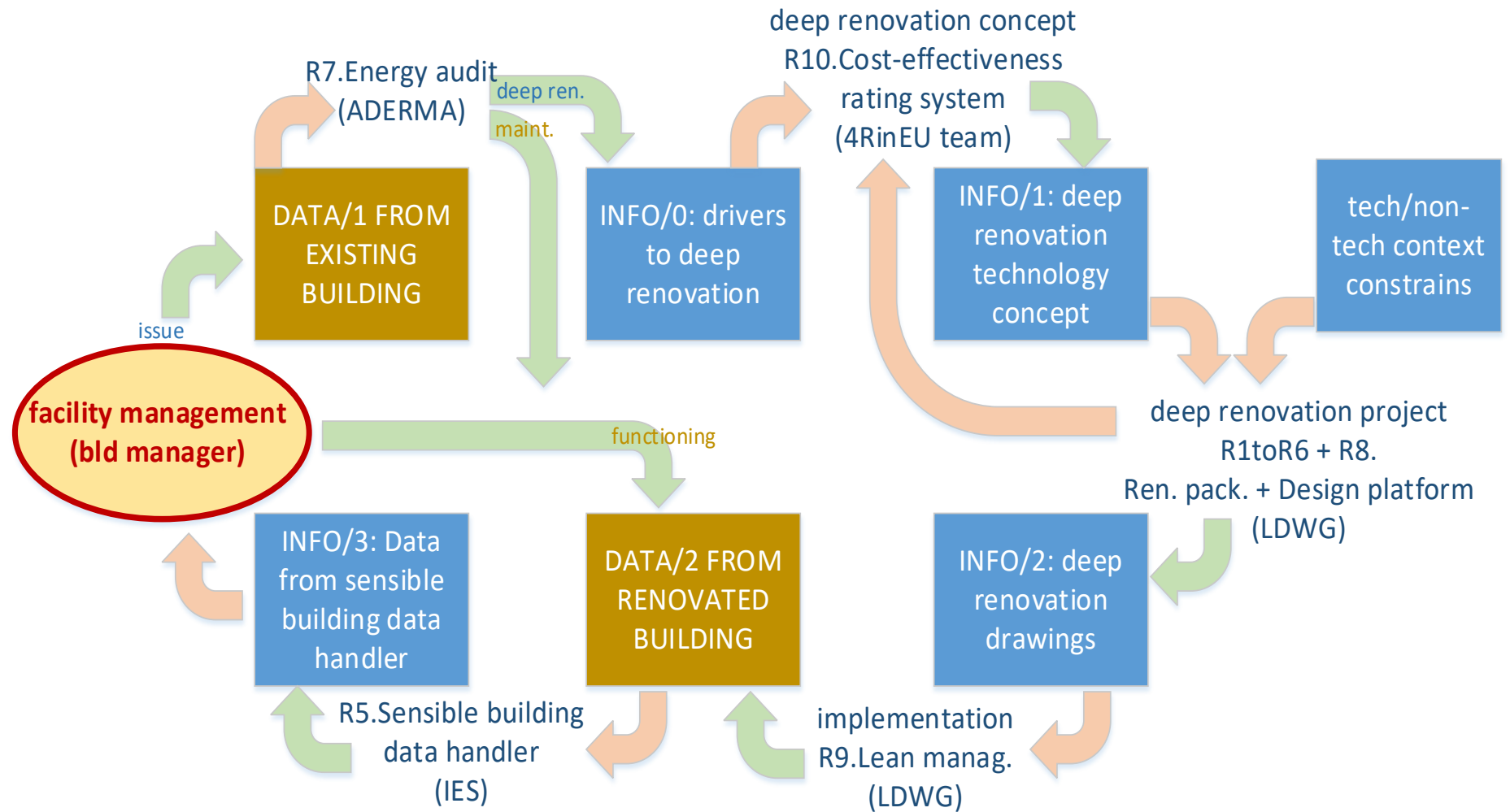
PMF

To increase efficiency of whole deep renovation process

- ✓ Auditing
- ✓ Design
- ✓ Implementation
- ✓ Commissioning
- ✓ Managing
- ✓ Maintenance
- ✓ Dismantling



- ✓ Auditing
- ✓ Design
- ✓ Implementation
- ✓ Commissioning
- ✓ Managing
- ✓ Maintenance
- ✓ Dismantling



4RinEU enables to manage complexity improving the key elements of deep renovation process, by transforming data in effective information for different players, and rating the possible alternatives in terms of: energy, comfort, renovation time and costs, environmental impact.

