WEBINAR

Dialogues with FuturHist & HeriTACE

From Case-by-Case to Scalable Solutions: Typology Approaches in Historical Building Renovation

13 October -30 November Close to You 2025

Date:
15TH OCTOBER

Hour:
11 – 12:30 PM

HeriTACE

FuturHist

JOIN US

Agenda

11:00 – Welcome & Introduction

11:05 – Part 1: Future-proofing heritage buildings for the clean energy transition: Challenges & Potential solutions
Speaker: Yann Grandgirard, Edinburgh World Heritage

11:20 – Part 2: Towards replicable solutions for energy renovation of heritage buildings: a typology approach
Speakers: Elena Poma, EURAC Research
& Alessia Buda, Politecnico di Milano

12:00 – Part 3: Overview of innovative solutions for energy renovation of heritage buildings
Speakers: Eline Himpe, Ghent University
& Daniel Herrera, EURAC Research

12:15 – Q&A and Discussion
12:25 – Closing Words

WEBINAR

Dialogues with FuturHist & HeriTACE

Date: **15TH OCTOBER**

Hour: **11 – 12:30 PM**

From Case-by-Case to Scalable Solutions: Typology Approaches in Historical Building Renovation

Moderator: Marta Candidi

ACE Project Officer

Yann Grandgirard

Head of Climate Change
Edinburgh World Heritage

Alessia Buda

Architect
Postdoctoral Researcher
at Politecnico di Milano

Elena Poma

Postdoctoral Researcher
at Eurac Research

Eline Himpe

Research manager at
Ghent University
Building Physics group

Daniel Herrera

Research Group Leader
Institute for Renewable Energy

13 October
-30 November
Close to You
2025

HeriTACE

FuturHist

JOIN US

Which country are you joining us from?

How would you describe your profession?

From Case-by-Case to Scalable Solutions: Typology Approaches in Historical Building Renovation

Part 1: Challenges & Potential solutions

Yann Grandgirard
Edinburgh World Heritage

15th October 2025

#EURegionsWeek

Introduction

- Historic buildings are diverse and have different degrees of protection (or none)
- 1/4 of the existing building stock built before 1945 in Europe (~20% of housing stock before 1919 in UK)
- Energy retrofit: repairs and improvements
- Many benefits – mainly reduce CO2 and energy consumption, but also comfort
- Many requirements to sensitively retrofit HBs – need to mitigate multiple risks
- Many stakeholders involved

1. Overview of the challenges

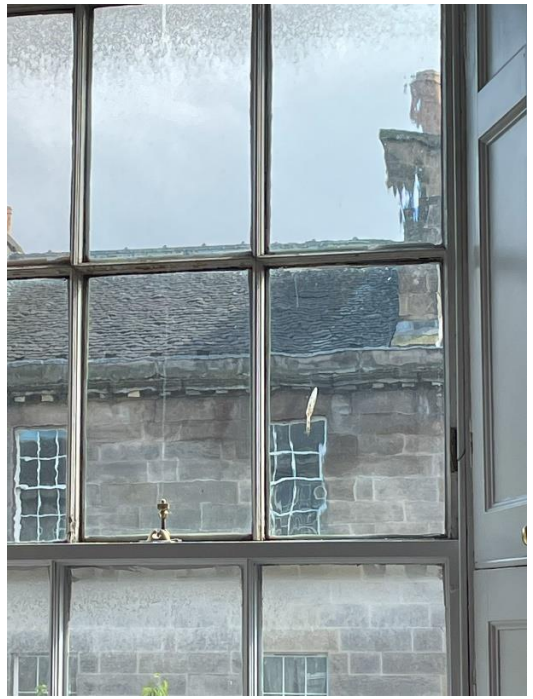
1. Overview of the challenges

Lack of understanding of Historic Buildings:

Heritage significance

1. Overview of the challenges

Lack of understanding of Historic Buildings: Heritage significance



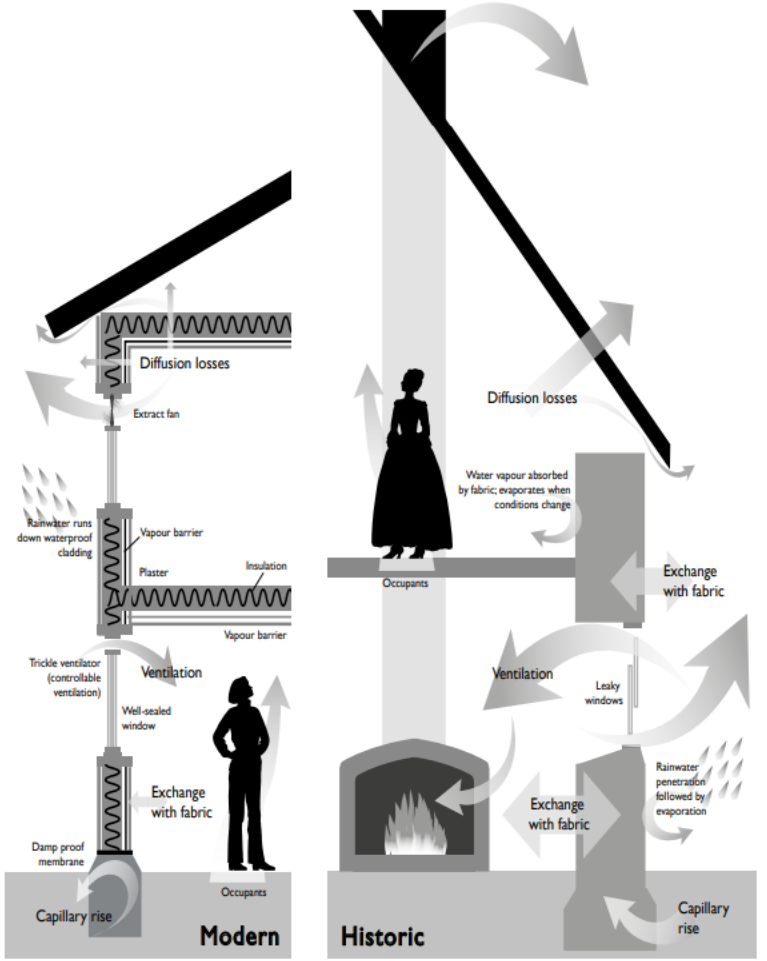
1. Overview of the challenges

Lack of understanding of Historic Buildings:

Design, performance & technical compatibility

From Historic Environment Scotland's 'Guide to Energy Retrofit of Traditional Buildings' (2021)

Accelerated stone decay due to cement pointing

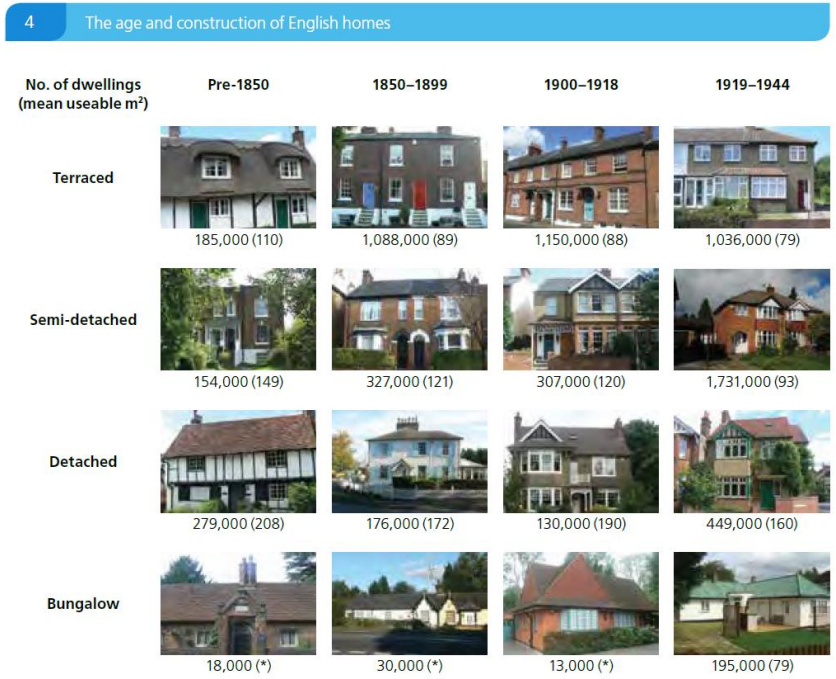


From Robyn Pender, typical differences in the movement of moisture and air in modern and traditional construction

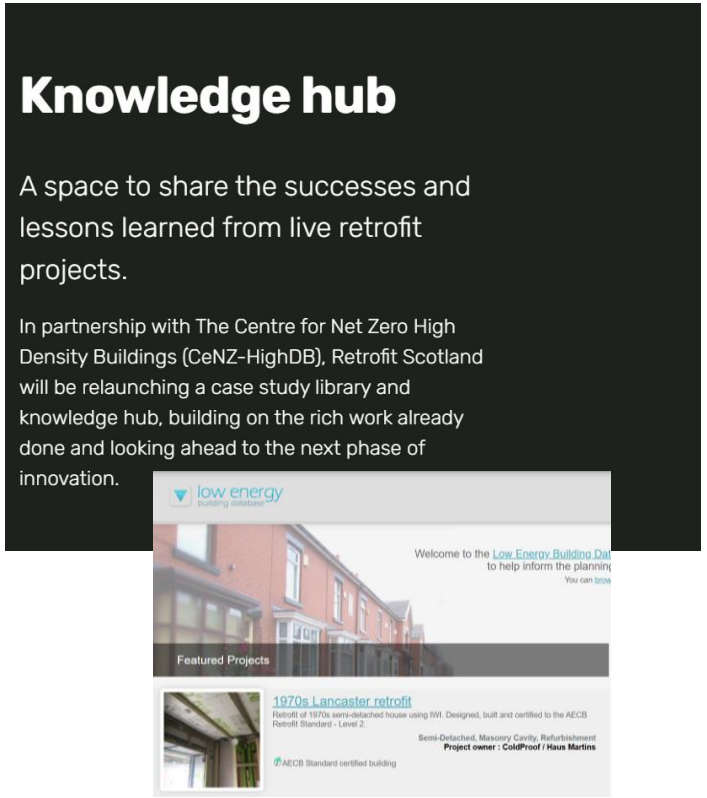
#EURegionsWeek

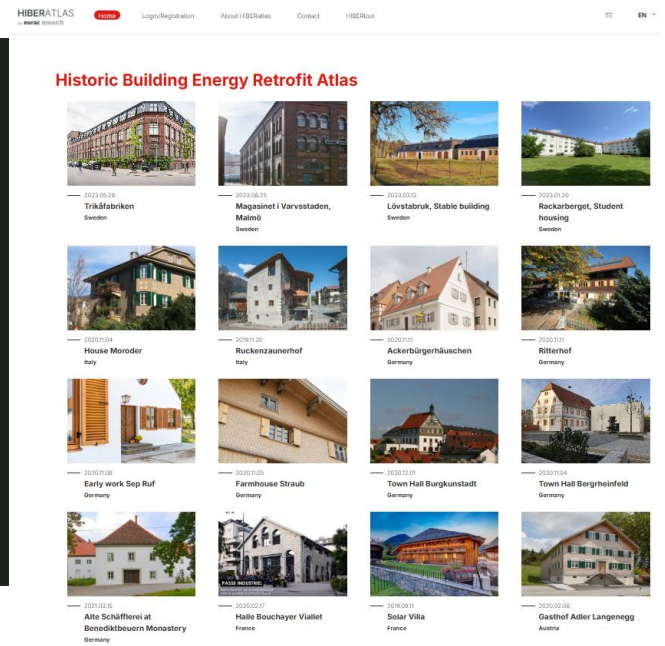
1. Overview of the challenges

Lack of understanding of Historic Buildings: Categorisation & data (baseline performance)



From BRE 'The age and construction of English homes' (2014)





#EURegionsWeek

1. Overview of the challenges

Lack of holistic approach in energy retrofit for <u>any</u> building

- Flat vs whole building (whole house approach)
- Many criteria to consider:

- Cultural value
- Energy performance
- Carbon emissions (operational and embodied carbon)
- User needs and aspirations
- Indoor air quality & comfort
- Climate resilience
- Smart readiness
- Renewable Energy Systems
- Low maintenance costs

1. Overview of the challenges

Maintenance too often overlooked…

- Yet first step for :

⇨ Energy efficiency

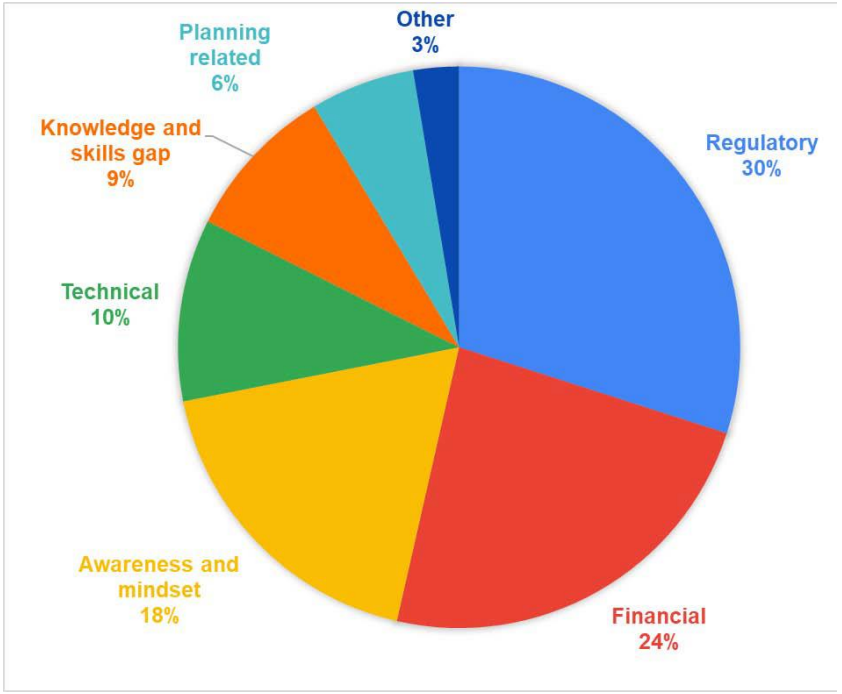
⇨ Climate change adaptation

- Futureproofing interventions
- Costs often omitted

Leaking downpipe is causing damp and algae growth, which will erode the stonework

1. Overview of the challenges

- Barriers are often interconnected and not easily categorized
- Importance of barriers varies with local context
- Regulatory and financial barriers (e.g. funding) dominate



Barrier categorization from FuturHist online survey

260 answers to the question “What do you think the main barriers to making historic buildings more energy efficient are?”

#EURegionsWeek

1. Overview of the challenges

Building owners and tenants:

- Where to start? What to do? Who to ask?
- Fast changing technology
- Guidance too complex and/or too general
- Lack of free impartial advice for HBs (no single point of information)
- Affordability & financial support for historic building owners (availability and awareness)
- Exposed to standardised solutions (not context-specific)
- Lack of holistic approach = piecemeal approach (and high risks)
- Planning process is complex

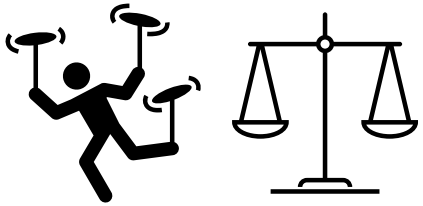
1. Overview of the challenges

Designers/practitioners 

- New tools are required (e.g. heritage value & impact assessment)
- Some tools need simplifying and optimising (e.g. energy performance assessment)
- Simpler/more guidance is needed (e.g. indoor environmental assessment, economic viability and environmental impact – LCA and waste)
- Need to gain time
- Facilitate comparison between retrofit scenarios and reliability of results
- Different tools and processes used depending on size of practice, approach and costs

1. Overview of the challenges

Policy makers



- Pressure to deliver net-zero…
- … and tension with heritage regulations
- Need to enable adoption of new technologies (net-zero targets, economic growth)…
- … in line with best practice for HBs
- Local authorities not directly in charge of privately owned buildings – lack of resources to support transition (extra)

1. Overview of the challenges

Contractors 

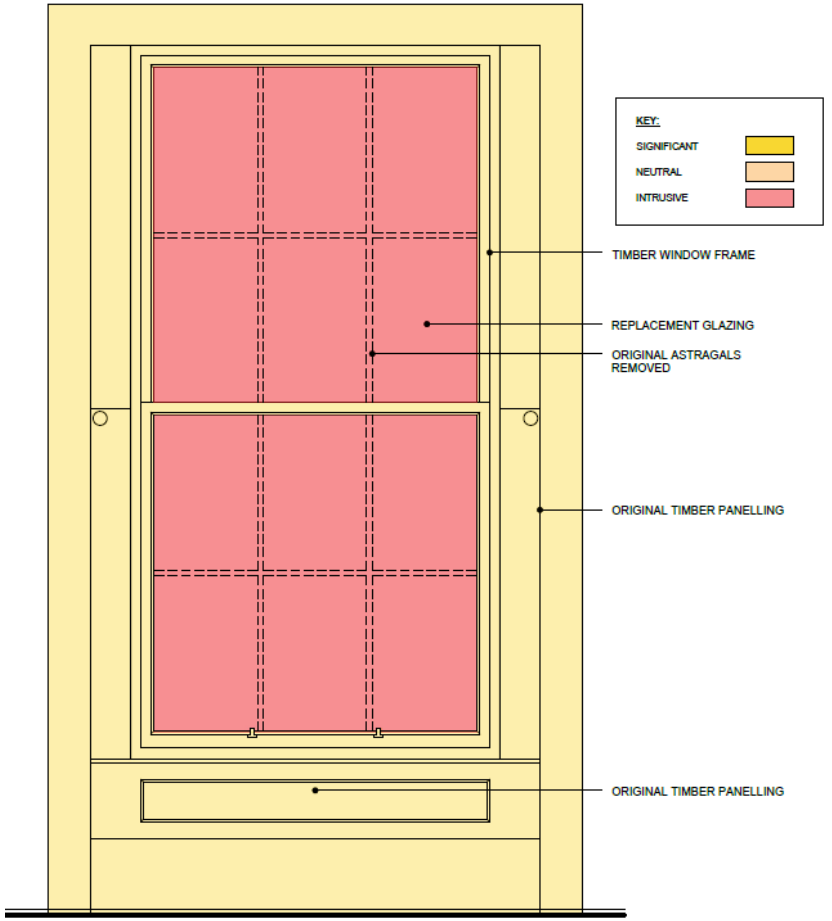
- Lack of understanding of HBs significance, their design and performance
- Too specialised (either insulation, heating system, windows) = piecemeal approach
- Fast changing landscape (standards, technology)
- Not time to train (off work)

