SUSTAINABLE PLACES 2024

23-25 September 2024

Luxembourg

Sustainable Construction & Renovation

WORKSHOP

Sustainable and resource-efficient solutions for cultural heritage

HeriTACE

CALECHE

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Inherit

www.sustainableplaces.eu

AGENDA

1) Etienne Wurtz (CEA, project coordinator), CALECHE project: "*General introduction and context" (10 min)*

2) Rachel Desmaris (R2M) CALECHE project: "*Objectives and strategies proposed by CALECHE »* (10 min)

3) Antonia Vronti (SingularLogic S.A), Inherit project: "Next generation solutions for cultural heritage buildings: The INHERIT approach » (10 min)

4) Elodie Héberlé (CEREMA), CALECHE project: "Measuring the airtightness of historic wooden windows: Cerema's contribution to the CALECHE project ». (10 min)

5) Arnold Janssens, HeriTACE project: "*Future-proofing Heritage Townhouses by optimising Comfort and Energy in Time and Space: introduction to project HeriTACE »*(10 min)

6)* Philippe Thony (CEA), CALECHE project*: "Approach proposed towards PV integration acceptance on historic buildings and first applications in the CALECHE project use cases. » (10 min)

Conclusion by Etienne Wurtz and discussion

CALECHE

CALECHE's objectives & strategies

Sept 24, 2024

Rachel Desmaris (R2M Solution)

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COHERENT
ACCEPTABLE
LOW
EMISSION
CULTURAL
HERITAGE
EFFICIENT RENOVATION

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WHY?

The challenges of renovating historic buildings: the starting point of the CALECHE project

City of Visby, Gotland Island, Sweden
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Renovation rate of the existing heritage built stock is still very low

➜ 0.4-1.2%

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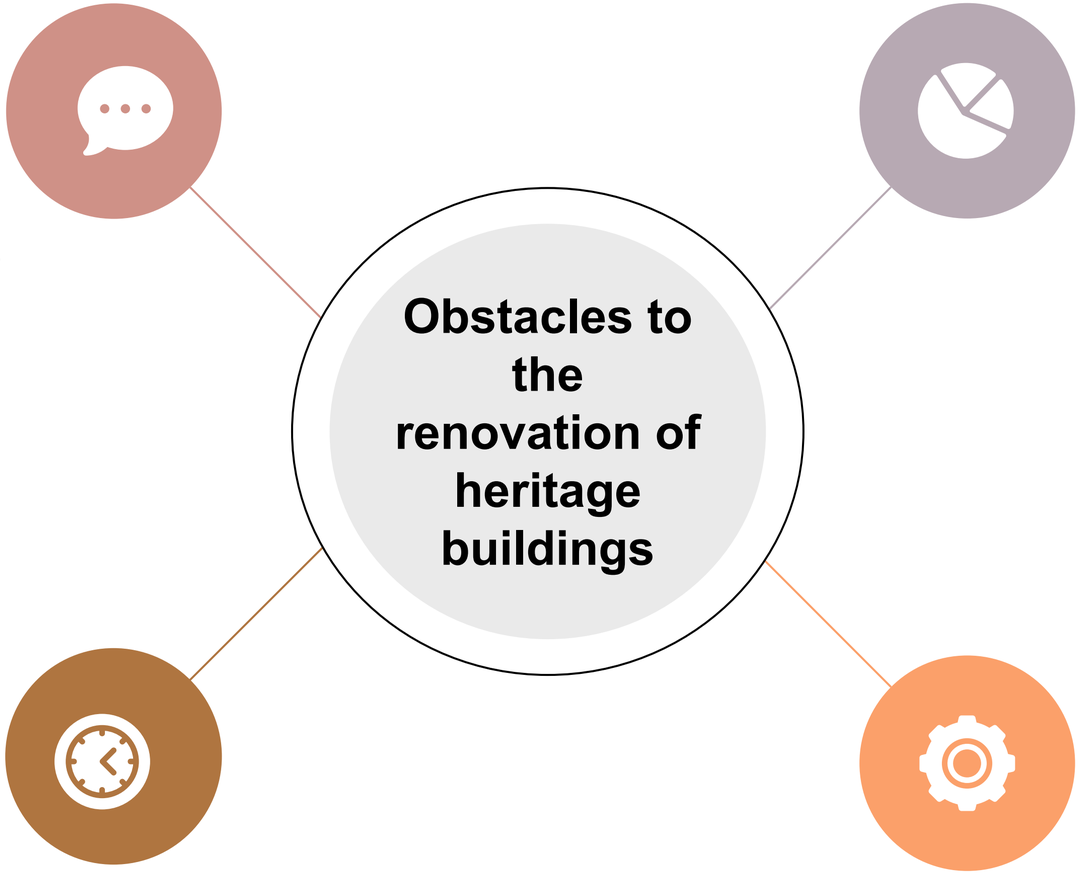
Difficulties in finding suitable technical solutions

Either they do not exist, do not have a sufficiently proven implementation, are not known or are too expensive



Difficulty in involving users in the act of renovating,

Difficulty in having technical solutions validated by conservation authorities

Difficulty in reconciling all the criteria required to make decision

energy, cultural value, safety, inclusion, environment

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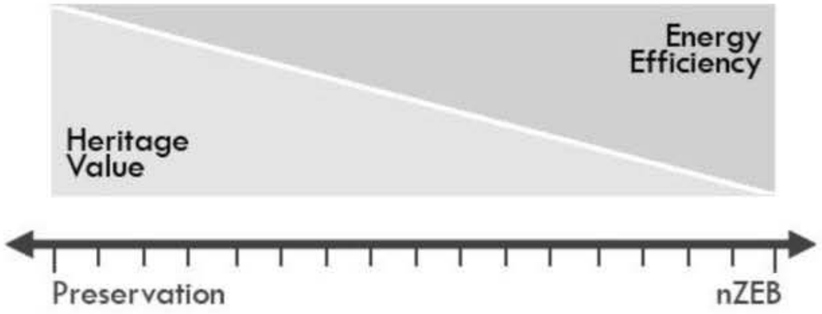
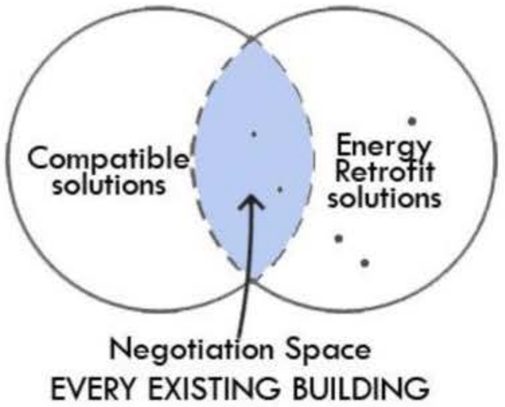
Smaller negotiation space