Tecnologie (robuste) per la riqualificazione

TO REDUCE ENERGY DEMAND



Prefabricated Multi-Functional facade

TO IMPROVE ENERGY EFFICIENCY



Plug&Play Energy Hub

TO IMPROVE BUILDING OPERATION



Sensible Data Handler

TO IMPROVE COMFORT



Comfort Ceiling Fan
Smart Operation

TO INCREASE RES RATE



Early Reno

TO REDUCE CONSTRUCTION WASTE



Strategies for
component end of life

Metodologie di supporto (usabili)

Credibility

Social



**USABLE
METHODOLOGIES**

To support the stakeholders along the whole renovation process:

- Help to understand renovation issues and associated potentials,
- Ensure an effective and participated design,
- Manage the construction site and reduce the working time and the associated failures.

TO UNDERSTAND RENOVATION
NEEDS AND POTENTIALS



Cost-optimal energy audit

TO ENSURE PARTICIPATED DESIGN



Collaborative design
platform

TO REDUCE CONSTRUCTION
FAILURES



Deep renovation
implementation
management



Modelli di investimento (affidabili)

Financial



**RELIABLE
BUSINESS MODELS**

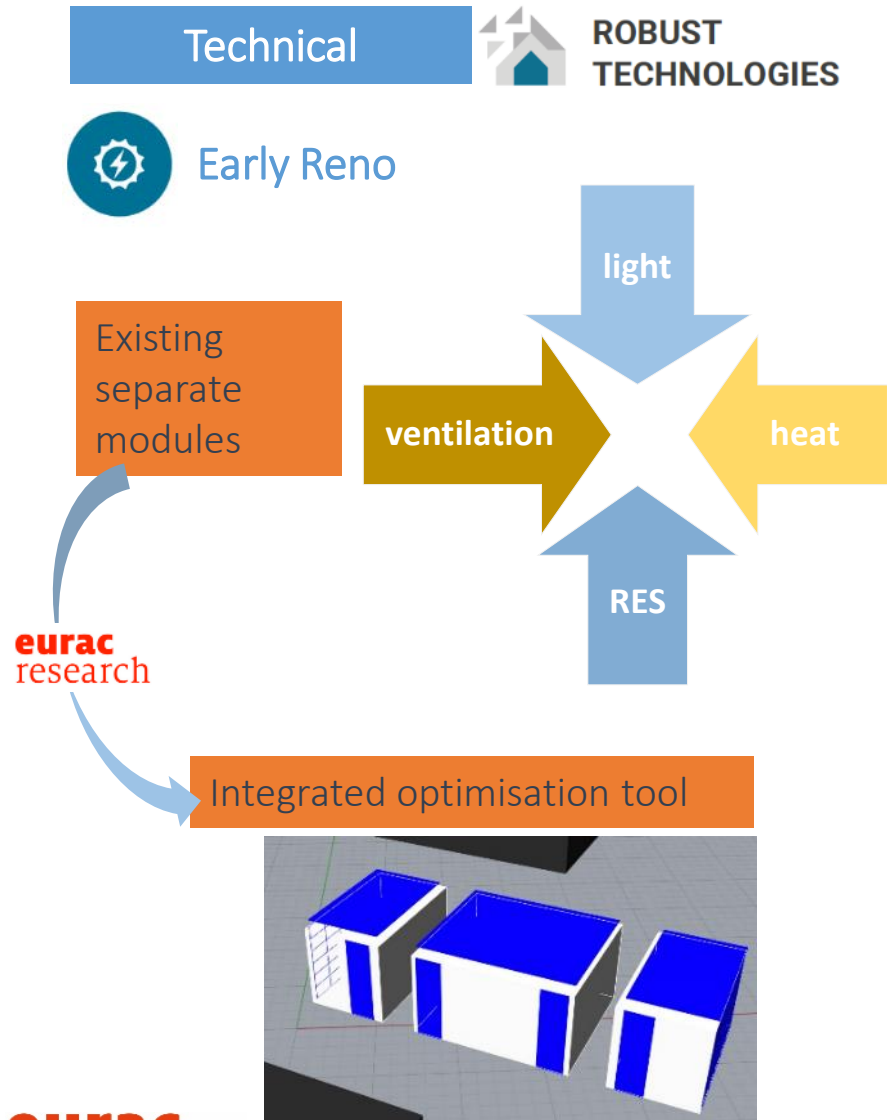


Cost-Effective Business Models