2. Solutions needed

2. Solutions needed

- **Help people to easily understand cultural significance and integrate heritage <u>at the start of the process</u>**

From Simpson & Brown Architects' Sir Basil Spence's Canongate Housing – Conservation Statement (2013)



From Smith Scott Mullan Architects Elm Row project (2024)

#EURegionsWeek

2. Solutions needed

- **Speed things up**: introduce and mainstream a **typology-based approach** for energy retrofit

- Group buildings and define replicable packages of solutions

⇨ Identifying and protecting common elements of cultural significance

⇨ Addressing common issues and risks

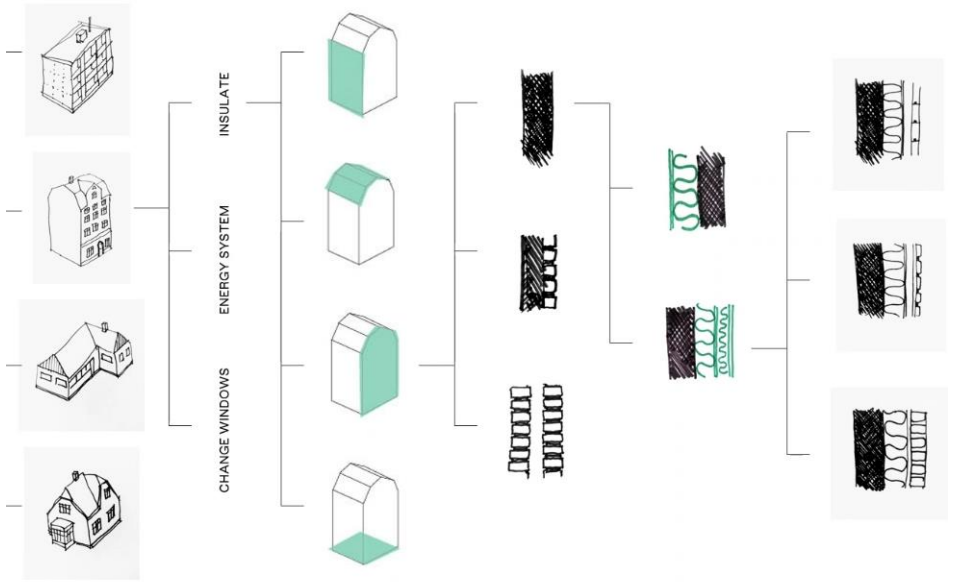
⇨ Requiring minimal adaptation for specific buildings within the typology

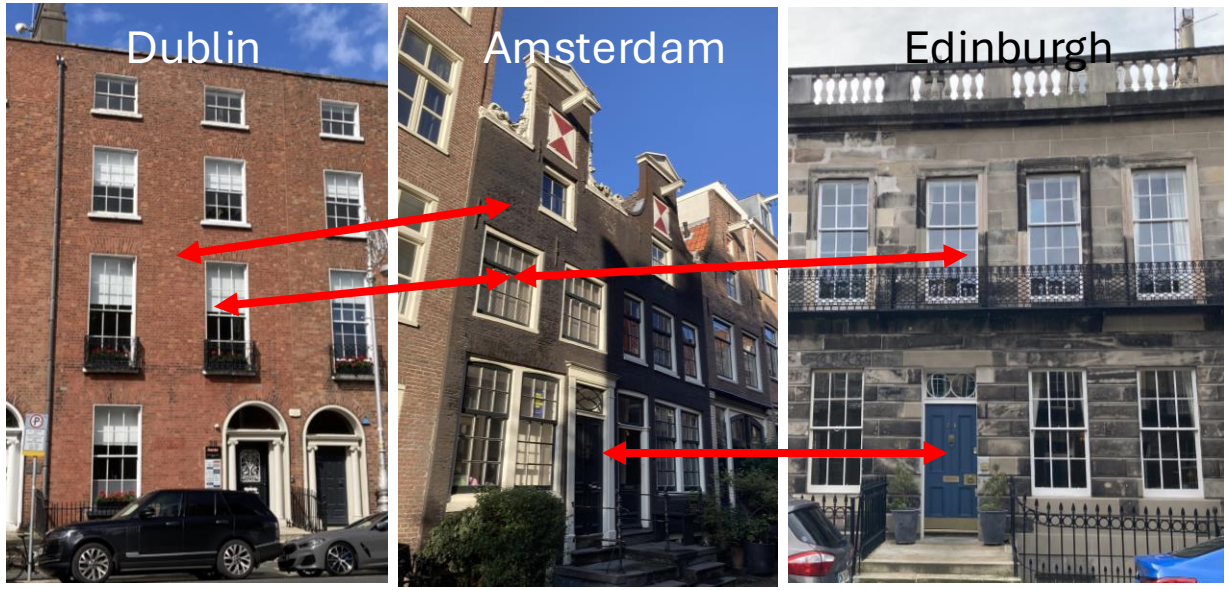
2. Solutions needed

- **Provide replicable technical solutions** for individual building elements

- Mapping the solutions and their applicability per typology

- Different typologies but same building elements (e.g. windows)





#EURegionsWeek

2. Solutions needed

- **Promote and enable project stakeholders to adopt a holistic approach:**

Develop retrofit approach/process, decision-making support tools, and guidance to:

⇨ Rise awareness of risks and help mitigate them

⇨ Help make right decisions and consider all retrofit aspects

⇨ Show best practice via case studies and guidance

In your experience, which is the main challenge?

- Oversimplification is not an option. We need upskill of professionale and more knolwedge
- Skill, knoledge gap and also financial opportunities (if there is)
- Connect heritage with new regulations
- Bureaucracy
- Compromise between regulations
- Financial and lack of knowledge
- Prescriptive building standards
- responsibility for outcome
- Complexity
- Financial
- Lack of competence for holistic solutions.
- Understanding
- Skills and knowledge gap amongst the general public
- Cost
- Guidance
- Lack of knowledge
- Burocracy
- Costs
- Financial
- Moisture safety

Horizon EU call: “Future-proofing historical buildings for the clean energy transition”

- Target **building types with cultural heritage value** renovation restrictions, representing min. 1% country building stock
- Develop **standardised renovation approaches and directly replicable solutions** for buildings of the same type
- **Target energy demand reduction of min. 60% while preserving heritage value**, and: improve indoor environmental quality and cost effectiveness, increase local use of renewable energy and smart readiness, reduce maintenance costs and construction waste
- European Green Deal & New European Bauhaus
- **HeriTACE** and **FuturHist** projects (2024-2027)

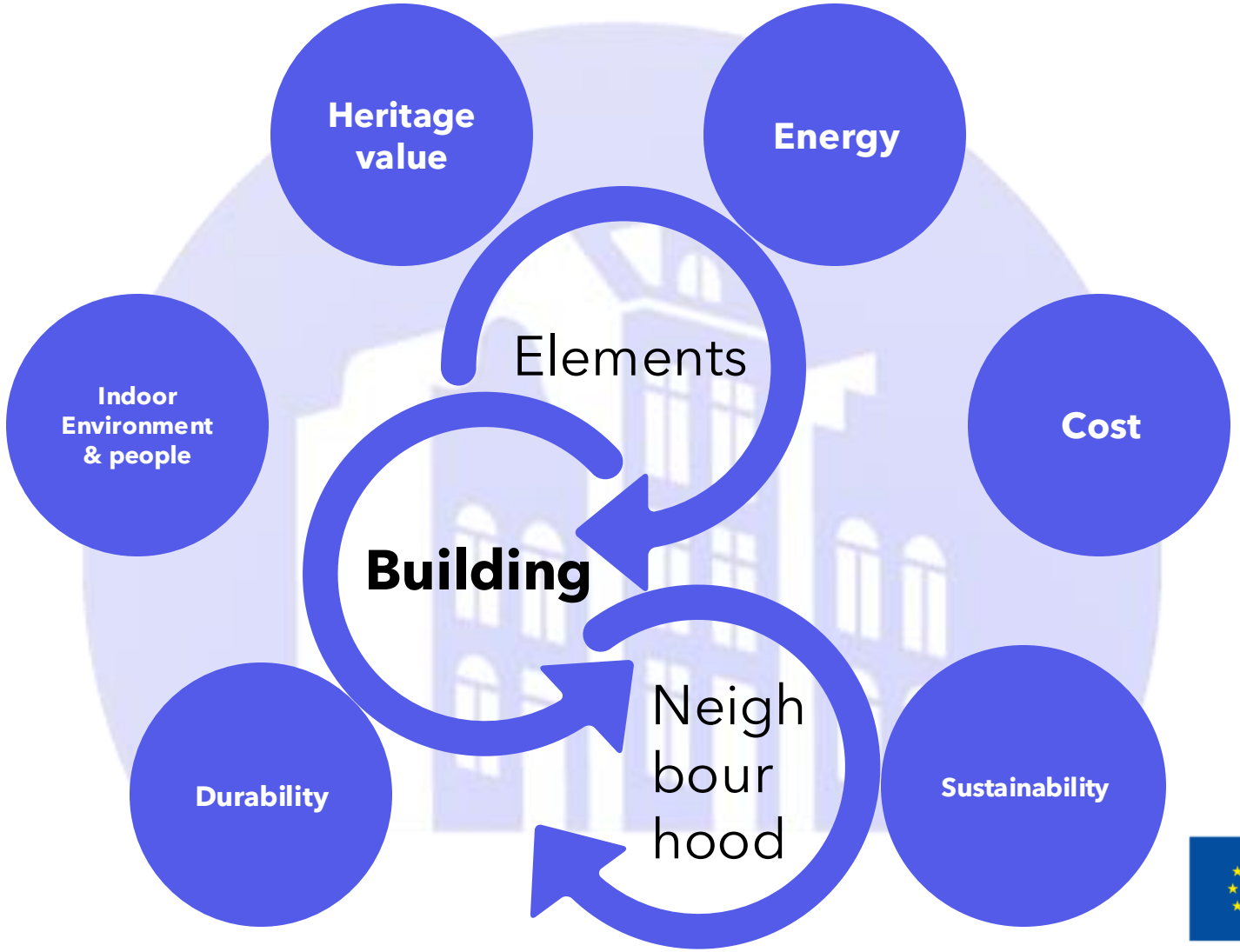
HeriTACE

Holistic & Multi-scale renovation approach

supported by building envelope, HVAC and energy solutions

optimising integration of solutions in Time and spACE

for the historical townhouse typology



#EURegionsWeek

FuturHist's approach

Develop a streamlined, **standardised approach** for energy retrofitting of historic buildings, based on building **typologies**.

Demonstrate and validate **innovative passive and active solutions** for energy efficiency, comfort, and durability, compatible with heritage values.

Enable **scalable replication** of solutions and methodologies across Europe, supporting the EU's clean energy transition and climate goals.

Webinar "From Case by Case to Scalable Solutions: Typology Approaches in Historical Building Renovation"

Part II: Towards replicable solutions for energy renovation of heritage buildings – a typology approach

FuturHist typology-based approach

Elena Poma, PhD

eurac research

#EURegionsWeek

Every historic building
is different.

FuturHist

Well, sort of.

FuturHist

FuturHist

FuturHist

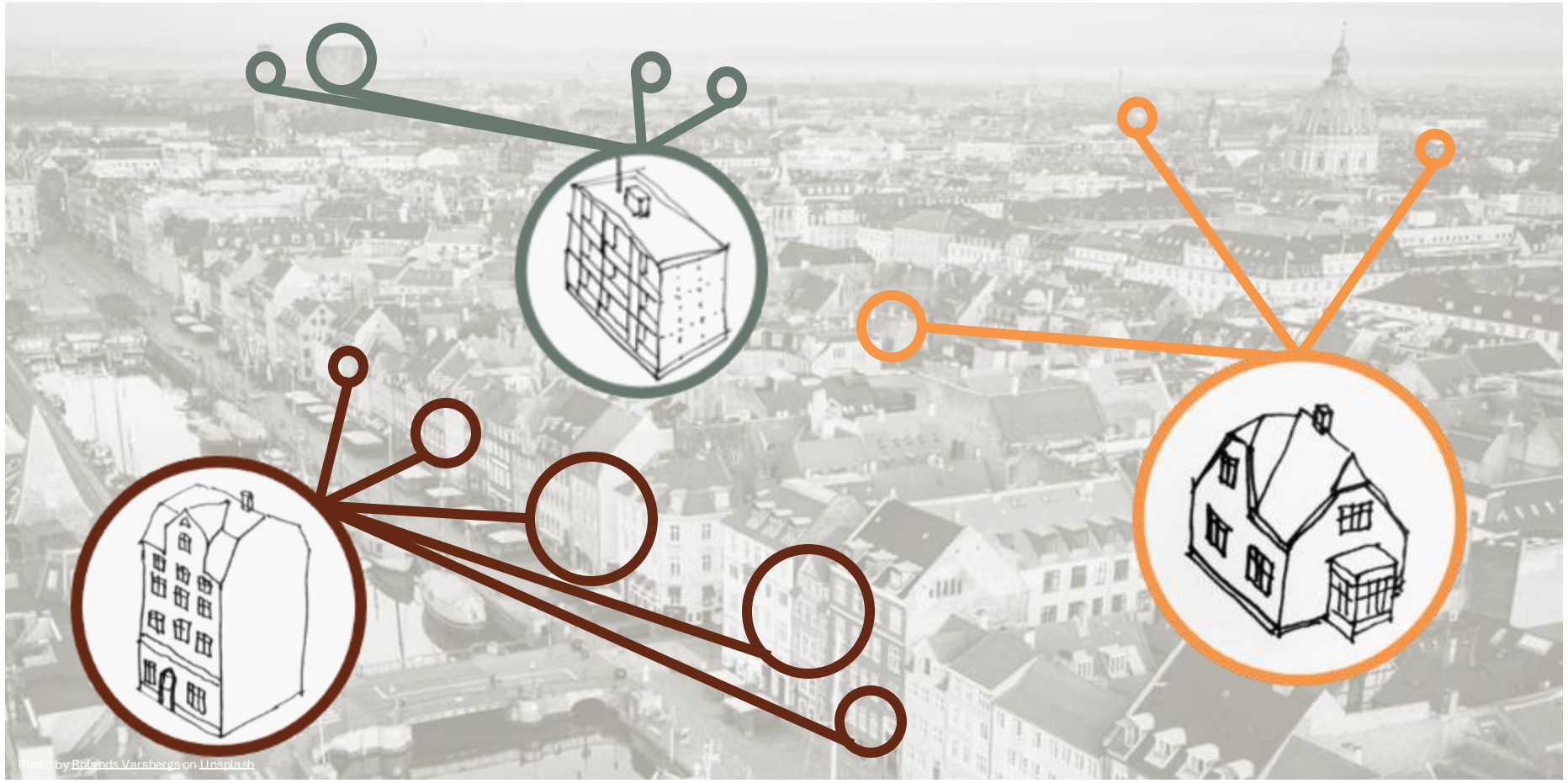
What if we could develop replicable retrofit solutions to future-proof historic buildings?