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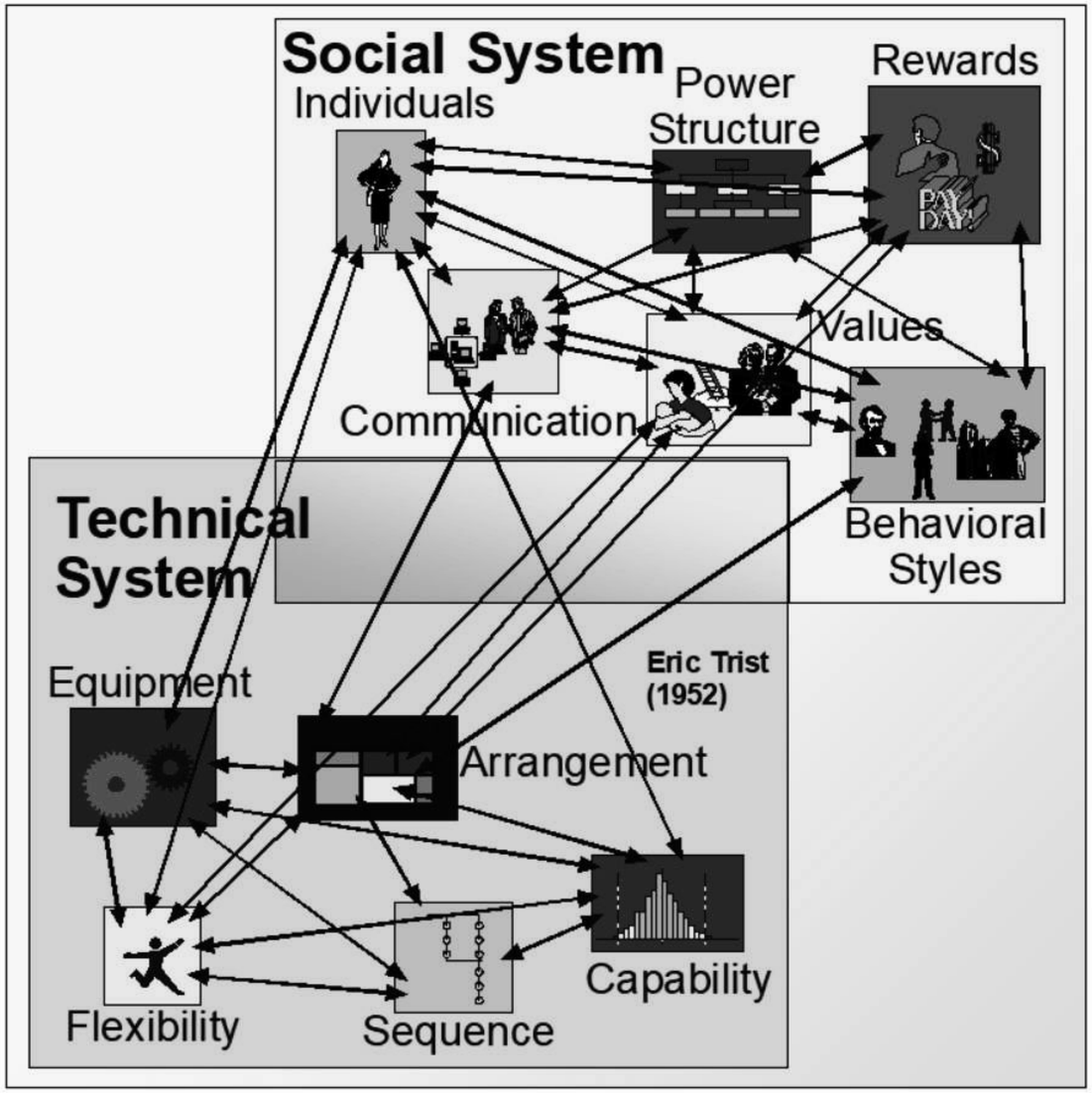

Many of the obstacles to the energy retrofit in historic buildings are neither purely social nor purely technical, but rather the combined result of sociotechnical issues

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WH0?

An Integrated Team Uniting Key Stakeholders Across the Sector's Value Chain for Collective Excellence

CALECHE

CALECHE Consortium

Research institute

COORDINATOR

University

Architect

Industrial

Association

Consultant

TECHINAL

INNOVATION MNGT

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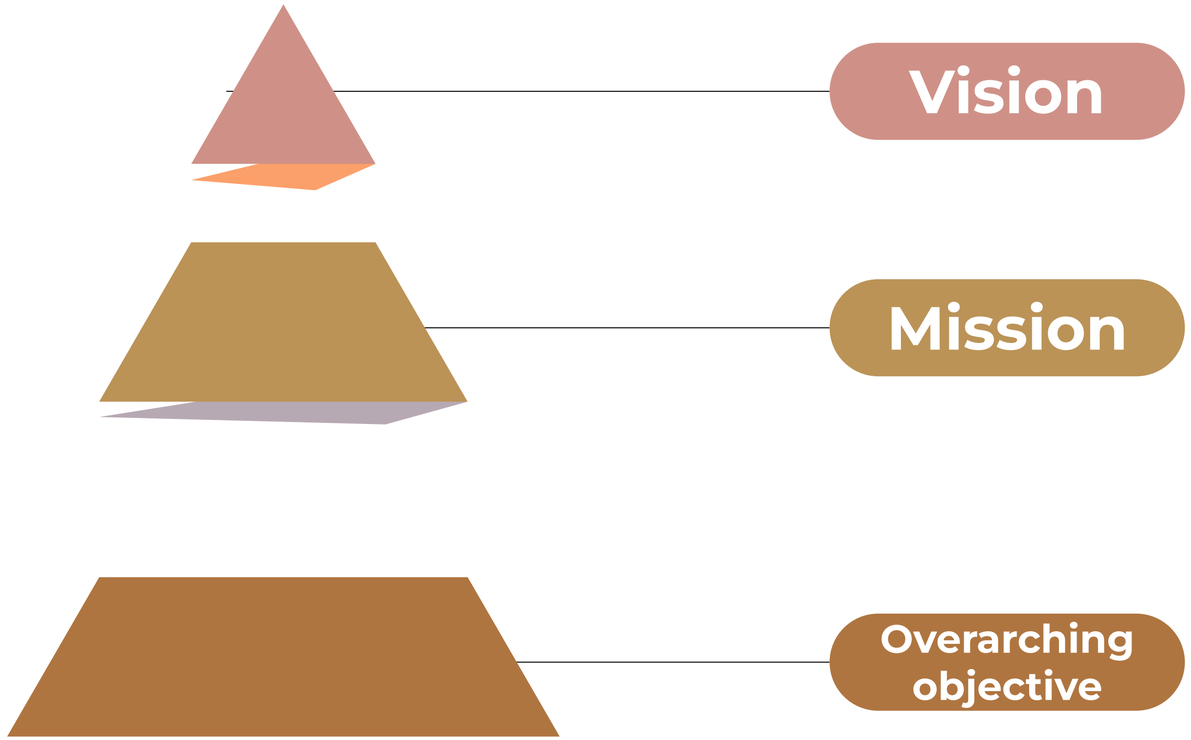
WHAT?