Fed with the Technologies and the methodologies.
The 4RinEU Business Models will:

- drive the investors in deep renovation, considering 5 evaluation topic: energy saving, environmental impact, IEQ, construction time, LCCs
- identify the level of risk of deep renovation process
- enable well-founded investments supported by tailor-made financial tools.

Sviluppo tecnologico

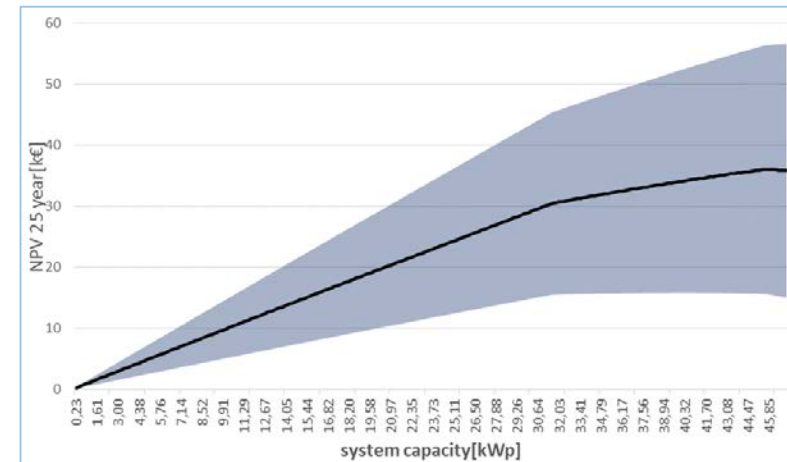


eurac
research

Source: Eurac research

Early design tool per ottimizzazione FER:

- dove installare PV o ST
- come massimizzare effetti ventilazione naturale (ventilative cooling e air change)
- come ottimizzare il daylighting



Business plan installazione PV – scenari in base alla potenza installata

4Rineu

Sviluppo tecnologico in 4RinEU

Technical



ROBUST
TECHNOLOGIES



Prefabricated Multifunctional Facade

KIT 3

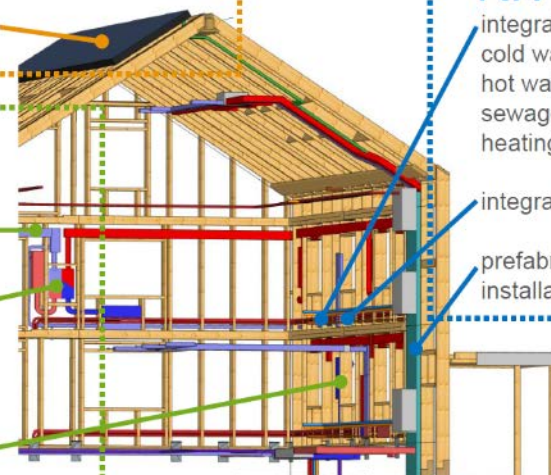
Building integrated solar
energy generation

KIT 1

integrated
ventilation

integrated
heat recovery

integrated micro
heat pump



KIT 2

integrated pipes:
cold water
hot water
sewage
heating (centr.)