FuturHist

Shift the focus from individual buildings

FuturHist

Shift the focus from individual buildings

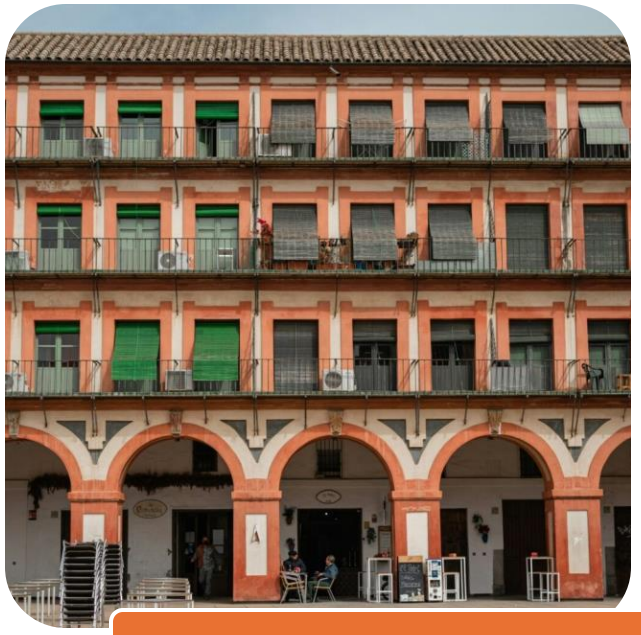


… to Building typologies

FuturHist

Case-specific approach:

From the real building to energy retrofit solutions



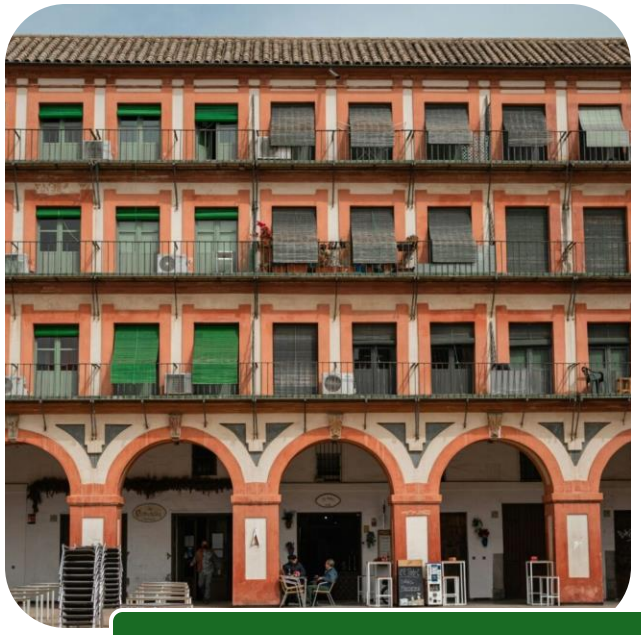
Real historic building

Tailored retrofit solutions

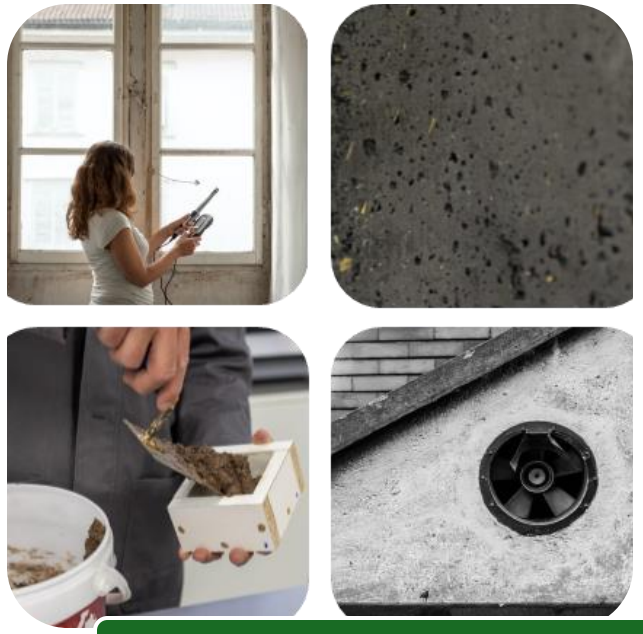
FuturHist

Can we reverse/change the process?

From energy retrofitting solutions to the real building



Real historic building



Tailored retrofit solutions

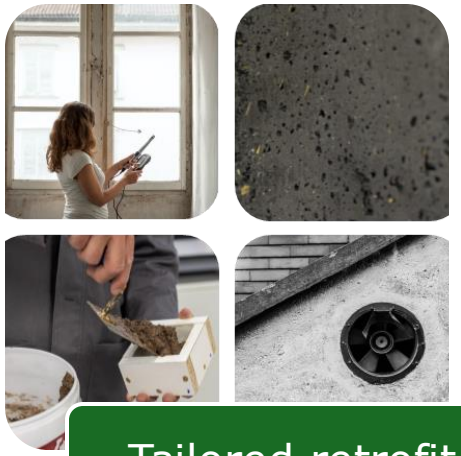
FuturHist

Can we reverse/change the process?

Typologies can be used to link retrofitting solutions to real buildings

Real historic building

Typology

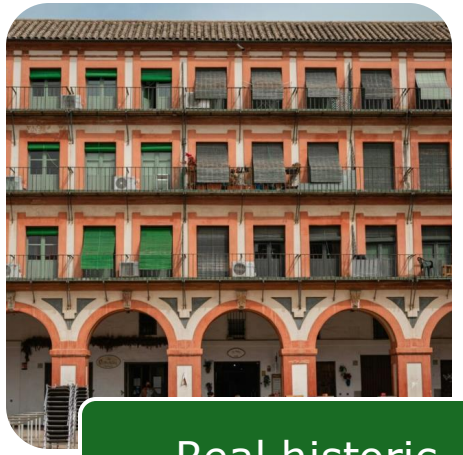


Tailored retrofit solutions

FuturHist

Can we reverse/change the process?

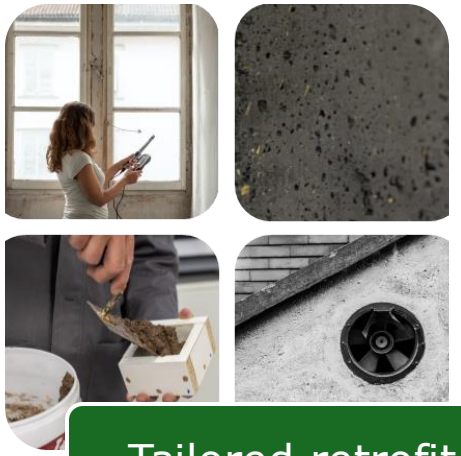
Typologies can be used to link retrofitting solutions to real buildings



Real historic building

Typology

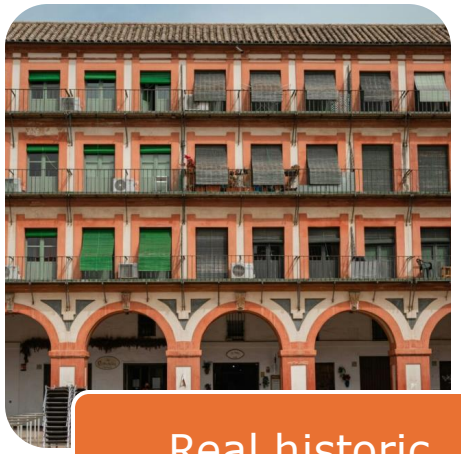
A set of buildings with common properties (e.g., age of construction, geometry, thermo-physical properties, climate context, energy performance…)



Tailored retrofit solutions

FuturHist

Every retrofitting design for an historic buildings requires multiple efforts



Real historic building

Owner

Heritage authorities

User

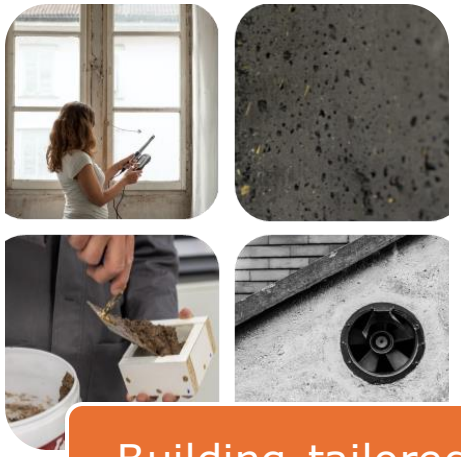
Retrofitting project

Designers

Consultants

Specialists

...



Building-tailored retrofit solutions

FuturHist

Typologies can be used to link retrofitting solutions to real buildings

Typology

Owner

Heritage authorities

User

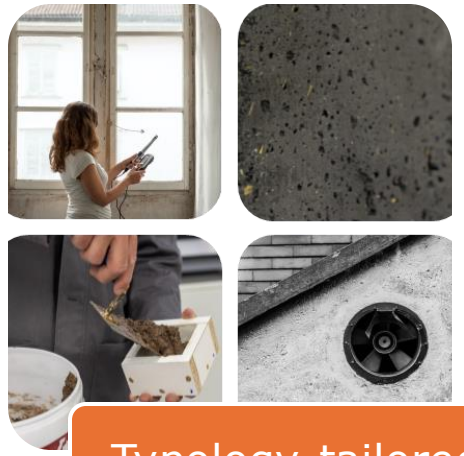
Retrofitting solutions design

Designers

Consultants

Specialists

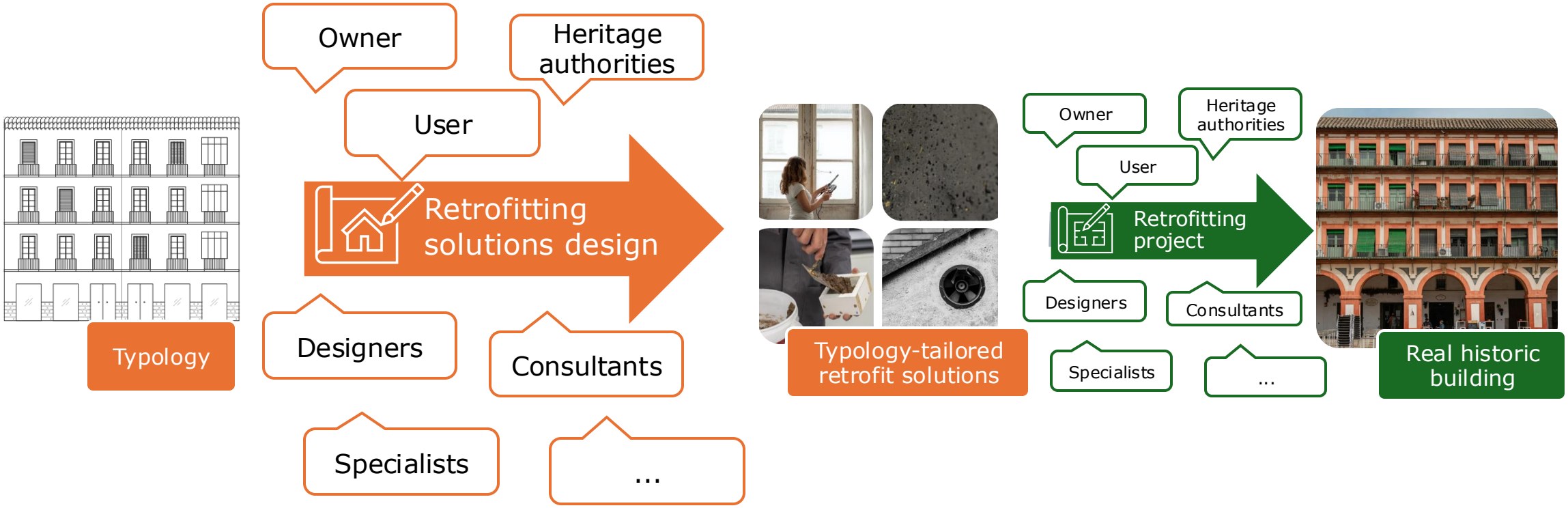
...



Typology-tailored retrofit solutions

FuturHist

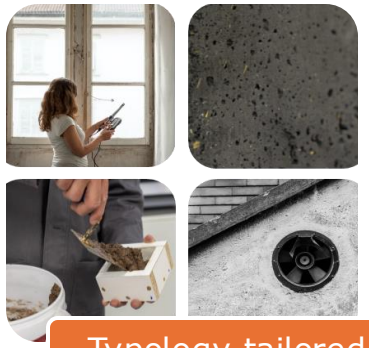
Typologies can be used to link retrofitting solutions to real buildings



FuturHist

Developing and testing typology-based solutions

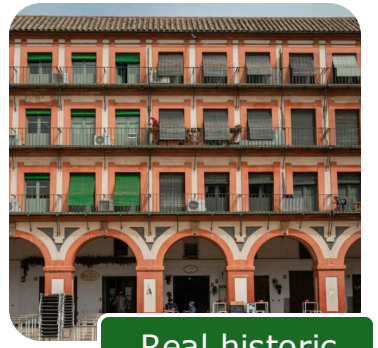
Typology



Typology-tailored retrofit solutions

Typology

Real building



Real historic building

Selection of compatible solutions

Selection of feasible solutions

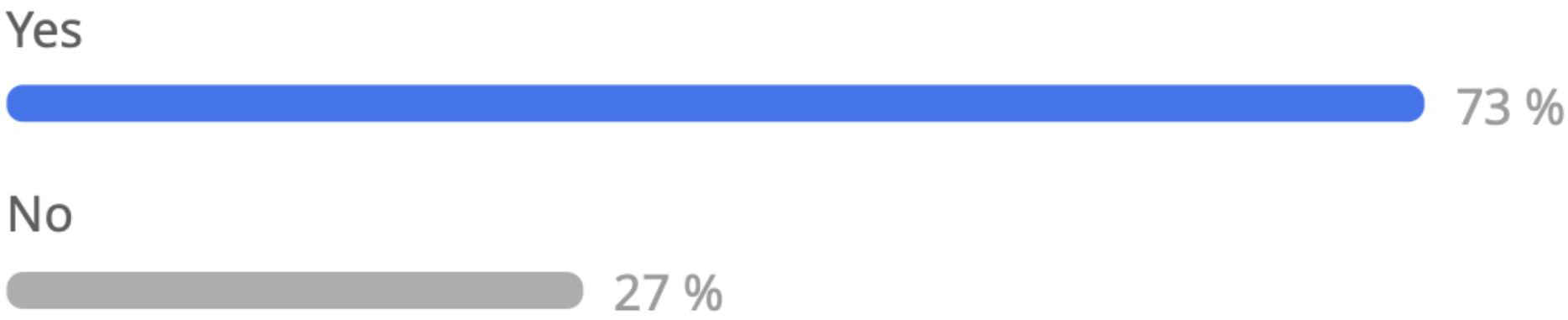
Typology-based evaluations

Building-based evaluations

Retrofit

FuturHist

Have you already addressed typologies or used typology-based approach?



FuturHist

If yes, in which context?

- Research for environment information and analysis
- Building stock analysis
- Research
- Design for reabilitation of 1950's building in Portugal
- Energy retrofit of heritage houses and other
- Research
- Research - energy retrofitting strategies for individual houses
- Hımış hybrid sturcutre, stone masonry with timber frame upper floors
- Research
- Guidelines development
- Design
- Research
- practice
- Research
- Energy retrofit in Heritage context
- Research
- Stonehouses

Defining historic building typologies

FuturHist

Defining historic building typologies

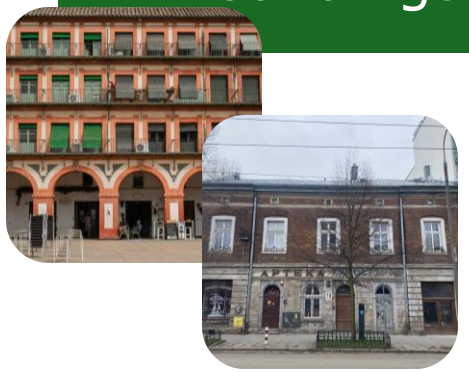
Literature

EU datasets

List of typological features to collect data from existing buildings

Past projects working with typologies

Data collection about 5 demonstrator buildings



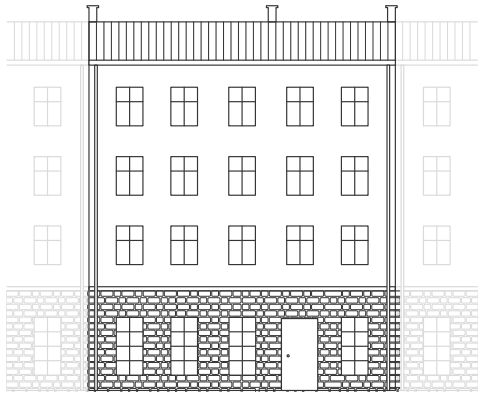
Defining features

Identification of typological features

Variable features

FuturHist

Defining historic building typologies



DEFINING FEATURES

VARIABLE FEATURES

- GENERAL INFORMATION
  - *CONSTRUCTION PERIOD*
  - CLIMATE
  - ORIGINAL USE
  - CONTEXT
- OCCUPANCY
  - CURRENT USE
- SPATIAL SITUATION
  - SURROUNDINGS
  - BUFFER SPACES
- HERITAGE VALUE
  - LEVEL OF PROTECTION
  - AUTHENTICITY
  - INTEGRITY
  - RARITY
  - REPRESENTATIVENESS
  - INTEREST(S)
- HERITAGE ATTRIBUTES
  - ELEMENTS TO PRESERVE
- ARCHITECTURAL CHARACTERISTICS
  - *CONSTRUCTION
  - ARCHITECTURAL STYLE
  - LAYOUT
- GEOMETRICAL PARAMETERS
  - *SHAPE
  - *SURFACE
  - POSITION

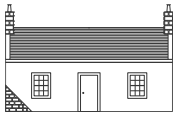
**RANGE-BASED FEATURES*

FuturHist

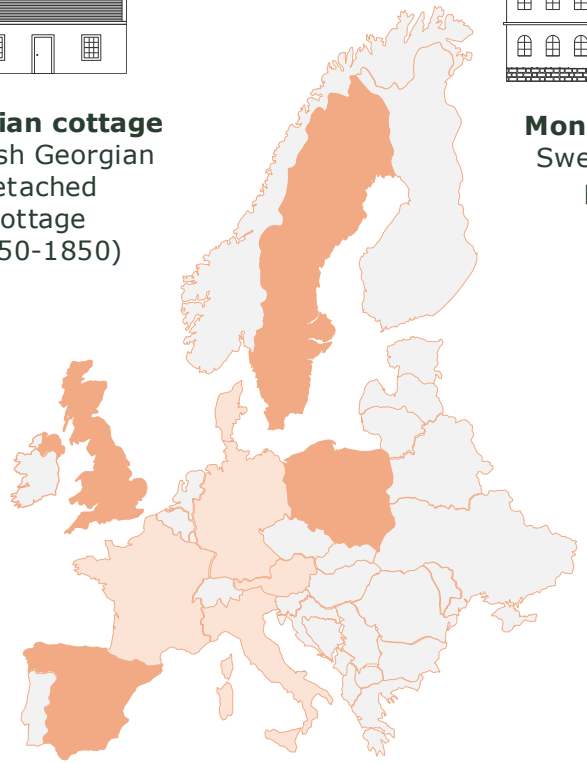
4 countries, 9 typologies

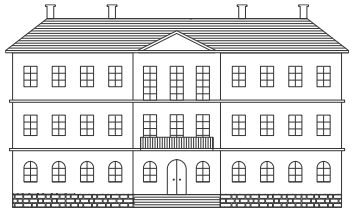
Victorian terraced house
Scottish Victorian terraced house
(1850-1920)