Our multi-benefit & multi target concept

CALECHE Mission, vision, goals



To **boost the renovation** of historic buildings

- To **work on trigger points to unlock the renovation of historic buildings** at each step of the life cycle
- To **put human and social approaches at the heart of the process**

- CALECHE will introduce innovations both in governance, social approaches, and technical improvements for products and construction processes.
- Each innovation will follow a **multi-benefit approach.**
- The project promotes **low-tech renovation** (repair over replacement) while leveraging **advanced digital technologies**.
- Digital tools like HBIM, BIM2Scan, AI, and machine learning will aid decision-making and help create renovation roadmaps.

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Two complementary work scale

HISTORIC RENOVATION HUB

GLOBAL

- Multi-benefit evaluation and decision approach
  DSS+Evaluation approach+ Engagement process
- Decision trees/DSS

INDIVIDUAL

- Initial evaluation process
- Stakeholder engagement in decision process
- Informed success stories and best practises
- Repository of selected products and solutions

BREAKTHROUGH IN PRODUCTS AND TECHNIQUES

- Customisable BIPV
- Bio indoor insulation, high hygro. perf.
- Historic wooden window retrofit protocol
- Package of systems
- Repository of selected products and solutions

PILOT SITES

4 pilot sites for real life validation of CALECHE development

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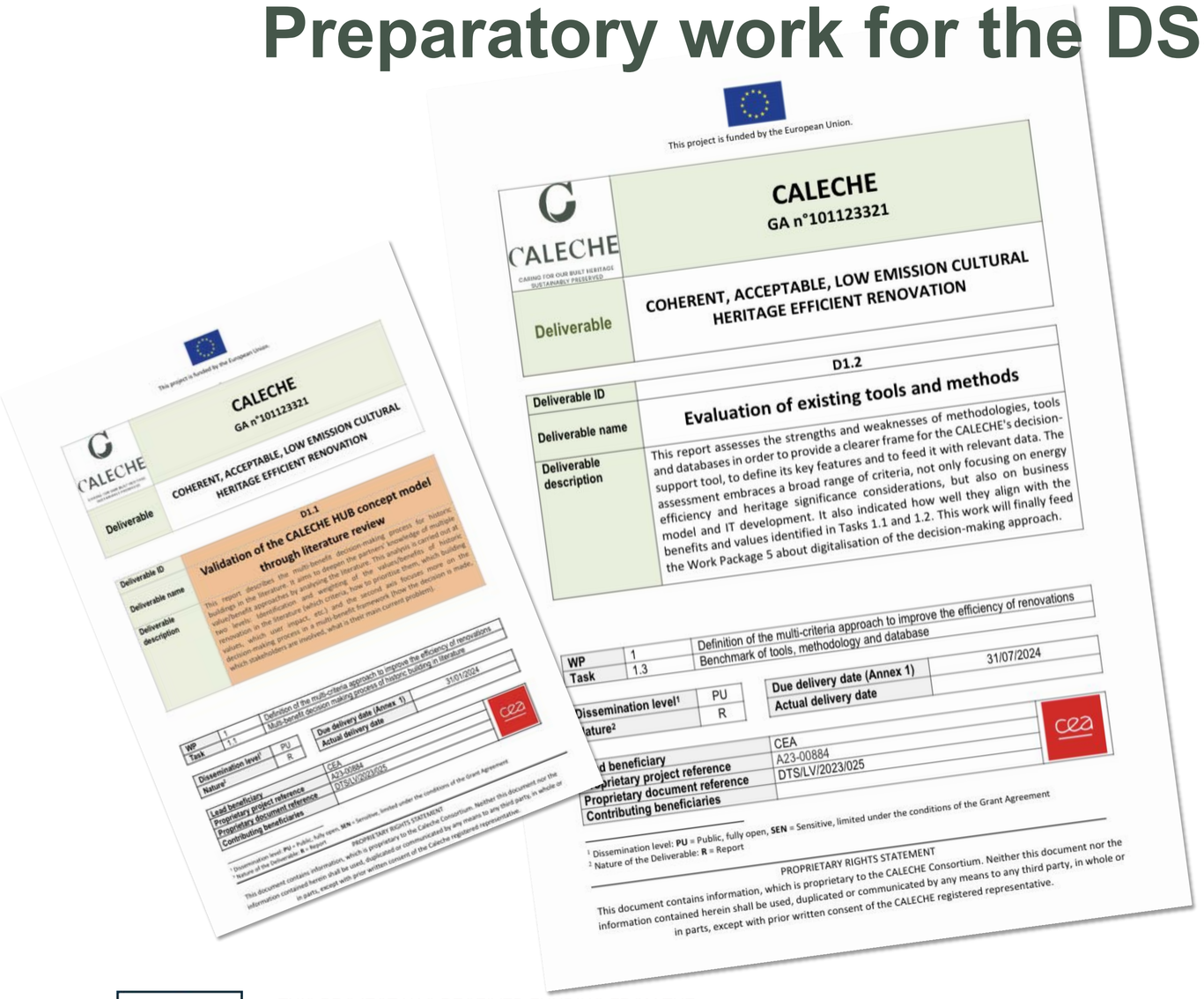
HISTORIC RENOVATION HUB

Preparatory work for the DSS development



This project is funded by the European Union.