integrated el. cables

prefabricated
installation shaft

Source: Gump & Maier

Da un concetto di
integrazione

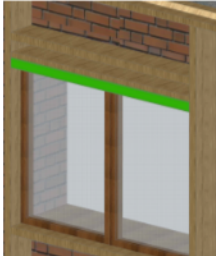
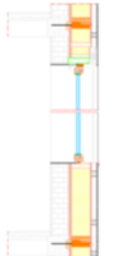


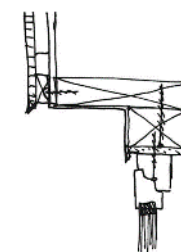
Alla definizione di
specifiche tecniche,
capitolati e dettagli tecnici

eurac
research

Sources: Gump & Maier,
Eurac research

Timber-frame prefabricated façade system - Technical Specifications

FAÇADE CONCEPT		BB, SINTEF
VENT 1 	Demo owner/manager	Single Family Home
	Building Typology	Oslo, Norway
	Location	Humid Continental (Dfa/Dfb, Köppen Classification)
	Climate	none
	ISO	Xe °C
	Winter peak temperature	Xe °C
	Summer peak temperature	for hygrothermal analysis
Heating set point	for hygrothermal analysis	
Cooling set point		
Façade concept - technical specifications		Integrated Energy/Technology Concept
Façade Structure		Decentralized mechanical ventilation around window frame
		
3D image (EURAC)		Façade vertical section (EURAC)



4RinEU

Sviluppo tecnologico in 4RinEU

Technical



ROBUST
TECHNOLOGIES



Prefabricated Multifunctional Facade

Integrazione macchine di
ventilazione

eurac
research

Analisi Tecnologie disponibili:

- Integrazione nella finestra
- Nano-tubi
- Box



- Dimensioni
- Prestazioni
- Costi
- Manutenzione
- Rumore
- Semplicità di installazione
- Disturbo per gli inquilini

gumpp & maier
solutions made of timber

eurac
research

- Studio del dettaglio costruttivo
- Prototipazione
- Test in laboratorio
- Simulazioni prestazionali
- Indicazioni e schede tecniche



Sources: Airria, Freshbox, ICOVENT

eurac
research

 4RinEU

Sviluppo tecnologico in 4RinEU

Technical



ROBUST
TECHNOLOGIES



Plug and Play Energy Hub

TO IMPROVE ENERGY EFFICIENCY

From a **prototype...**



...to a **product!**



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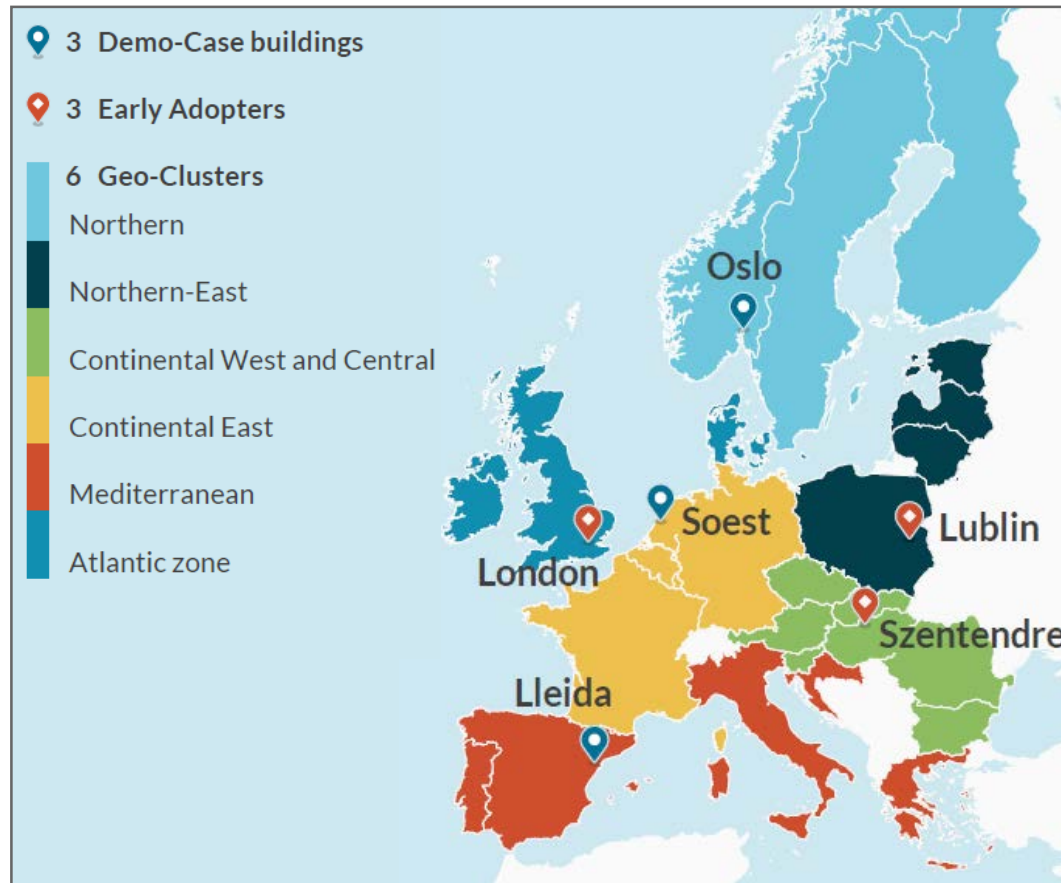
Thermics