Georgian tenement
Scottish Georgian terraced tenement building
(1750-1850)

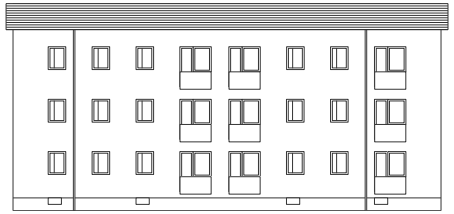


Georgian cottage
Scottish Georgian detached cottage
(1750-1850)

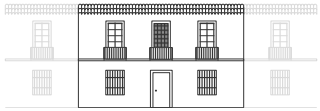




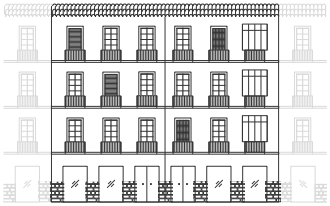
Monumentalbyggnad
Swedish monumental public building
(1850-1920)



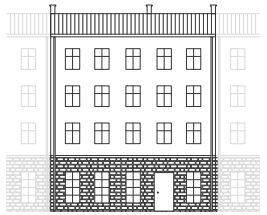
Flerbostadshus functionalism
Swedish functionalist multi-family housing block
(1920-1945)



Patio de vecinos
Spanish terraced courtyard tenement building
(1600-1920)



Casa de pisos
Spanish terraced tenement building
(1600-1920)



Kamienica
Polish terraced tenement building
(1750-1945)

Willa miejska
Polish garden city/urban villa
(1900-1945)

FuturHist

Typologies addressed in FuturHist

FuturHist

© Fundación Sandoval

TYPOLOGY 1 SPAIN

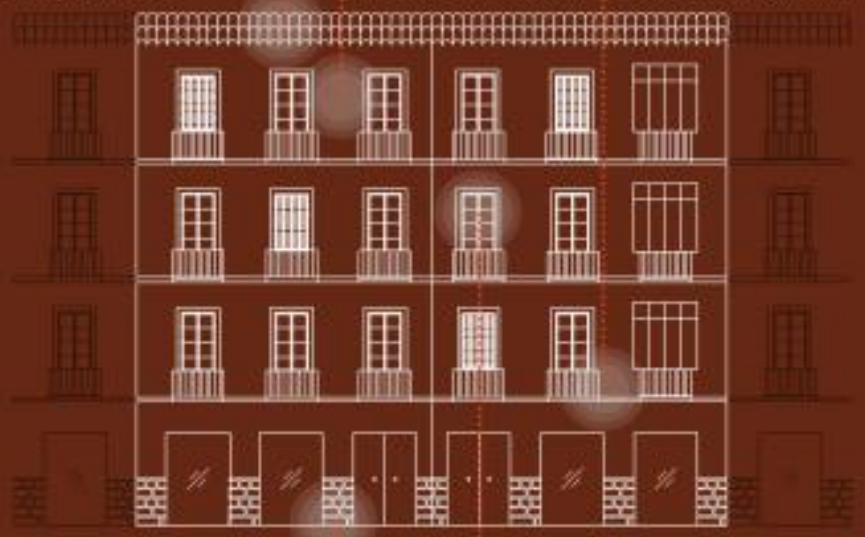
Casa de pisos Spanish terraced tenement building (1600–1920)

Multi-storey, multifamily residential buildings in historic centres, notable in cities like Málaga, Seville, and Cádiz, popularised in the 19th and early 20th centuries to maximise the use of urban land and also to respond to the organisational needs of a new society

HERITAGE FEATURES

- Sloping Arabic tiles roof or "azoteas" (rooftops) with ceramic flooring, depending on the historic centre
- Façade, a load-bearing wall with a constant proportion of vertical openings
- Lime mortar coating
- Surface treatments and paint colour
- Windows with vertical wooden swing door and inward opening

CONSTRUCTION



KÖPPEN-GEIGER CLIMATE CLASS

Warm temperate, summer dry, hot summer (Csa)

DISTRIBUTION

Multifamily houses and blocks built < 1945 — **3.2 %** of the buildings in Spain

Multifamily dwellings in main Andalusian cities built < 1950 — **4.38 %** of the whole dwelling stocks

ORIGINAL USE

Commercial use (ground floors) and residential use (upper levels)

CONTEXT

Urban

ENERGY PERFORMANCE RANGES

U-values [W/m²*K]

Walls	0.76–2.75
Floor	1.07–2.60
Roof	1.73–5.00
Windows	3.92–5.47

Energy demand [kWh/m² year]

Heating demand:	Cooling Demand:
59–123	50–70

FuturHist

Learn more about this and other typologies at futurhist.eu

Co-funded by the European Union

UK Research and Innovation

Co-funded by the European Union and the UK Research and Innovation. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Webinar "From Case by Case to Scalable Solutions: Typology Approaches in Historical Building Renovation"

Part II: Towards replicable solutions for energy renovation of heritage buildings – a typology approach

Alessia Buda,
Politecnico di Milano

FUTURE-PROOFING HERITAGE TOWNHOUSES BY OPTIMISING COMFORT AND ENERGY IN TIME AND SPACE

HeriTACE

HeriTACE ambition is:

- To develop replicable renovation **strategies for selected townhouse typologies, using an archetype approach**
- To define a **replicable holistic assessment model for heritage townhouses** in historical neighbourhoods

FUTURE-PROOFING HERITAGE TOWNHOUSES BY OPTIMISING COMFORT AND ENERGY IN TIME AND SPACE

HeriTACE

HeriTACE ambition is:

- To develop replicable renovation **strate**
  for selected archetypes
- To define a **replicable holistic assessment model for heritage townhouses** in historical neighbourhoods

An archetype is a typical and often repeated principle of a building design with clear characteristics.

An archetype serves as a prototype for designing building with the same function.

ARCHETYPES ANALYSIS

The research is conducted simultaneously in **four countries: Belgium, Norway, Estonia, and Italy,** each with its distinct variations of this specific building type.
One representative **historic city** was chosen in each country, where archetypes and case studies were identified.

Archetypes analysis was made using:

- **extensive literature research** (both historical and recent)
- input from **heritage experts**
- inputs from **past research projects**

CASE STUDIES SELECTION

- **Small and medium-scale heritage buildings** in historical neighbourhoods/cities
- Used as **single- or multi-family dwellings**, and/or office – commercial spaces etc.
- **Predating 1945**











BELGIUM



NORWAY

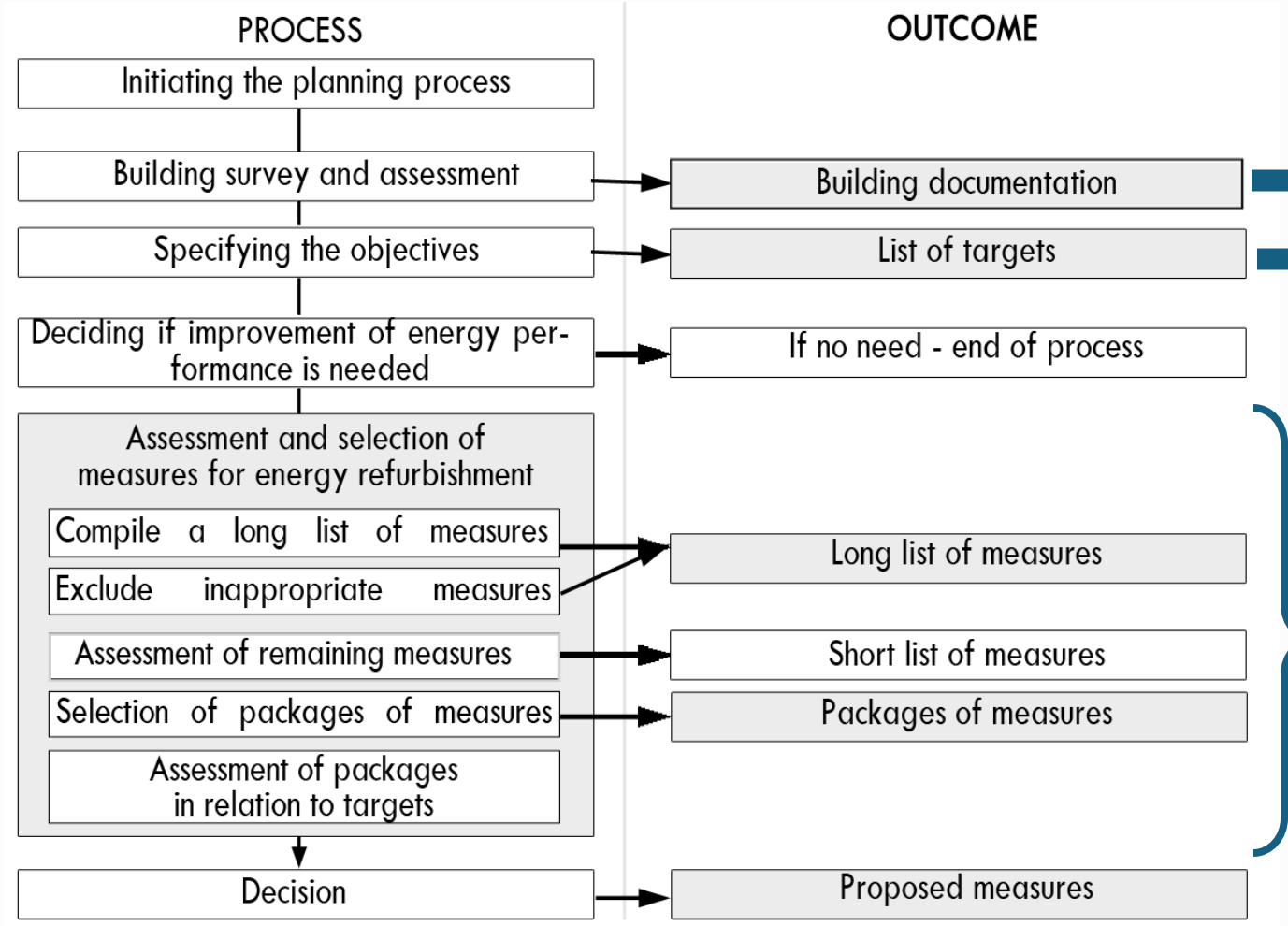



ITALY





ESTONIA



Integrating building and neighbourhood scales?

Definition of targets for assessment?

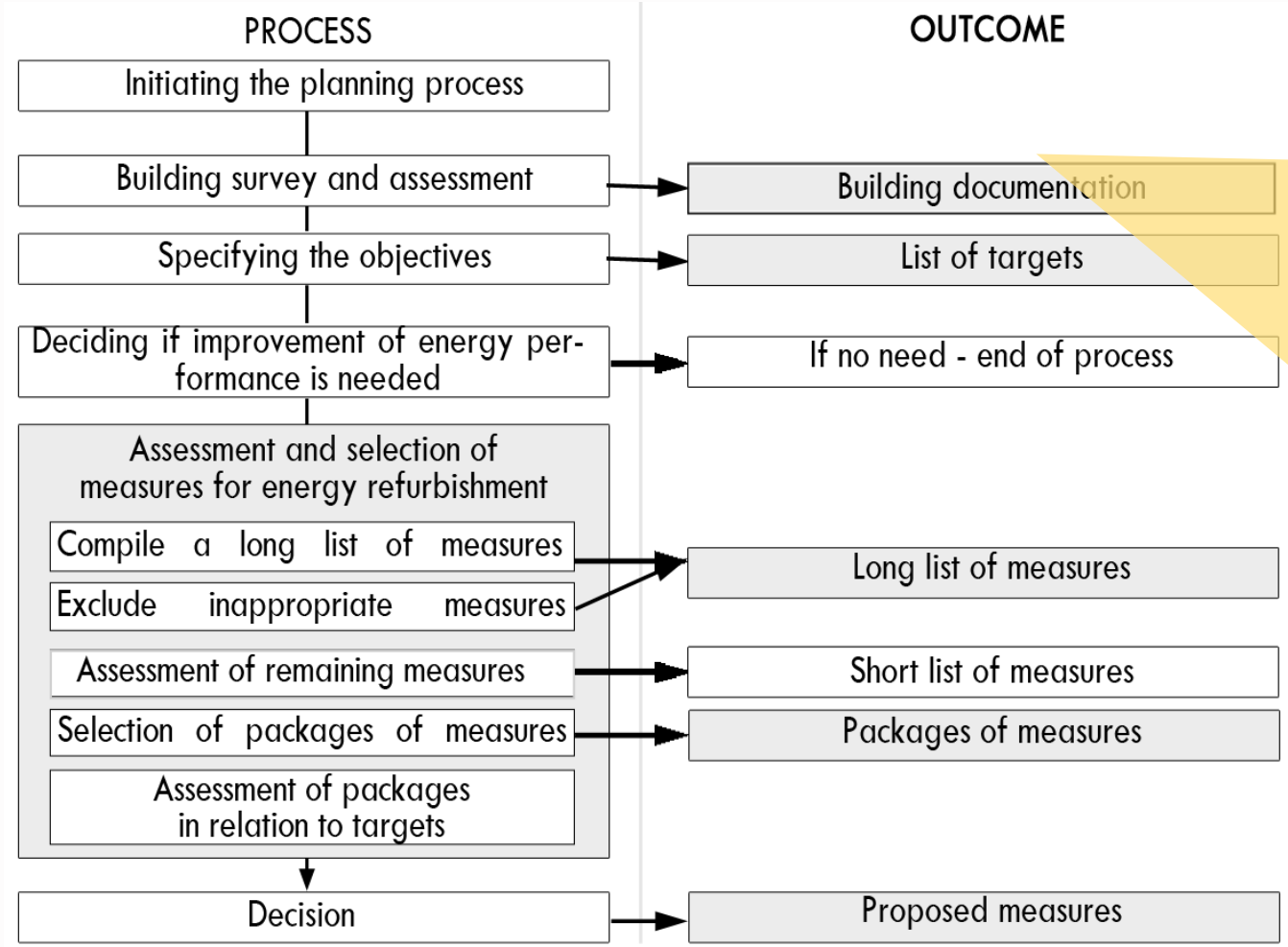
CRITICAL POINTS:

SELECTION OF PACKAGES OF MEASURES

DIFFICULTY TO CONSIDER THE MEASURES EFFECT AS A WHOLE

Optimal packages?
Time-consuming!?
Expert knowledge!?
Design cost?