CALECHE
GA n°101123321

Deliverable: COHERENT, ACCEPTABLE, LOW EMISSION CULTURAL HERITAGE EFFICIENT RENOVATION

D1.2

Deliverable ID	
Deliverable name	Evaluation of existing tools and methods
Deliverable description	This report assesses the strengths and weaknesses of methodologies, tools and databases in order to provide a clearer frame for the CALECHE's decision-support tool, to define its key features and to feed it with relevant data. The assessment embraces a broad range of criteria, not only focusing on energy efficiency and heritage significance considerations, but also on business model and IT development. It also indicated how well they align with the benefits and values identified in Tasks 1.1 and 1.2. This work will finally feed the Work Package 5 about digitalisation of the decision-making approach.

WP	1	Definition of the multi-criteria approach to improve the efficiency of renovations
Task	1.3	Benchmark of tools, methodology and database
Dissemination level[1]	PU	Due delivery date (Annex 1): 31/07/2024
Nature[2]	R	Actual delivery date:
Lead beneficiary	CEA	
Proprietary project reference	A23-00884	
Proprietary document reference	DTS/LV/2023/025	
Contributing beneficiaries		

[1] Dissemination level: **PU** = Public, fully open, **SEN** = Sensitive, limited under the conditions of the Grant Agreement
[2] Nature of the Deliverable: **R** = Report

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Deliverable Report D1.2 – Evaluation of existing tools and methods

4.2 *Existing tools related to energy retrofit of historic buildings*

This table compares the studied tools in Annex 2: benchmark of existing tools related to energy retrofit of historic buildings.

	Objective	Sponsors	Language	Form of the tool	Beneficiaries	Level of action	Business Model	IT development
DEMI-MORE (Netherlands and Belgium, 2019)	Demonstrate and facilitate the energy retrofit of historic buildings without compromising their heritage value	EU-funded (Interreg program)	Dutch, French	Applied methodology, visual checklist, advices	Buildings owners, buildings managers, buildings contractors	Whole building. All the planning process	None. Free of charge	Easy to use, requires some technical knowledge. No AI
Heritage Building Retrofit Toolkit (UK, 2024)	Reduce carbon emissions and enhance climate resilience	Public funding	English	Applied methodology, advices, best practices by examples	Buildings owners, buildings managers, buildings contractors	Whole building. All the planning process	None. Free of charge	Easy to use, requires some technical knowledge. No AI
KuReRa (Sweden, 2021-...)	Assess the status and risks of historic buildings, addressing building antiquarian, biology, and physics aspects	Government-funded	Swedish	Applied methodology, set of checklists	Experts in historic buildings	Whole building. All the planning process	None. Free of charge	For experts only. No AI
3encult handbook (Europe, 2015)	Guide the energy-efficient retrofitting of historic buildings while preserving their heritage value	EU-funded (research program)	English	Handbook, advices,best practices by examples	Architects, engineers	Whole building. All the planning process	None. Free of charge	Comprehensive, requires scientific knowledge. No AI
Task 59 handbook (Europe, 2021)	Provide practical guidance for implementing energy-efficient retrofits in historic buildings, following the EN 16883:2017 standard	EU-funded (research program)	English	Handbook, advices, best practices by examples	Architects, engineers	Whole building. All the planning process	None. Free of charge	Comprehensive, requires scientific knowledge. No AI
Methodology for the energy renovation of heritage buildings using BIM (Europe, 2022)	Provide guidelines on utilizing BIM in energy diagnosis and integrating it with Building Performance Simulation (BPS) systems to support energy efficiency decision-making for historic buildings	EU-funded (cooperation program)	English	Handbook, advices, best practices by examples	Architects, engineers	Whole building. All the planning process	None. Free of charge	Comprehensive, requires scientific knowledge. No AI

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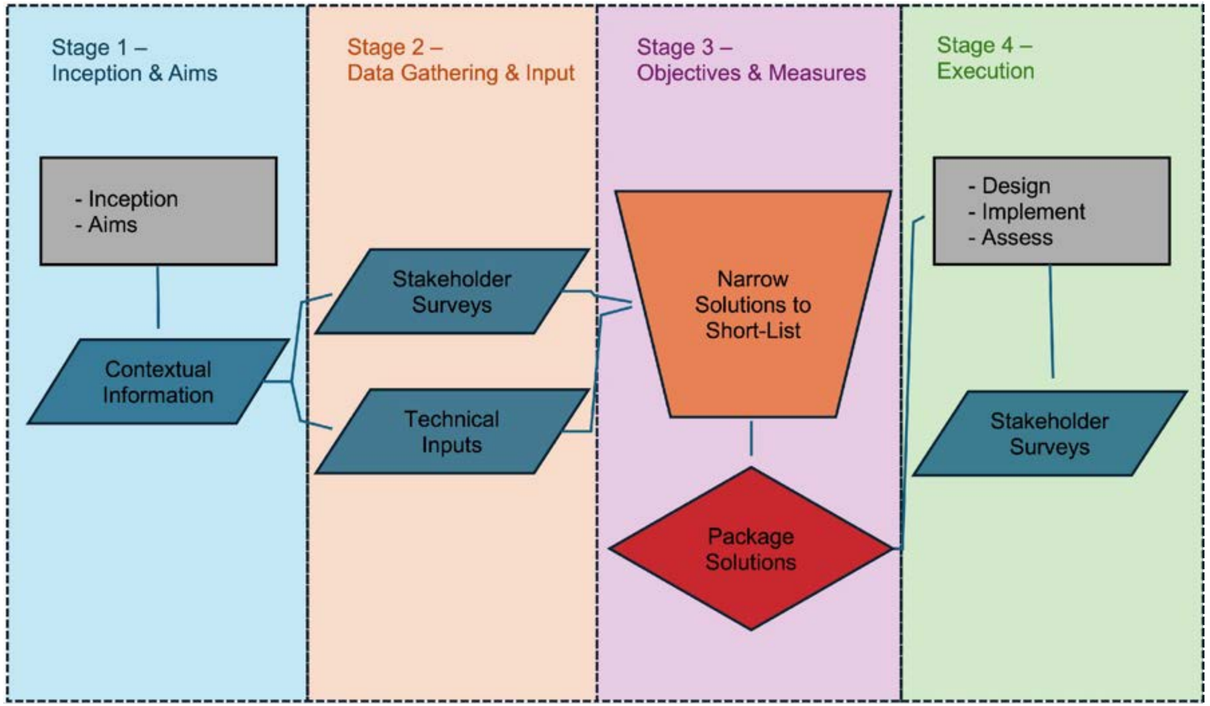
DSS Process