...through **industrialisation...**

Sources: Thermics, eurac research

- Ottimizzazione costi (scelta componenti)
- Re-design dell'elemento
- Prototipazione
- Test in laboratorio
- Installazione in opera

Demo cases and early adopters



Source: eurac research

3 Demo cases:



**HAUGERUDSENT
ERET**
Oslo - Norway



MARIËNBURG
Soest – The
Netherlands

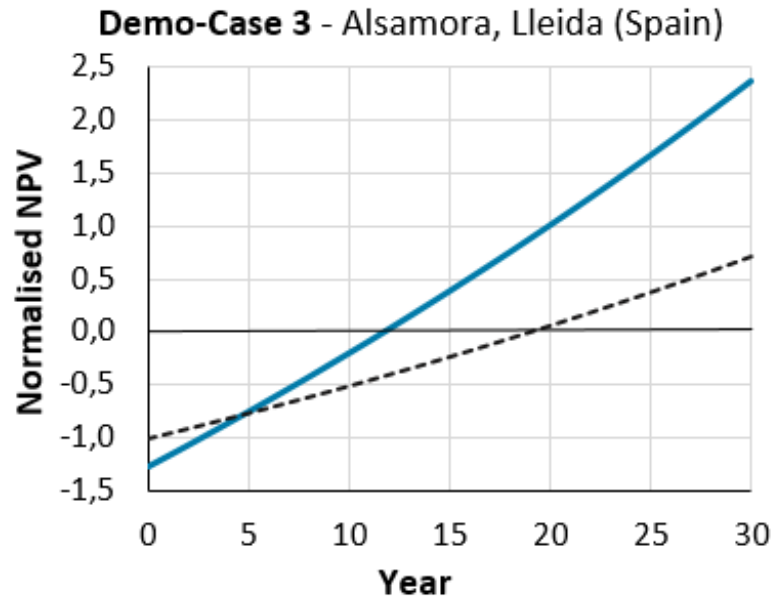


ALSAMORA 6
Lleida - Spain

Specific target: residential social housing

Identified with the partners the main renovation drivers → demo cases representative of the renovation needs

Demonstration of the impact



Renovation package Demo case 3:

-  PFM + integration of ventilation
-  New heating system + PPEH
-  Optimisation of RES with Early Reno
-  Installation of ceiling fans

Expected energy savings **>70%**

Life Cycle cost reduction **>15%** due to:

-  Reliable savings estimated by 4RinEU audit
-  Higher durability and reduced maintenance of 4RinEU technologies
-  Failure reduction during the construction

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THANKS!

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