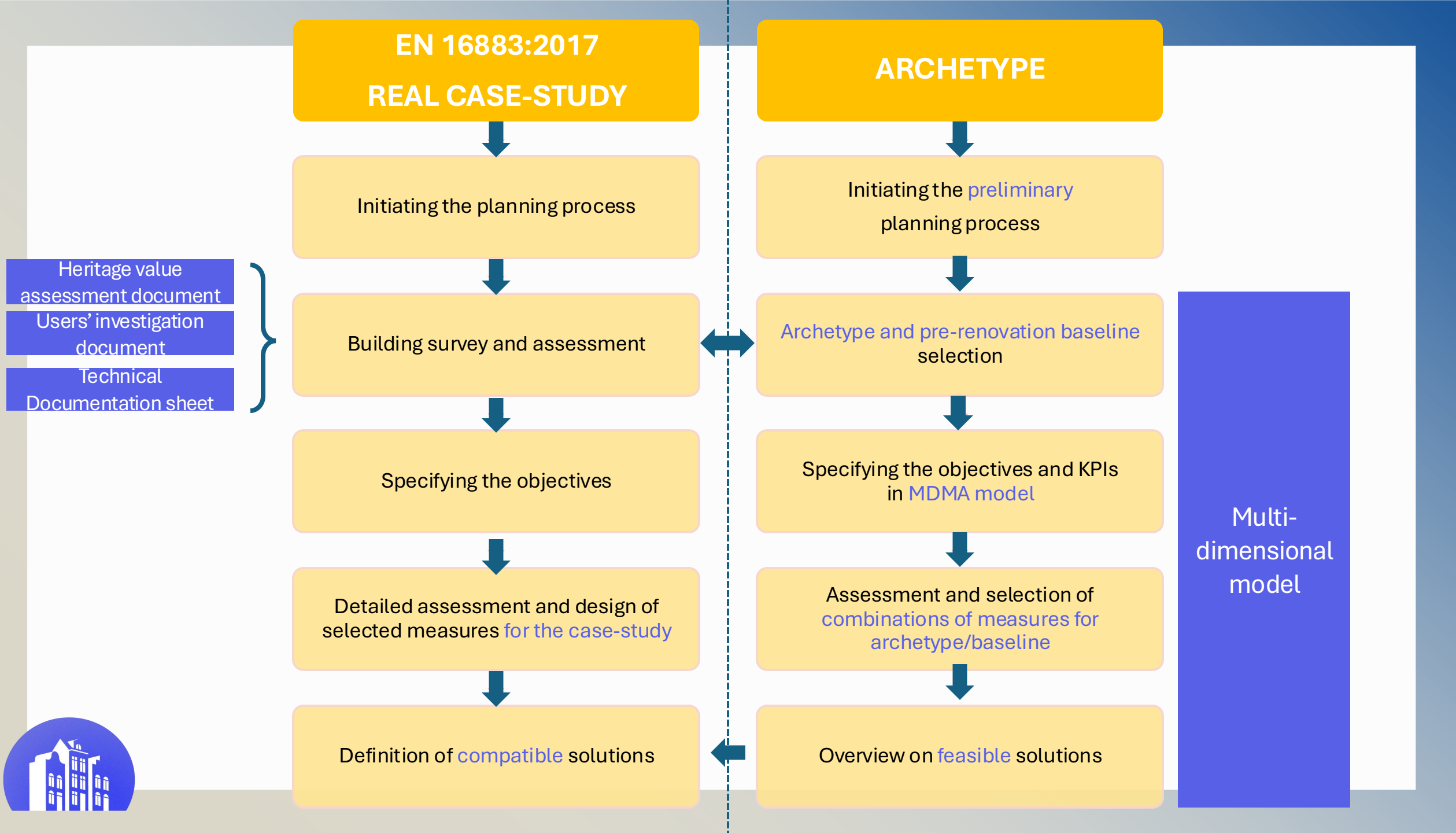
EN 16883 – GUIDELINES FOR IMPROVING THE ENERGY PERFORMANCE OF HISTORIC BUILDINGS

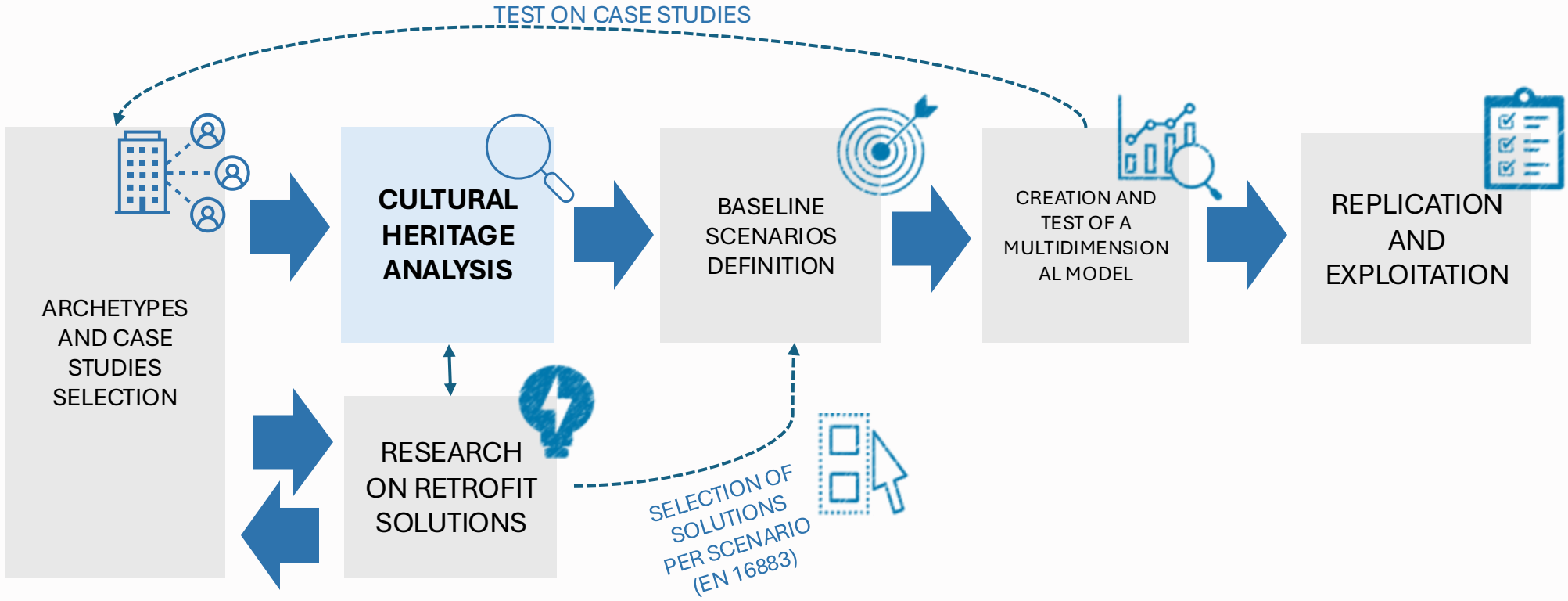


For ‘similar’ buildings, part of the same building typology,

Is it needed to repeat the entire process every time? for every case?

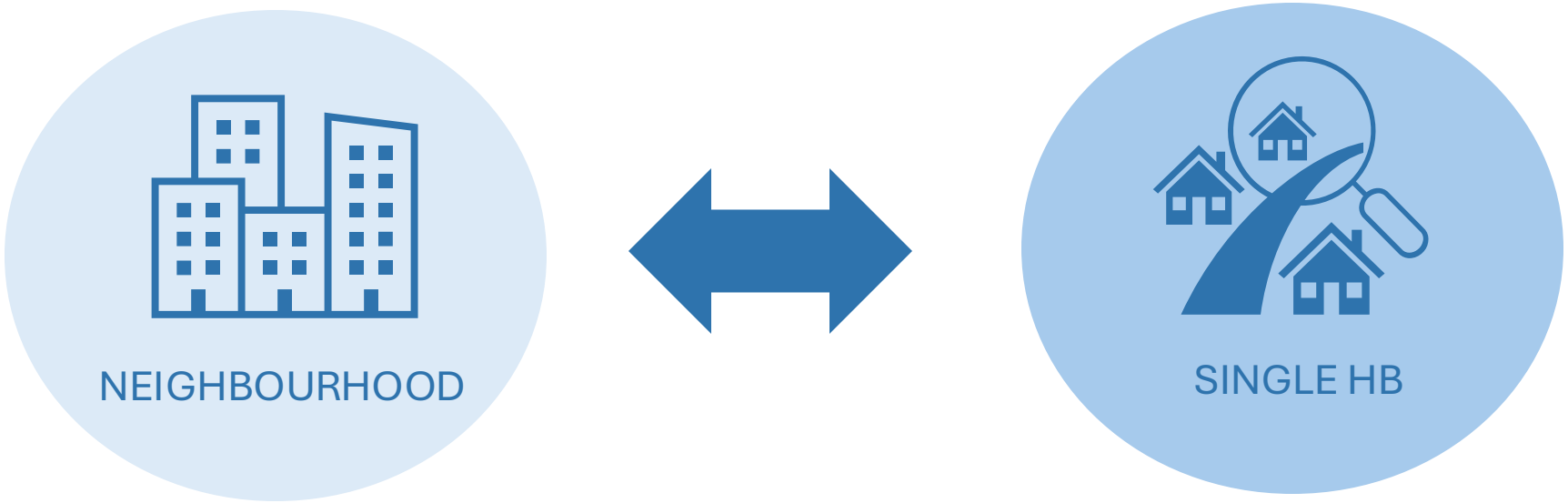
Can we make it faster
ànd have optimised packages
Ànd set holistic targets?


EN 16883:2017
REAL CASE-STUDY
ARCHETYPE
Initiating the planning process
Initiating the preliminary planning process
Heritage value assessment document
Users' investigation document
Technical Documentation sheet
Building survey and assessment
Archetype and pre-renovation baseline selection
Specifying the objectives
Specifying the objectives and KPIs in MDMA model
Detailed assessment and design of selected measures for the case-study
Assessment and selection of combinations of measures for archetype/baseline
Definition of compatible solutions
Overview on feasible solutions
Multi-dimensional model


TEST ON CASE STUDIES
ARCHETYPES AND CASE STUDIES SELECTION
CULTURAL HERITAGE ANALYSIS
BASELINE SCENARIOS DEFINITION
CREATION AND TEST OF A MULTIDIMENSIONAL MODEL
REPLICATION AND EXPLOITATION
RESEARCH ON RETROFIT SOLUTIONS
SELECTION OF SOLUTIONS PER SCENARIO (EN 16883)

CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

This process aims supporting **the heritage building significance investigation** through a more transparent and systematic **understanding of the multiple values** embedded within historic buildings and neighbourhoods



CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

Creating a **document/technical sheet for facilitating decisions** that balance conservation with performance enhancement

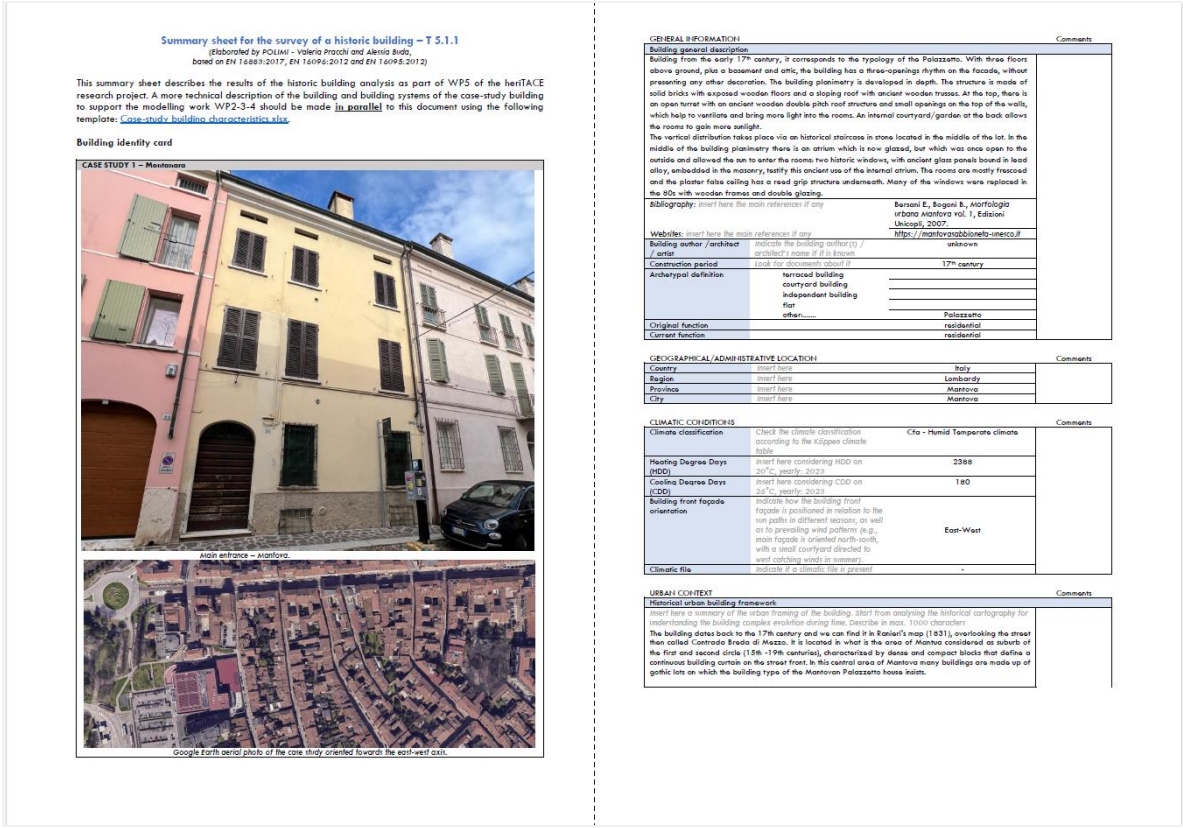
Discussing through **users' need survey** and protocol about the social acceptability of interventions

Implementing the holistic renovation approach **key performances**

CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

A DOCUMENT FOR SUPPORTING DECISION-MAKERS in compiling building knowledge data*

- **SEMPLICITY:** simple, shareable criteria of building analysis with examples for the compiler
- **FLEXIBILITY:** applicable across different contexts and countries, including at the neighbourhood scale



Summary sheet for the survey of a historic building – T 5.1.1

(Elaborated by POLIMI - Valeria Pracchi and Alessia Brida, based on EN 16883:2017, EN 16096:2012 and EN 16095:2012)

This summary sheet describes the results of the historic building analysis as part of WP5 of the heriTACE research project. A more technical description of the building and building systems of the case-study building to support the modelling work WP2-3-4 should be made in parallel to this document using the following template: Case-study building characteristics.xlsx.

Building identity card

CASE STUDY 1 – Montanara

Main entrance – Mantova.

Google Earth aerial photo of the case study oriented towardt the east-west axis.

GENERAL INFORMATION — Comments

Building general description		
Building from the early 17th century, it corrasponds to the typology of the Palazzetto. With three floors above ground, plus a basement and attic, the building has a three-openings rhythm on the facade, without presenting any other decoration. The building planimetry is developed in depth. The structure is made of solid bricks with exposed wooden floors and a sloping roof with ancient wooden trusses. At the top, there is an open turret with an ancient wooden double pitch roof structure and small openings on the top of the walls, which help to ventilate and bring more light into the rooms. An internal courtyard/garden at the back allows the rooms to gain more sunlight. The vertical distribution takes place via an historical staircase in stone located in the middle of the lot. In the middle of the building planimetry there is an atrium which is now glazed, but which was once open to the outside and allowed the sun to enter the rooms: two historic windows, with ancient glass panels bound in lead alloy, embeddded in the masonry, testify this ancient uss of the internal atrium. The rooms are mostly frescoed and the plaster false ceiling has a reed grip structure underneath. Many of the windows were replaced in the 80s with wooden frames and double glazing.		
Bibliography: insert here the main references if any		Bersani E., Bogoni B., *Morfologia urbana Mantova vol. 1*, Edizioni Unicopli, 2007.
Website: insert here the main references if any		https://mantovaabbionela-unesco.it
Building author / architect / artist	Indicate the building author(s) / architect's name if it is known	unknown
Construction period	Look for documents about it	17th century
Archetypal definition	terraced building	
	courtyard building	
	independent building	
	flat	
	other.....	Palazzetto
Original function		residential
Current function		residential

GEOGRAPHICAL/ADMINISTRATIVE LOCATION — Comments

Country	insert here	Italy
Region	insert here	Lombardy
Province	insert here	Mantova
City	insert here	Mantova

CLIMATIC CONDITIONS — Comments

Climate classification	Check the climate classification according to the Köppen climate table	Cfa - Humid Temperate climate
Heating Degree Days (HDD)	insert here considering HDD on 20°C, yearly: 2023	2388
Cooling Degree Days (CDD)	insert here considering CDD on 26°C, yearly: 2023	180
Building front façade orientation	Indicate how the building front façade is positioned in relation to the sun paths in different seasons, as well as to prevailing wind patterns (e.g., main façade is oriented north-south, with a small courtyard directed to west catching winds in summer).	East-West
Climatic file	Indicate if a climatic file is present	-

URBAN CONTEXT — Comments

Historical urban building framework
Insert here a summary of the urban framing of the building. Start from analysing the historical cartography for understanding the building complex evolution during time. Describe in max. 1000 characters
The building dates back to the 17th century and we can find it in Ranieri's map (1831), overlooking the street then called Contrada Broda di Mezzo. It is located in what is the area of Mantua considered as suburb of the first and second circle (15th -19th centuries), characterized by dense and compact blocks that define a continuous building curtain on the street front. In this central area of Mantova many buildings are made up of gothic lots on which the building type of the Mantovan Palazzetto house insists.