DSS Inputs and outputs

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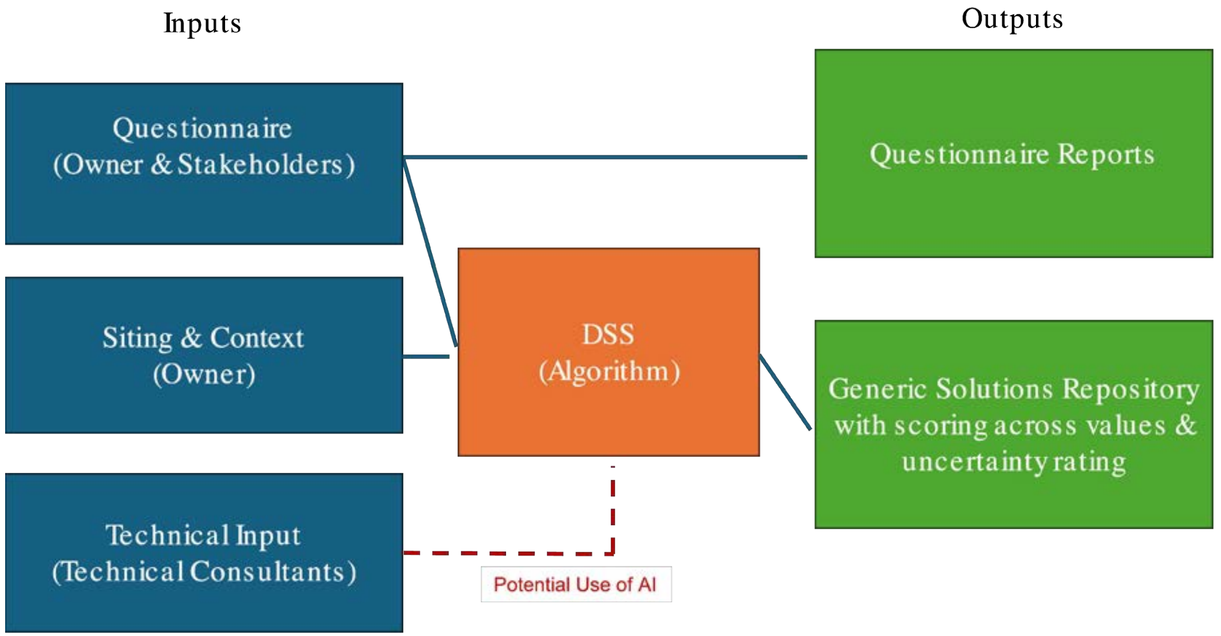
DSS inputs and outputs



DSS Inputs and outputs

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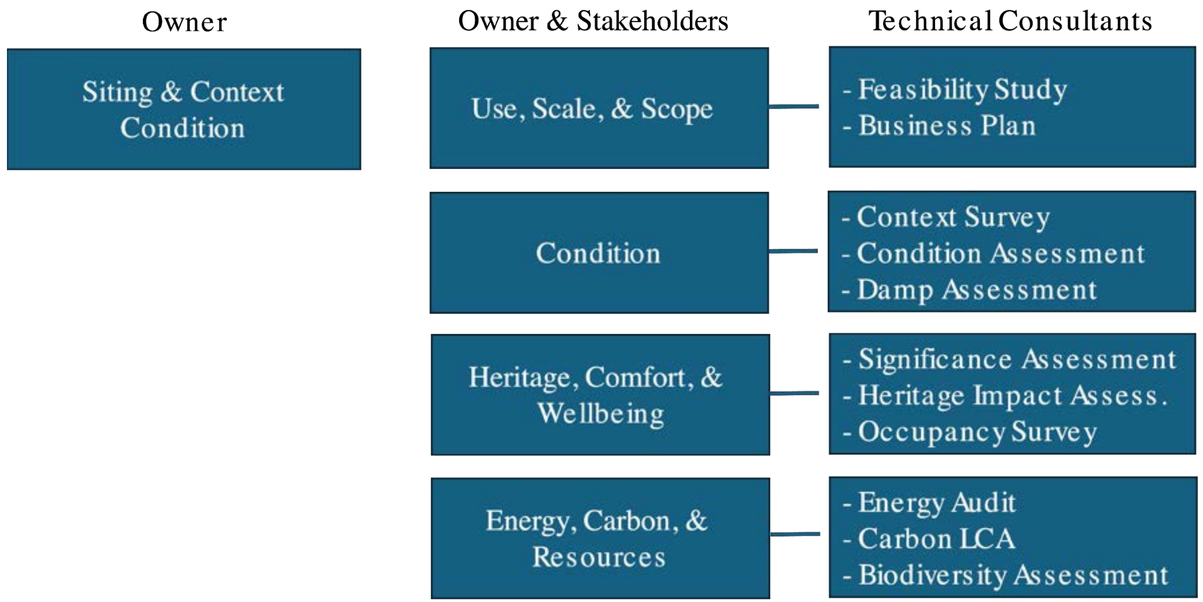
DSS providers of inputs information



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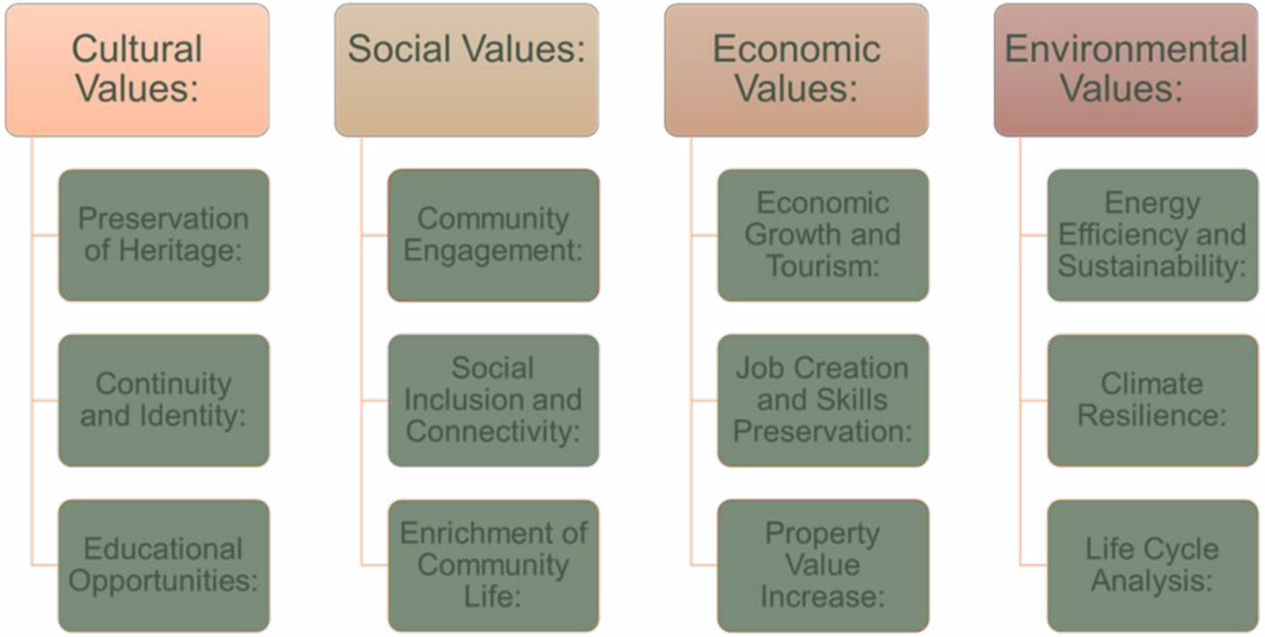
DSS multi-benefit evaluation



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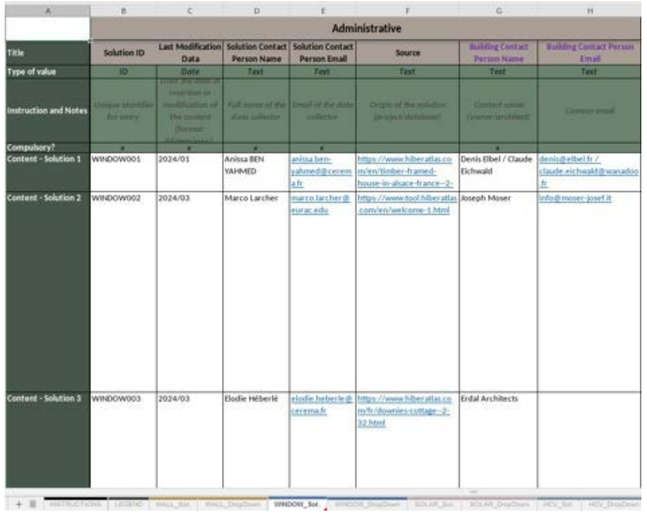
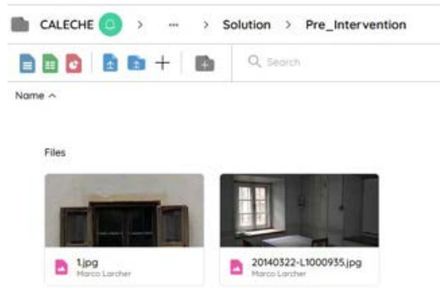
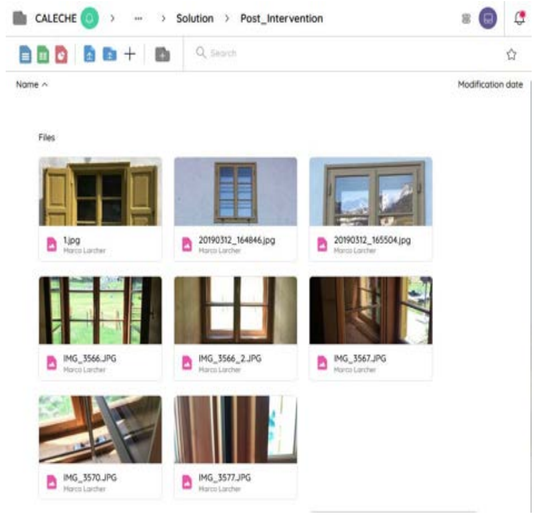
Solution collection tool



	A	B	C	D	E	F	G	H
		Administrative						
Title		Solution ID	Last Modification Data	Solution Contact Person Name	Solution Contact Person Email	Source	Building Contact Person Name	Building Contact Person Email
Type of value		ID	Date	Text	Text	Text	Text	Text
Instruction and Notes		Unique identifier for entry	Enter the date of creation or last modification of the content (format: dd/mm/yyyy)	Full name of the data collector	Email of the data collector	Origin of the solution (project/database)	Contact name (owner/architect)	Contact email
Compulsory?		x	x	x	x		x	
Content - Solution 1	WINDOW001	2024/01	Anissa BEN YAHMED	anissa.ben-yahmed@cerema.fr	https://www.hiberatlas.com/en/timber-framed-house-in-alsace-france--2-	Denis Elbel / Claude Eichwald	denis@elbel.fr / claude.eichwald@wanadoo.fr	
Content - Solution 2	WINDOW002	2024/03	Marco Larcher	marco.larcher@eurac.edu	https://www.tool.hiberatlas.com/en/welcome-1.html	Joseph Moser	info@moser-josef.it	
Content - Solution 3	WINDOW003	2024/03	Elodie Héberlé	elodie.heberle@cerema.fr	https://www.hiberatlas.com/fr/downies-cottage--2-32.html	Erdal Architects		





- Location of the repository
  - Current proposal: integrate the repository within the platform **HiBERatlas**

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BREAKTHROUGH IN PRODUCTS AND TECHNIQUES

Bio-insulation

- **Bio-plaster & Bio-coating:**
- Binders;
- Aggregate;
- Additives;
- Vegetable Waste;

- In this first phase we focused on identifying as many aggregates as possible for the realization of this new interior bio-plaster.