*Developed by PoliMI, based on EN 16883:2017, EN 16096:2012 and EN 16095:2012

CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

CASE STUDY – MONTANARA, Mantova (Italy

Building Identity Card

General information

- Construction period
- Archetype
- Architectural configuration
- Original Function
- Actual function

- Building from the early 17th century
- Palazzetto typology (building planimetry is developed in depth and three-openings rhythm on the façade)
- three floors above ground, plus a basement and attic
- Original and actual use is Residential building

Urban context

- It is located in what is the area of Mantua considered as suburb of the first and second circle (15th -19th centuries)
- The area is characterized by dense and compact blocks that define a continuous curtain on the street front

Geographical / administrative location

- Mantova, Italy

Climatic conditions

- Cfa - Humid Temperate climate (HDD 2388, CDD 180)

Ownership and existence of protection constraints

- Private property
- Single owner
- UNESCO protection area; PGT Areas with very high landscape sensitivity

Only interventions within the **limit of building renovation** are allowed, and, if necessary, verifying the landscape and the **sensitivity of the intervention on the surroundings**

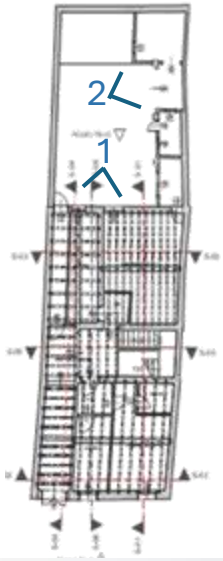
CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

CASE STUDY – MONTANARA, Mantova (Italy)

Building Identity Card

Architectural Characteristics

- Number of floors
- Presence of attic/basement
- Gross heated area / Unheated area
- External area of relevance

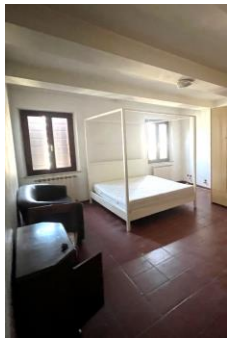


1

2

CONTEXT

INTERIORS



CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

CASE STUDY – MONTANARA, Mantova (Italy)

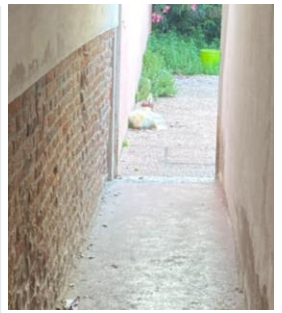
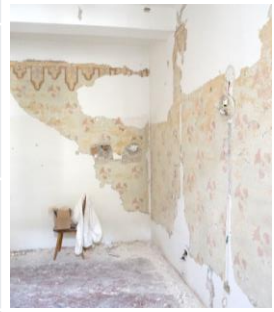
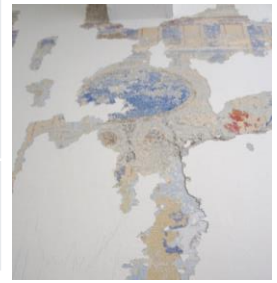
Building Identity Card

Building Elements

- Construction elements
- Roof
- Floor
- **Wall**
- Windows and doors
- Interiors

FOR EACH:

- Element typologies description
- State of conservation
- Valuable elements

	INSTRUCTIONS FOR THE COMPILER WITH EXAMPLES		
Wall typologies	• Describe the main wall typologies *(e.g., mixed stonewalls of the 15th century; brickwork from the 1920s, etc.)* • Describe each wall type as much as possible, including information on the layers of the wall components (from outside to inside) and the period of construction. *(e.g. WALL01 - mixed rubble stone of XVII cent., thickness 60 cm, layers: cement plaster outside (XX cent.) (around 2,5 cm), rubble stone with mortar cement (around 45-48 cm), gypsum plaster inside (XIX cent.) (variable)* • Annotate on plans with a code all different wall types *(e.g. WALL01, etc.)*	Brickwork from 17th century with small integrations in the upper levels.	
State of conservation	• Describe if different wall typologies present decay problems *(e.g., rising damp at the foot of the wall, etc.)*. Indicates whether any parts have been changed/replaced over time and in what period. • Add if there has been any retrofit of this element already	The façade located on the internal courtyard has numerous points of humidity especially in the uncovered passage of the portico.	
Finishing	Describe the internal and external wall finishing and their state of conservation *(e.g., 1950s cement mortar plaster in good condition; no external plaster, but internal Venetian stucco plaster from the 15th century; cladding panels in very poor condition)*	The different finishing layers show the presence of different historical stratifications.	
Valuable / authentic elements	Describe briefly and in general external valuable elements on the façades *(e.g., friezes, frescoes, frames, balconies, etc.)*	The main façade has a recently made plaster, the base of which has been covered with a cement mortar. The façade at the back is instead covered with a light lime-based plaster.	
	Describe briefly and in general the presence of internal decorative elements on the walls *(e.g., tapestries, mouldings, stucco decorations, wall frames, skirting boards, painted motif decorations, etc.)*	Under the recent plaster there are frescoes dating back to the late 19th century.	

CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

CASE STUDY – MONTANARA, Mantova (Italy)

Building Identity Card

Technical Installations

- Heating and cooling system
- Ventilation system
- Other information (DWW, RES, passive systems, other)

FOR EACH:

- Brief description
- Main features
- Distribution and control system
- State of use

- Technical equipment is not functioning. However, previously the building was divided into 6 apartments; in each of them there was a gas boiler used both for DHW and for heating and the terminals were radiators. No ventilation system
- Distribution along walls and in the ceiling
- Unclimatized rooms: staircases; attic; cellar
- Six electric POD (bills archive for one year)
- A **ventilation tower** was in use in the 17th-18th centuries. Then, it was closed

SUMMARY OF THE BUILDING AND INSTALLATIONS STATE OF CONSERVATION

detected building pathologies and their possible causes

+

state of conservation of the existing technical installations (including passive systems)

description useful to resume the needs for intervention

Building Value Assessment section

LISTED BUILDING / PRESENT LOCAL BINDING RESTRICTIONS

Compile the value assessment part to recognise the additional presence of values

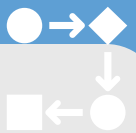
Consult your local conservation authority to clarify what are the elements that led to the recognition of a legal constraint

Proceed through a detailed knowledge of the building peculiarities, including those not listed

NOT LISTED BUILDING / DO NOT PRESENT BINDING RESTRICTIONS

Compile the value assessment part to recognise the presence of values

Consult your local conservation authority's opinion



Proceed through a detailed knowledge of the building transformation process to the present

CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

CASE STUDY – MONTANARA, Mantova (Italy)

Building Value Assessment

Historical values *e.g. place of key events; presence of notable figures; role in the local history; period of significance, etc.*	• It belongs to **the 17th century** • It has documentary evidence through **historic maps** (i.e. Ranieri's map)	**Social values** *e.g. community use, social function, linked to collective memory, etc.*	/	**Scientific values** *e.g. presence of passive building systems, innovative historic technical installations, etc.*	• The presence of a **wind tower** and a double courtyard (internal and external) allowed for improved **passive ventilation and lighting** within the lot
Cultural values *e.g. role in local/national culture concerning also the context; symbolic meaning, connection with intangible heritage, etc.*	• It is part of the Mantova historic centre second circle area and **UNESCO protected part**	**Aesthetic values** *e.g. presence of key define features; visual relationships with surroundings; artistic significance, etc.*	• It is part of the seventeenth-century **neighbourhood curtain** of the historic centre of Mantua with historic windows • Inside there are numerous relevant elements**: frescoes** of different dates, reed ceilings with **stuccoes** from the late '800	**Architectural values** *e.g. particular structural elements, external/internal local typical elements of a specific constructive period, etc.*	• Inside the building we find **a 17th century walled window** that demonstrates the ancient use of the wind tower. • Great importance is given to the **false ceiling system with hand-woven canes** that cover the ancient wooden floor

CULTURAL HERITAGE ANALYSIS AND VALUE ASSESSMENT OF BUILDINGS AND NEIGHBOURHOODS

CASE STUDY – MONTANARA, Mantova (Italy)

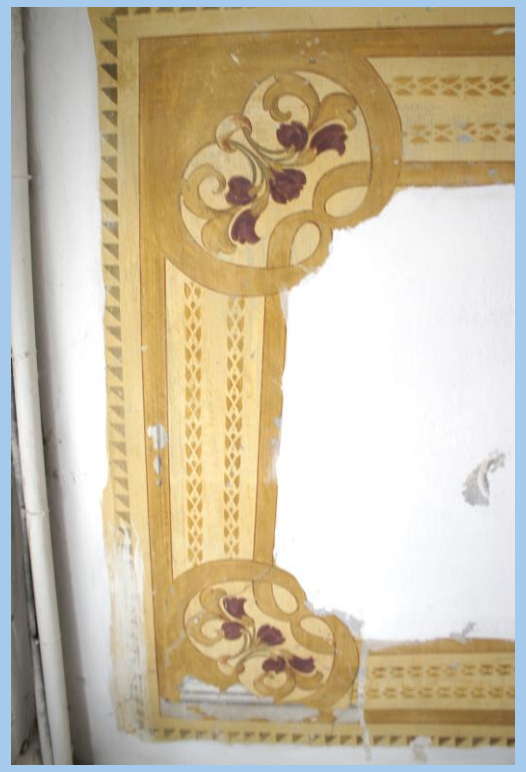
Building Value Assessment

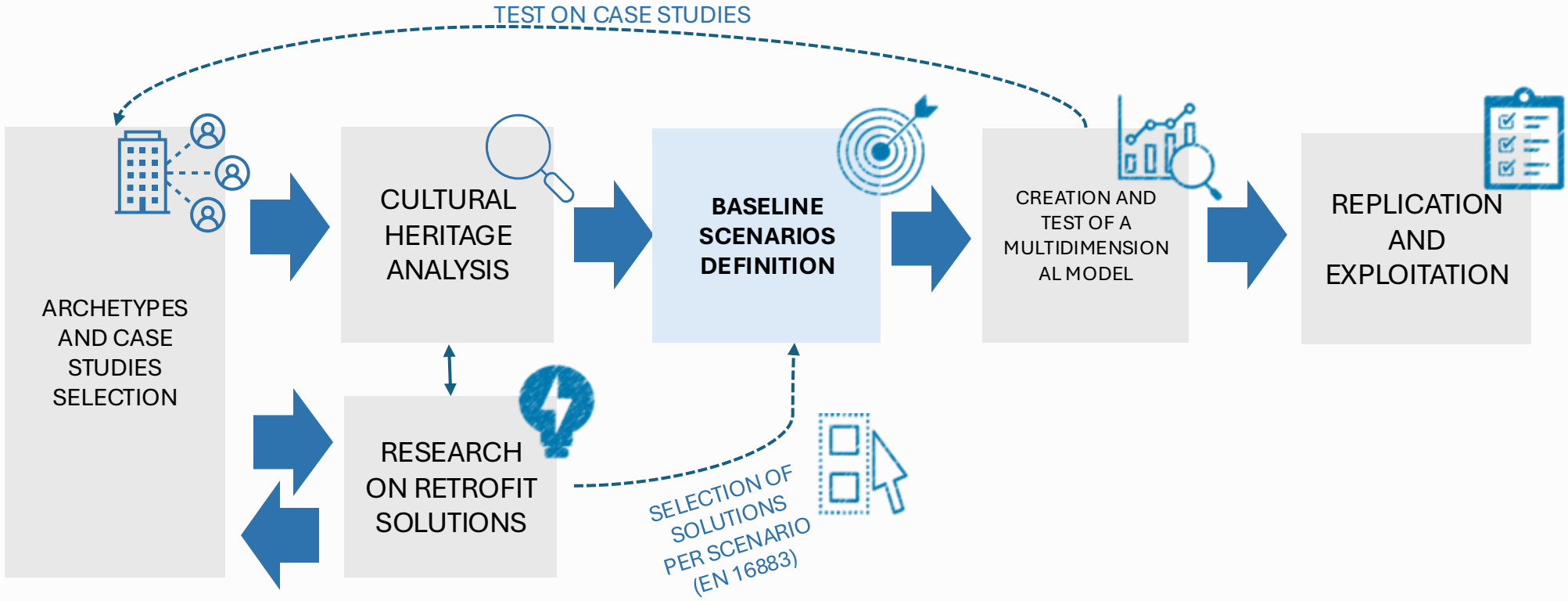
Authenticity / Integrity

THIS PART MAY SUPPORT TO UNDERSTAND:

- if the building/ part of it has been subject of **global or punctual restorations / interventions** (e.g., extension/additions, substitutions, etc.)
- if present **modifications and alterations are compatible** respect to the historic construction

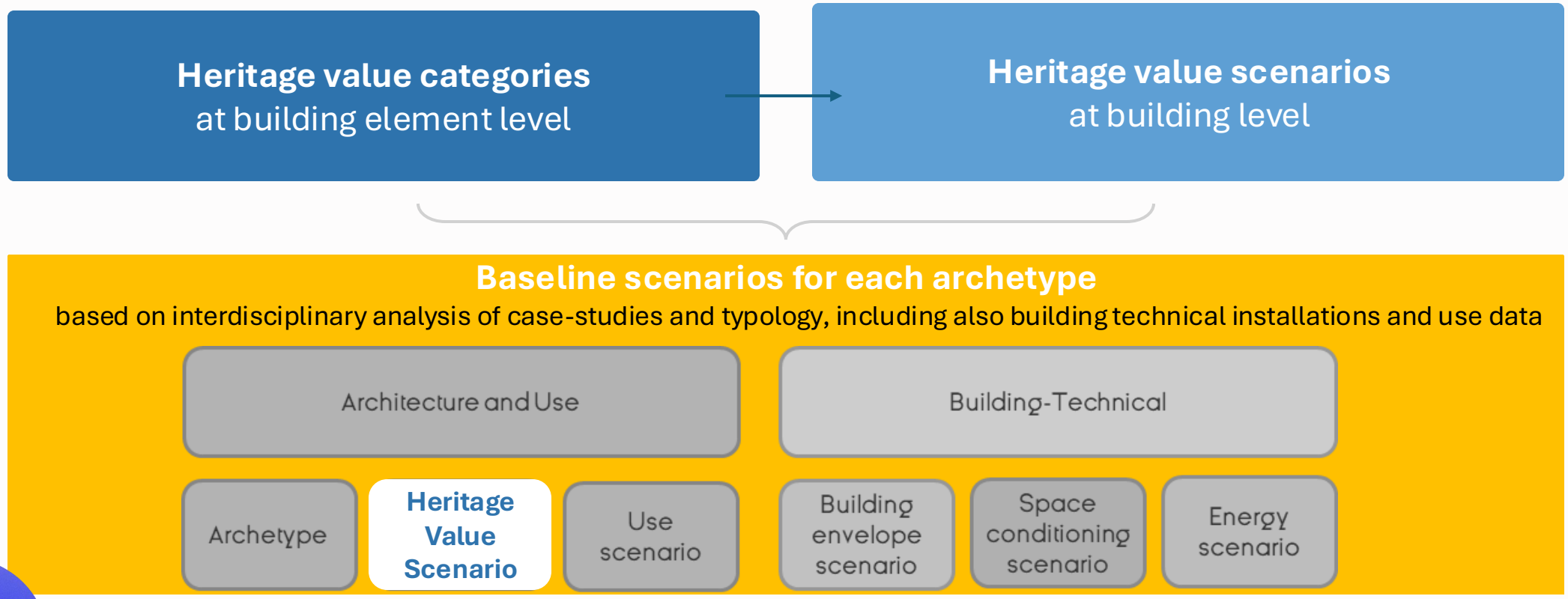
The term **authenticity/integrity** here is intended to indicate the preservation of building peculiarities that do not necessarily allude to perfect conservation. It means more specifically the ability to carry over time the significant characteristics of a site.




TEST ON CASE STUDIES
ARCHETYPES AND CASE STUDIES SELECTION
CULTURAL HERITAGE ANALYSIS
BASELINE SCENARIOS DEFINITION
CREATION AND TEST OF A MULTIDIMENSIONAL MODEL
REPLICATION AND EXPLOITATION
RESEARCH ON RETROFIT SOLUTIONS
SELECTION OF SOLUTIONS PER SCENARIO (EN 16883)

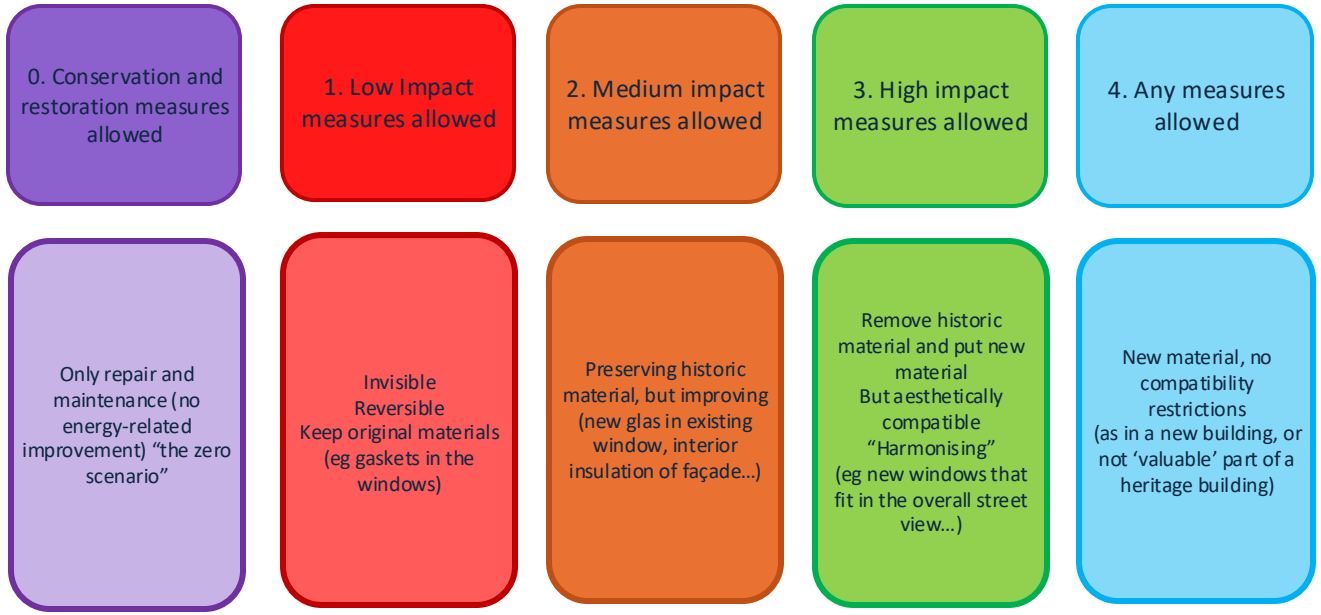
How to deal with the variation in heritage value?

- Archetypes are mainly about typology, geometry, lay-out…
- Within a typology, some buildings and some building elements are more / otherwise valuable than others
  - What means ‘heritage value’?