- Lightweight aggregate vegetable waste


Husk ash


Ground husk


Rice husk


Rice Husk


Rice straw

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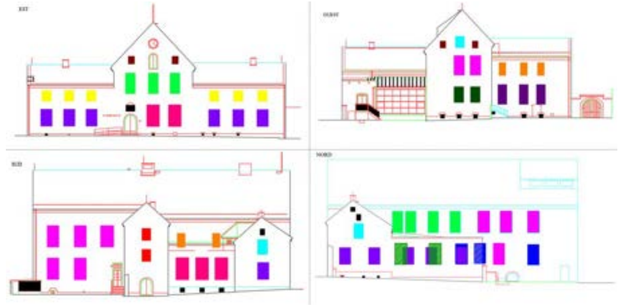
Methodology to repair window

- **On-site testing procedures (U-value and airtightness) for historic windows**
- Airtightness
- *In touch with similar ongoing projects (PERCHE from Buildwise, Belgium ; employer's union of craftspeople in France)*



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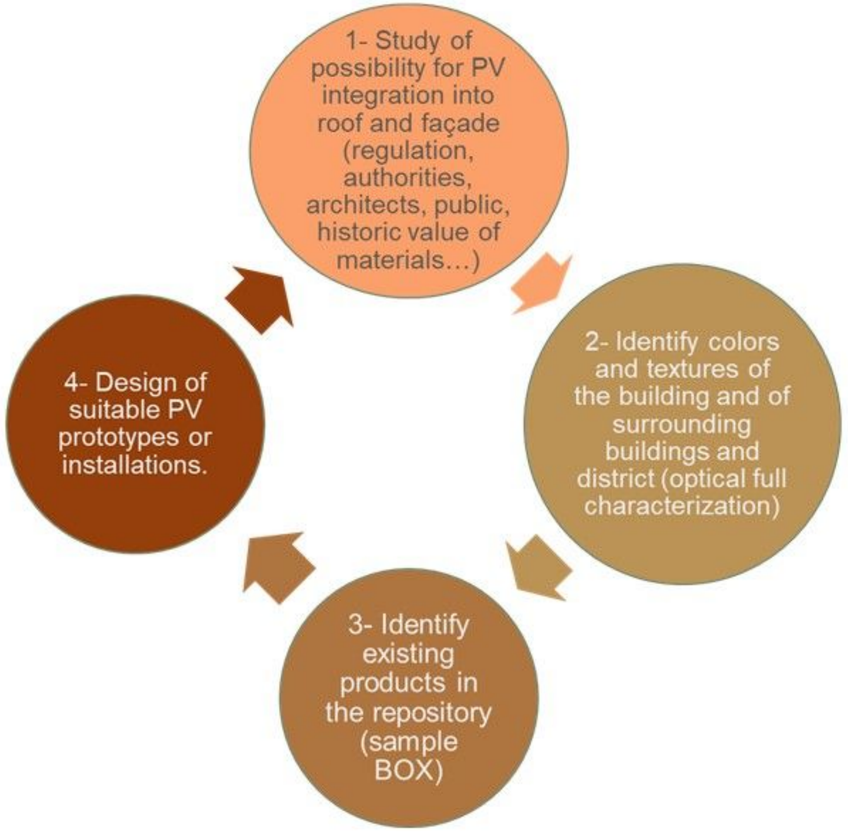
BREAKTHROUGH IN PRODUCTS AND TECHNIQUES

Customisable PV



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4 diverse use-cases

Use-case 1: ITALY, Ercolano - Villa Matarazzo

Use-case 2: SWITZERLAND, Le Locle et La Chaux-de-Fonds/ cities

Use-case 3: SWEDEN, Visby - Donner house

Use-case 4: FRANCE, Museum & Library of Grenoble

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Use-case 1: ITALY, Ercolano - Villa Matarazzo

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General presentation of the use case

Localisation: Ercolano, Italy

Type: Villa + garden (four levels plus a basement) located in a suburb area. Constructed in 1880, enlargements 1914.

Current use: abandoned (intended use after renovation: socio-cultural activities)

Heritage status: FAI (Fondo Ambiente Italiano)

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Renovation status of the use-case

- **What has been done so far?**
  - *Laser scanner survey*
  - *Photogrammetric survey*
  - *HBIM architectural model*

- **What are the ambitions for the building?**
  - *Redevelopment*
  - *Re-use*
  - *Increasing the confort of the spaces*
  - *Make it accessible, inclusive, resilient an low emission*

- What will be done in the framework of the project?
  - Scan2BIM of the full building
  - Enrichment of HBIM model
  - Heritage analysis
  - Analysis of the data

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Faro Focus S 150 PLUS

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Faro Focus 3D S120

Drone DJI Mavic 2 Zoom

Canon EOS 1100 D

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3D SURVEY

- Laser scanner

FARO FOCUS S 150 PLUS
Laser scanner high definition
Range: 150 m
Accuracy: + 2mm
Field of view: 360° x 300°
Speed: 976000 punti/sec

- Drone

DRONE DJI MAVIC 2 ZOOM
Cam Hasselblad 4/3 CMOS
Flight autonomy: 46 minuti
Range 15 km