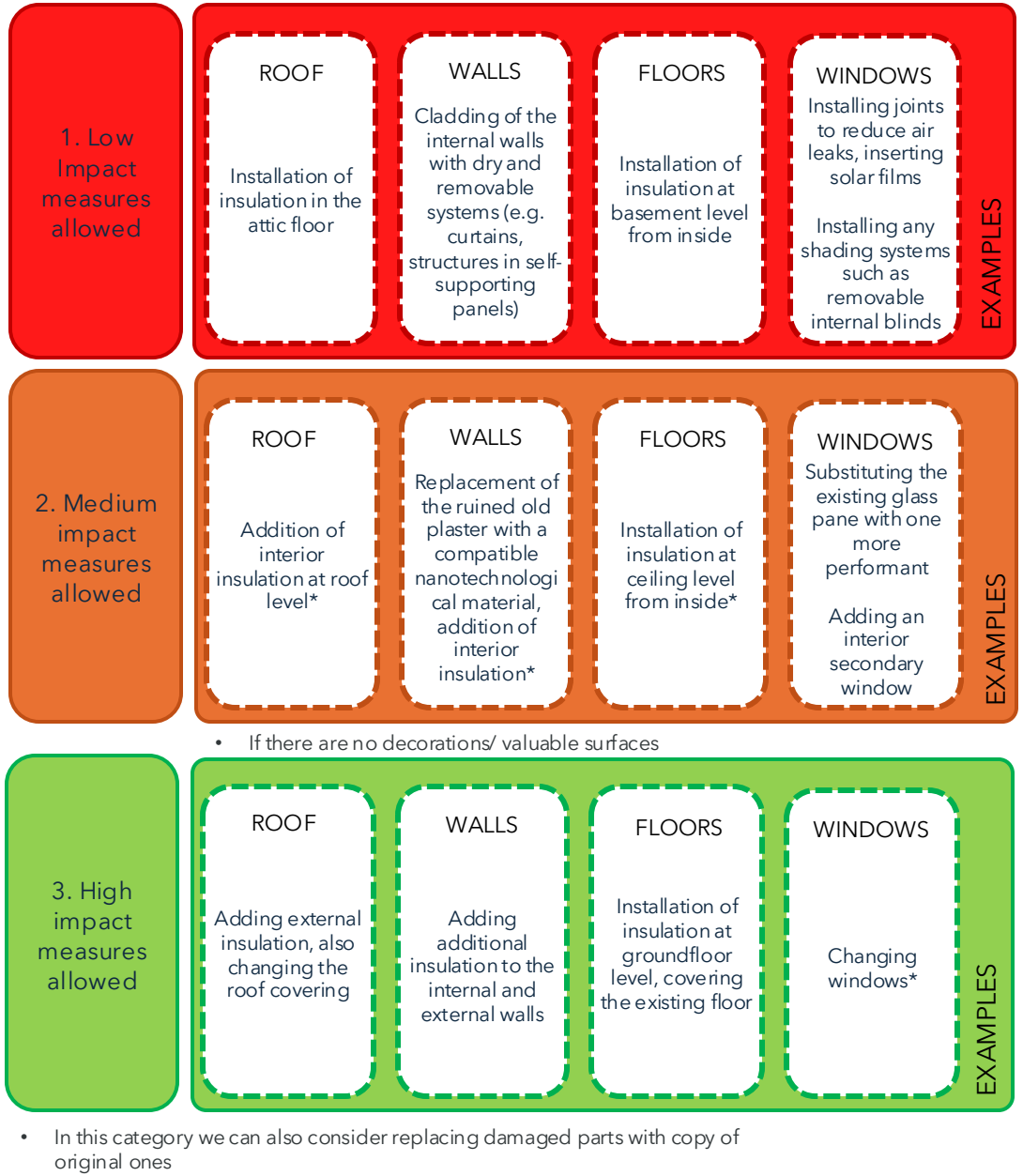


HERITAGE VALUE CATEGORIES

The baseline scenarios define the **situation of the heritage building as a starting point** for the HeriTACE renovation approach and are a reference situation for assessing the performance indicators.



HERITAGE VALUE CATEGORIES



- If there are no decorations/ valuable surfaces

- In this category we can also consider replacing damaged parts with copy of original ones

HERITAGE VALUE SCENARIOS

0. Conservation and restoration measures allowed

1. Low Impact measures allowed

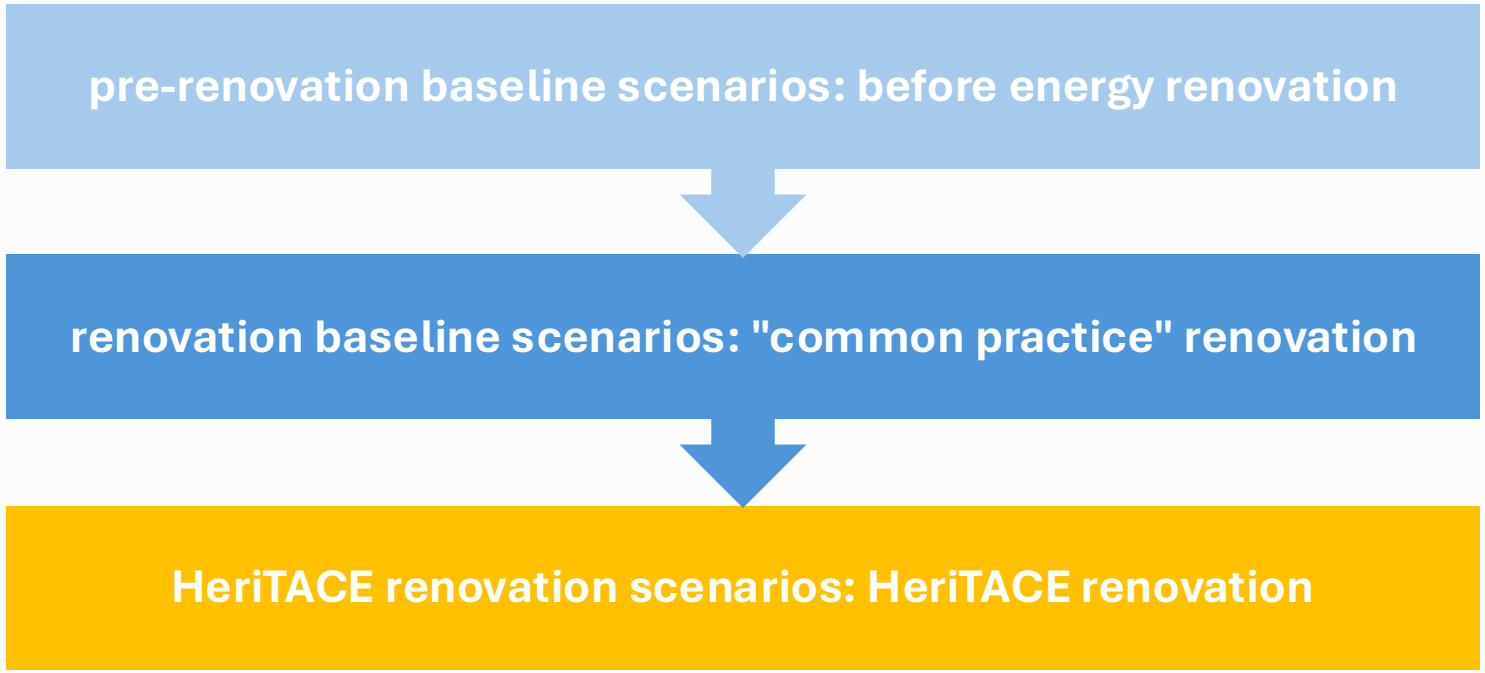
2. Medium impact measures allowed

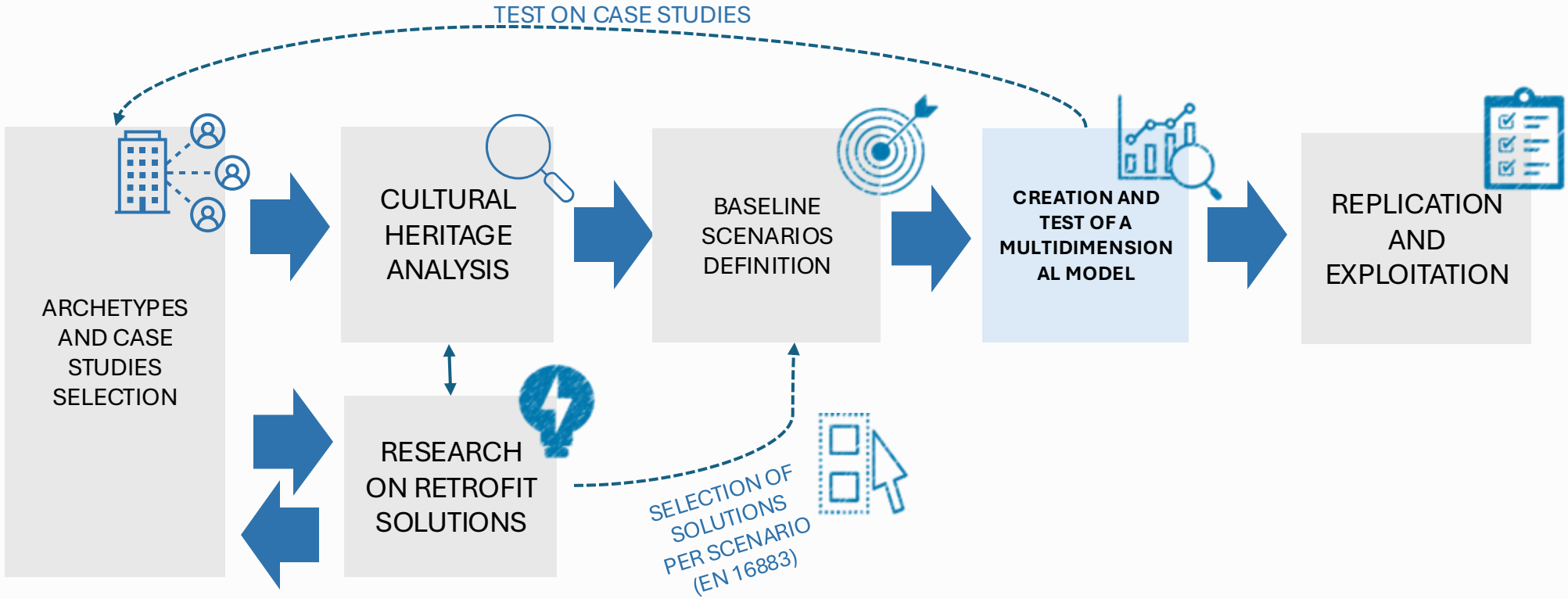
3. High impact measures allowed

4. Any measures allowed

Baseline scenarios

Based on interdisciplinary analysis of case-studies and typology, including also building technical installations and use data




TEST ON CASE STUDIES
ARCHETYPES AND CASE STUDIES SELECTION
CULTURAL HERITAGE ANALYSIS
BASELINE SCENARIOS DEFINITION
CREATION AND TEST OF A MULTIDIMENSIONAL MODEL
REPLICATION AND EXPLOITATION
RESEARCH ON RETROFIT SOLUTIONS
SELECTION OF SOLUTIONS PER SCENARIO (EN 16883)

Would this approach be useful to your profession?

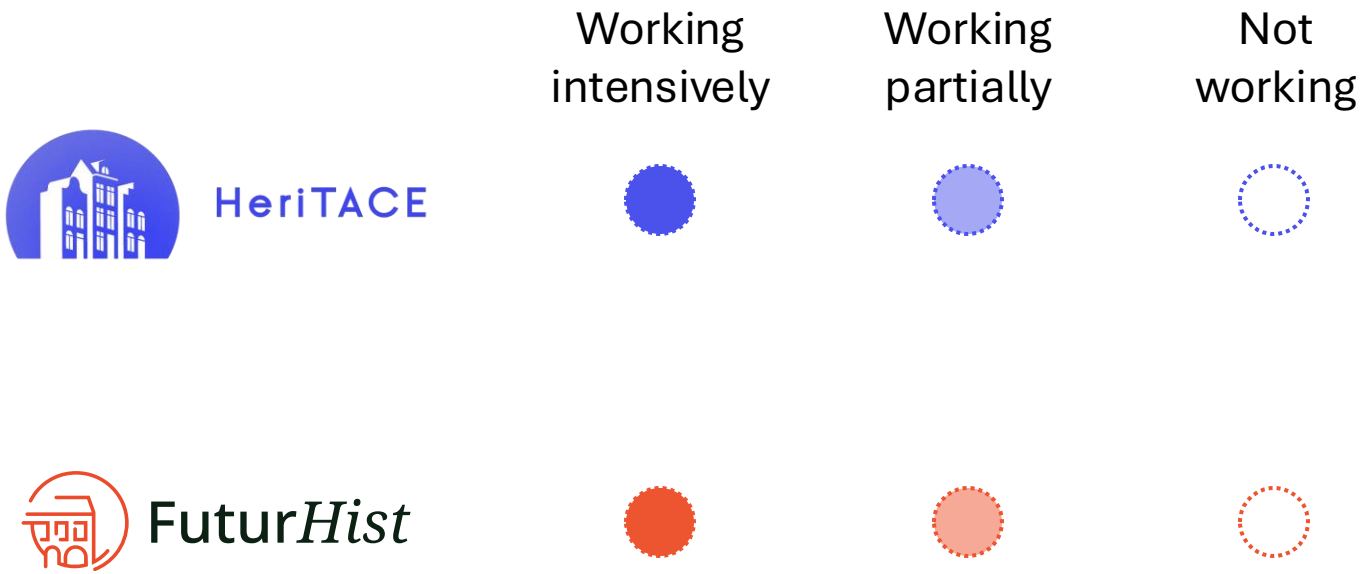
Are you familiar with the EU standards and how to apply them?

Webinar "From Case by Case to Scalable Solutions: Typology Approaches in Historical Building Renovation"

Part III: Overview of innovative solutions for energy renovation of heritage buildings

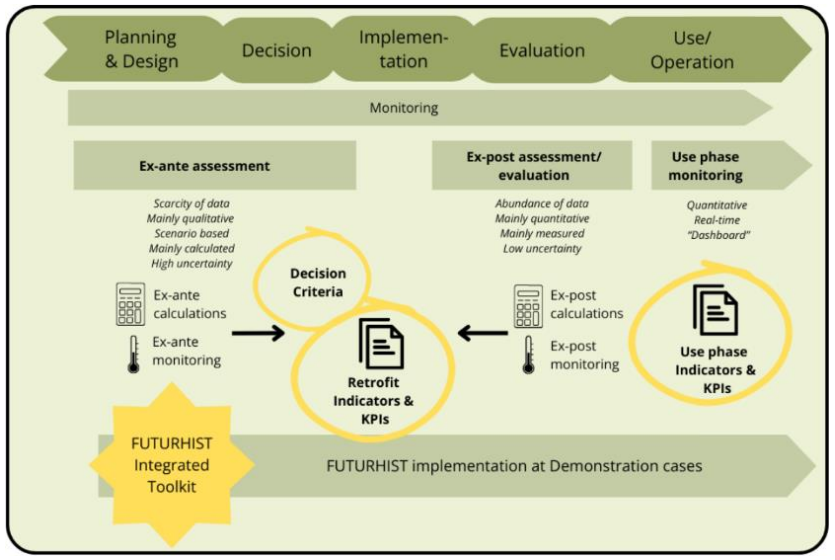
Eline Himpe, UGent & Daniel Herrera, EURAC Research

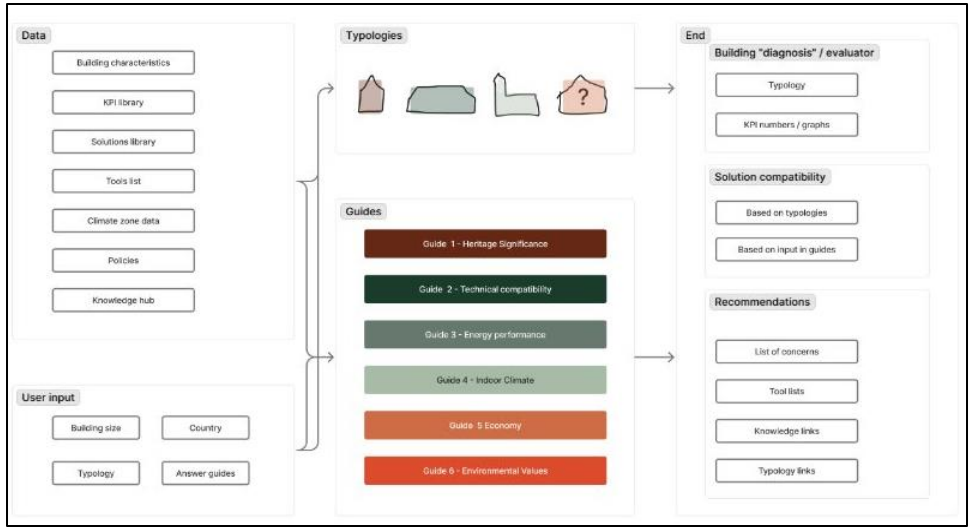
Overview of innovative solutions



Development of an integrated planning **toolkit**

Objective: To develop a **methodology** that based on input data from the user can identify an **optimised package of solutions** for **deep renovation** of historic buildings





#EURegionsWeek

Example elements of the toolkit

- Longlists / shortlists

Building element

"Long" lists of solutions

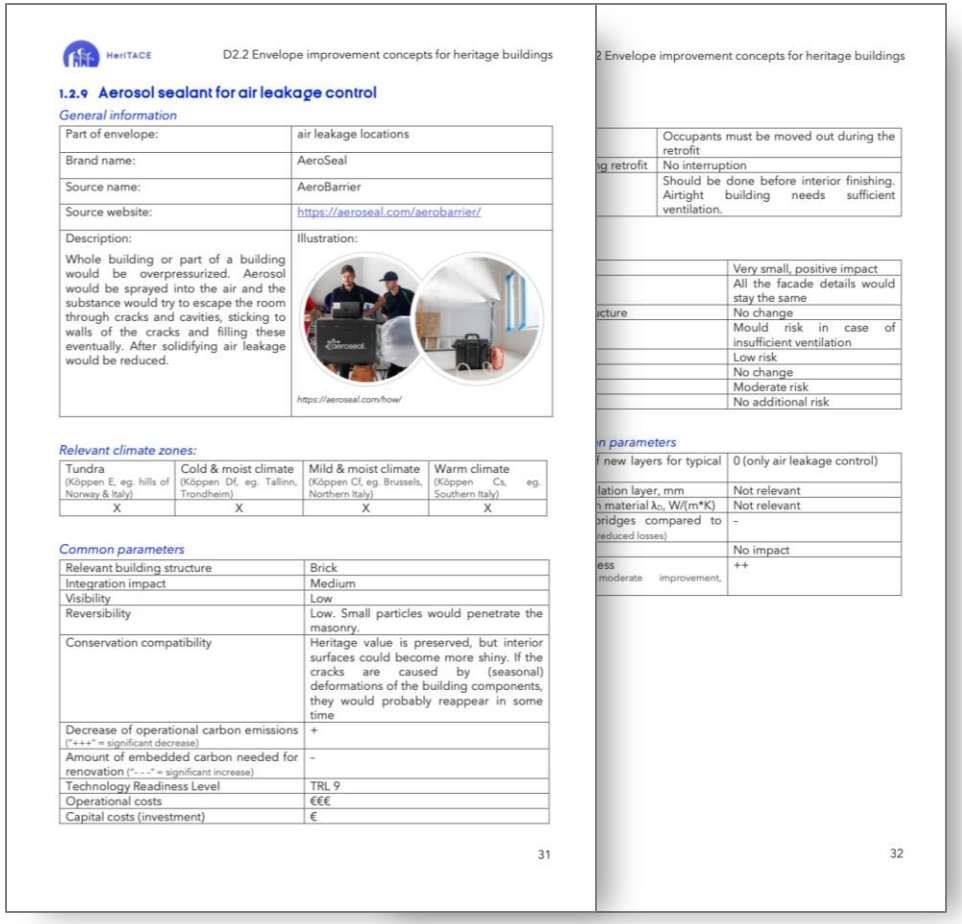
Wall

Roof

Windows

Basement

Solution	KPI1	KPI2	...
1			
2			
3			
4			
5			
6			
...			



HeriTACE D2.2 Envelope improvement concepts for heritage buildings

1.2.9 Aerosol sealant for air leakage control

General information

Part of envelope:	air leakage locations
Brand name:	AeroSeal
Source name:	AeroBarrier
Source website:	https://aeroseal.com/aerobarrier/
Description: Whole building or part of a building would be overpressurized. Aerosol would be sprayed into the air and the substance would try to escape the room through cracks and cavities, sticking to walls of the cracks and filling these eventually. After solidifying air leakage would be reduced.	Illustration: https://aeroseal.com/how/

Relevant climate zones:

Tundra (Köppen E, eg. hills of Norway & Italy)	Cold & moist climate (Köppen Df, eg. Tallinn, Trondheim)	Mild & moist climate (Köppen Cf, eg. Brussels, Northern Italy)	Warm climate (Köppen Cs, eg. Southern Italy)
X	X	X	X

Common parameters

Relevant building structure	Brick
Integration impact	Medium
Visibility	Low
Reversibility	Low. Small particles would penetrate the masonry.
Conservation compatibility	Heritage value is preserved, but interior surfaces could become more shiny. If the cracks are caused by (seasonal) deformations of the building components, they would probably reappear in some time
Decrease of operational carbon emissions ("+++" = significant decrease)	+
Amount of embedded carbon needed for renovation ("- - -" = significant increase)	-
Technology Readiness Level	TRL 9
Operational costs	€€€
Capital costs (investment)	€

31

2 Envelope improvement concepts for heritage buildings

g retrofit	Occupants must be moved out during the retrofit
	No interruption
	Should be done before interior finishing. Airtight building needs sufficient ventilation.
	Very small, positive impact
	All the facade details would stay the same
icture	No change
	Mould risk in case of insufficient ventilation
	Low risk
	No change
	Moderate risk
	No additional risk

n parameters

f new layers for typical	0 (only air leakage control)
lation layer, mm	Not relevant
material λ_D, W/(m*K)	Not relevant
ridges compared to reduced losses)	-
	No impact
ess moderate improvement,	++

32

D2.1 / Conservation compatible passive retrofit solutions

Table 38. Solution IWI-15: Hemp+lime insulation.

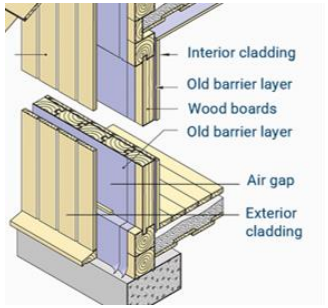
Type	Nr	Parameter	Parameter Assessment
General Information	1	Solution name	*Hemp+lime insulation*
	2	Category	*Biobased*
	3	Example of application	• Rebecca Farm • Réhabilitation Ecuries de Versailles - Aile de Sceaux • Timber-framed house in Alsace, France • Article 1 • Article 2
	4	Possible supplier	• dade design GmbH • Hempblock • Hempitecture • Schönthaler • UK Hempcrete
Technical Specifications	5	Composition (from inside to outside)	• Internal finish • Hemp blocks & bricks OR hempcrete (lime-hemp concrete)
	6	System thickness	*adaptable*
	7	Av. thermal conductivity	*0.08-0.1 W/mK*
	8	Thermal conductivity of ins. layer	*0.053-0.07 W/mK*
	9	Fire protection class	• *AI* • *B-s1,d0*
	10	System type	*vapour open (capillary active)*
	11	Capillary active	*yes (moderately)*
Sustainability and Lifecycle	12	Based on natural materials	*yes*
	13	Embodied energy	*< 25 MJ/kg*
	14	Average lifetime	*100 years*
	15	Recyclability	*yes, can be chopped up and recast into hemp bricks / hemp stones*
	16	Prefabricated solution	*no*
	17	Reversible system	*depends on installation*
	18	Installation	*Available as prefabricated blocks or mixed and formed on-site in temporary forms. Hempcrete is applied directly to the wall, suitable for uneven surfaces.*
	19	Cost	*Medium (€€)*

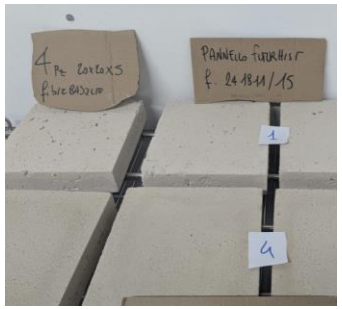
FuturHist 91

#EURegionsWeek

Building envelope: interior insulation

- Insulation of historical wooden façades in changing Nordic climates
- Prefabricated lime-based insulating panels
- Biochar as construction material with insulating and moisture regulating properties

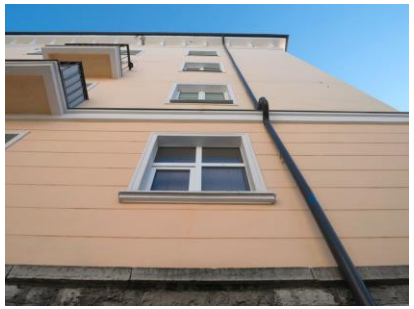


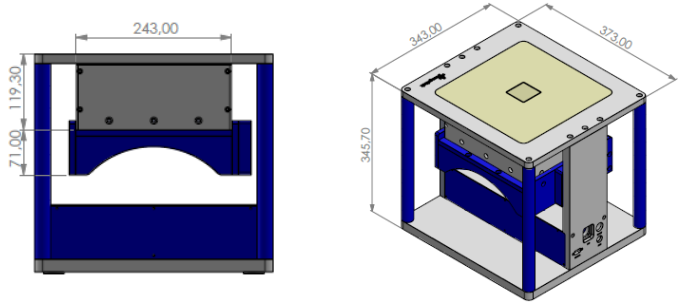


#EURegionsWeek

Building envelope: exterior insulation

- External Thermal Insulation Composite Systems (ETICS) with historical plasters
- Self-healing lime-based renders for improved durability
- Portable NMR for non-destructive onsite testing of moisture absorption of facades





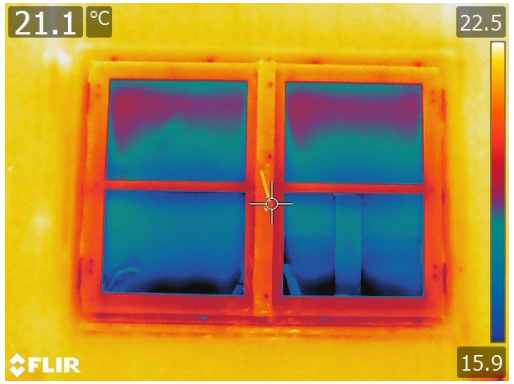
#EURegionsWeek

Building envelope : windows

- Measuring and improving the air tightness of historical windows
- Measuring and improving the energy performance of historic
  - Double (box-type) windows
  - Sash and case windows
  - Wooden balcony doors
- Improving summer performance of historic windows in northern countries



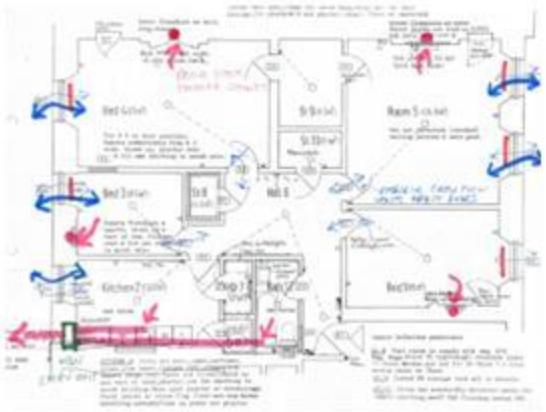


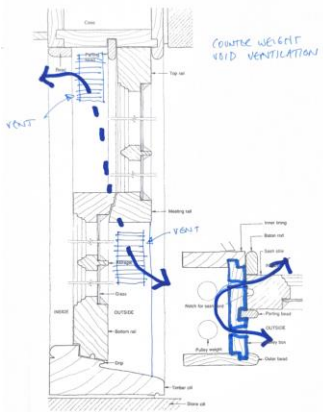



#EURegionsWeek

Ventilation solutions

- Integration of ventilation concepts in heritage buildings
- Performance-based ventilation concepts, incl. demand-control
- Balancing ventilation and insulation strategies to avoid moisture risks and mould growth





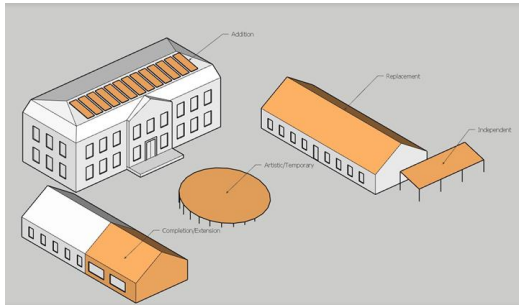
#EURegionsWeek

Heating and cooling solutions

- Ventilative cooling potential assessment tool
- Transformation of existing heating systems to low-temperature heating,
  - by reuse of existing radiators,
  - integration in hybrid systems
  - or complement with local comfort solutions
- System design and control
  - Optimising energy use and comfort exactly where and when people need it (in Time and space)

Energy and storage system solutions

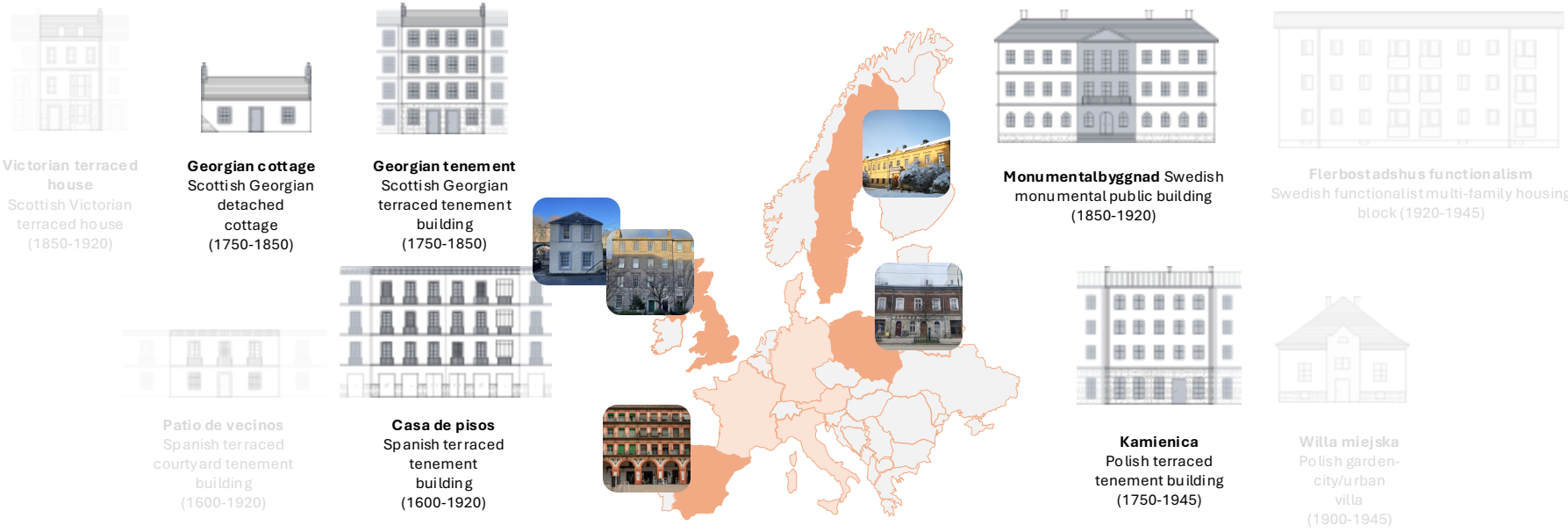
- Integration of renewable energy systems
  - Heat pumps in multi-tenement historic buildings
- Building Integrated PhotoVoltaics
  - BIPV modules that integrate aesthetically
  - Guidelines for users and designers
- Unharvested heat sources in historic cities
  - Large Attics, parking garages, thermal storage
- Small-scale 5th generation district heating
  - Optimal design and control



#EURegionsWeek

Building integration and **demonstration**

- Case-study buildings
  - Tailoring → Demonstration → Replication



#EURegionsWeek

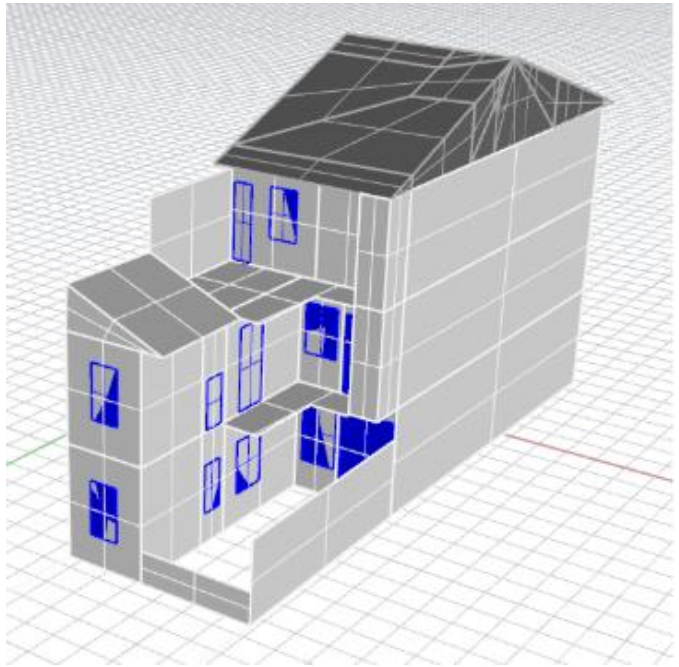
Building integration and **simulation**

Building simulation

- Energy, comfort, indoor air quality
- Heat and moisture transport

Used for…

- Research and development of solutions
- Performance assessment
- Simplified simulation methods: Accuracy vs Usability – Can simplified approaches provide useful information?
- Detailed simulations of variety of scenarios: database of pre-simulated renovation packages



Building integration and **optimisation**

- Optimal combination of building envelope and HVAC solutions for heritage building types
  - Accounting for holistic set of performance criteria
  - Design and control accounting for the dynamics of buildings, their use, energy sources
  - For example:
    - Optimising passive solutions providing summer comfort and moisture regulation
    - Optimising insulation and ventilation solutions to reduce moisture risks and increase energy efficiency
    - …
- Optimising the integration of buildings, renewable and residual energy sources in historical neighbourhoods
  - Design and control of 5th generation district heating

Which topics are of interest to you for future webinars?
(1/2)

- More detailed technical information would be useful! For example how do you impose thermal insulation or ventilation, etc.
- Sistematization of mid-XX century building strategies of intervention for the conversion into residential buildings.
- To what extent can the process of designing interventions be simplified?
- Ventilation and thermal insulation in histroric buildings
- Results of the retrofit, lessons learned in implementing the retrofits
- Using another interventions with no ETICS
- More specific case studies
- intervention solutions
- Typology
- In/situ monitoring processes and enstruments
- About LCA?
- Special Solutions of Energy Savings Interventions on Listed Buildings
- Practical: how do you involve the users of those heritace projects?

Which topics are of interest to you for future webinars?
(2/2)

- More about buildings involved
- Comparison of regulations between European countries
- Go deeper in the definition of the building typologies
- Building performance
- Simulation softwares

Thank you!

Follow us to stay informed

- HeriTACE: subscribe to newsletter, LinkedIn and YouTube

HeriTACE www.heritace.eu

- FuturHist: subscribe to newsletter and LinkedIn (Summer school in 2026!)

FuturHist www.futurhist.eu

#EURegionsWeek