- Photo

CANON EOS 1100 D
Digital camera
Resolution: 12.2 MP

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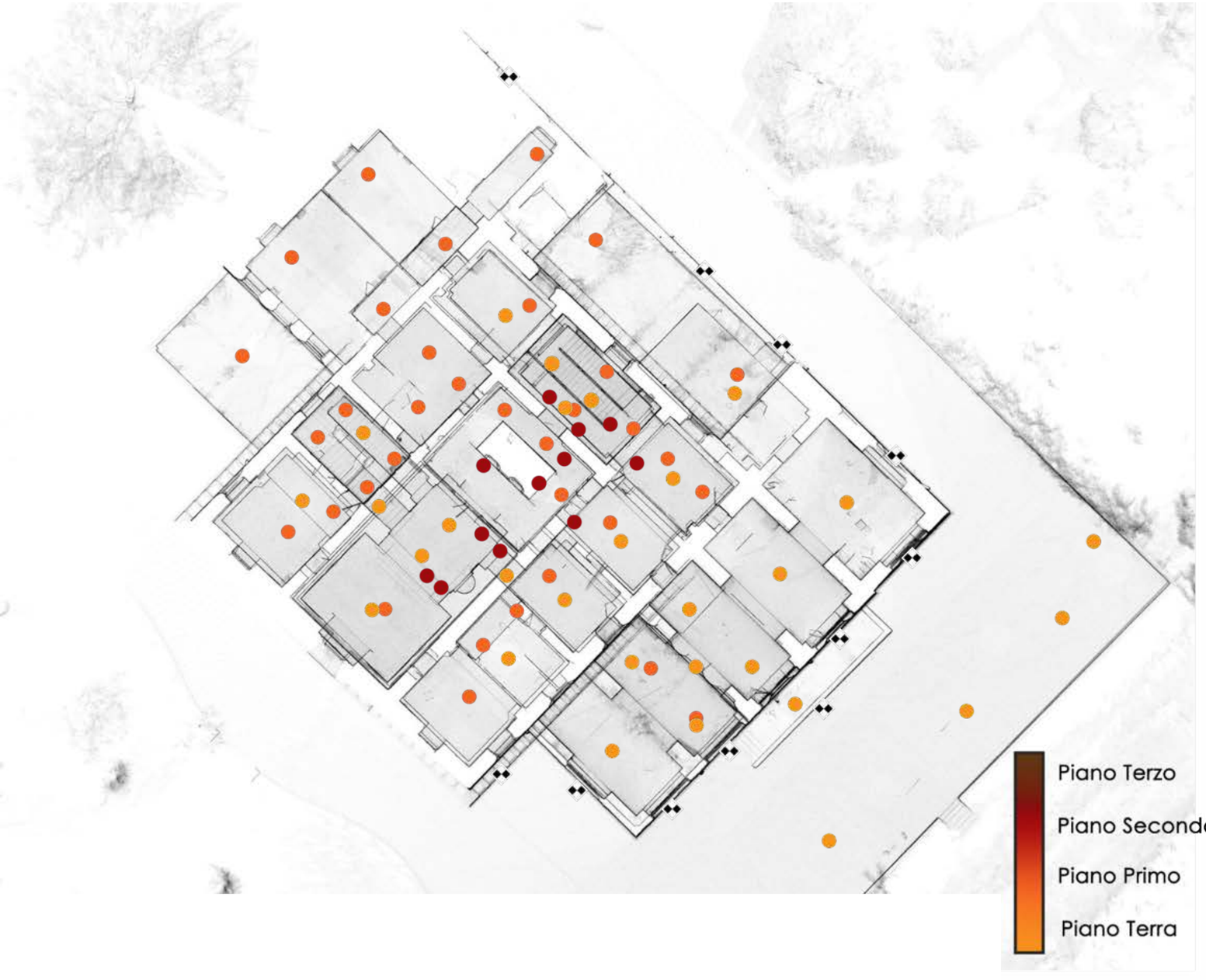
Piano Terzo
Piano Secondo
Piano Primo
Piano Terra

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HBIM
ARCHITECTURAL MODEL

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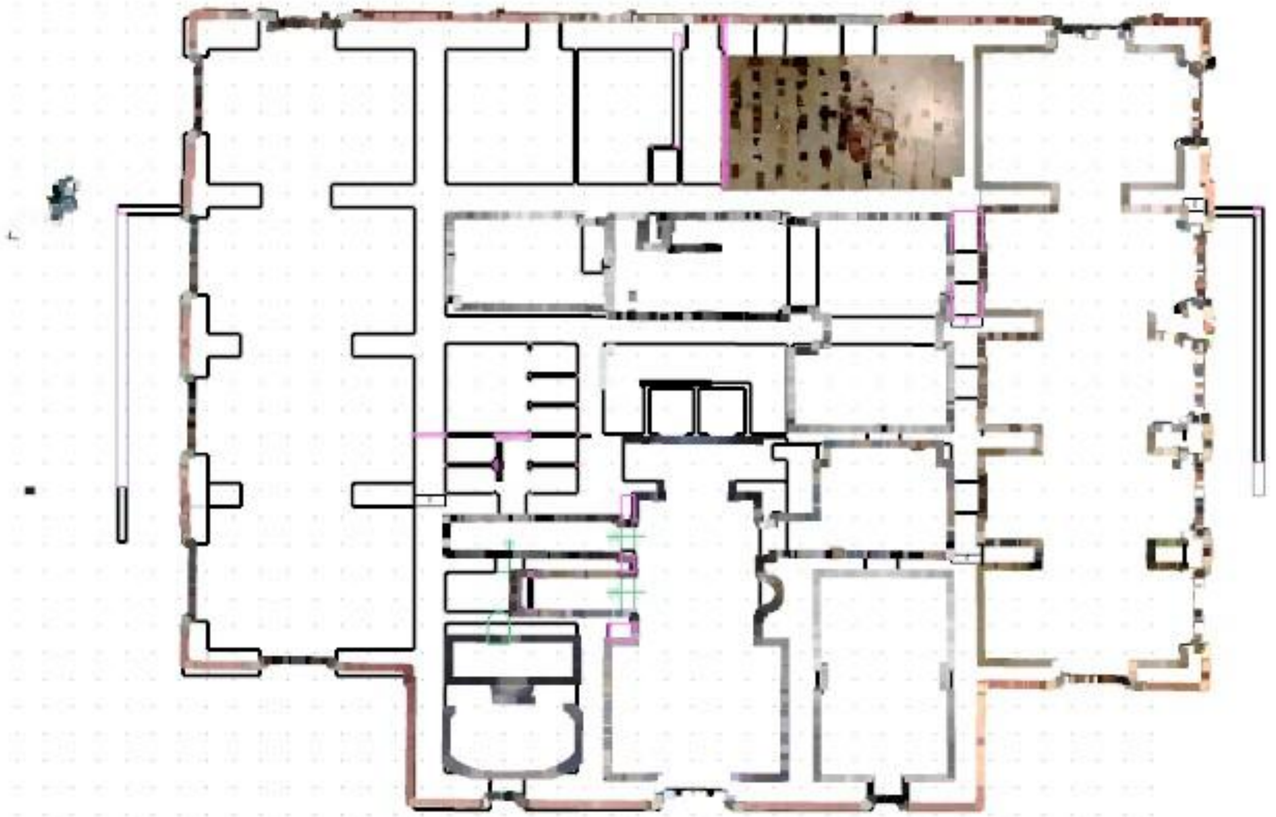

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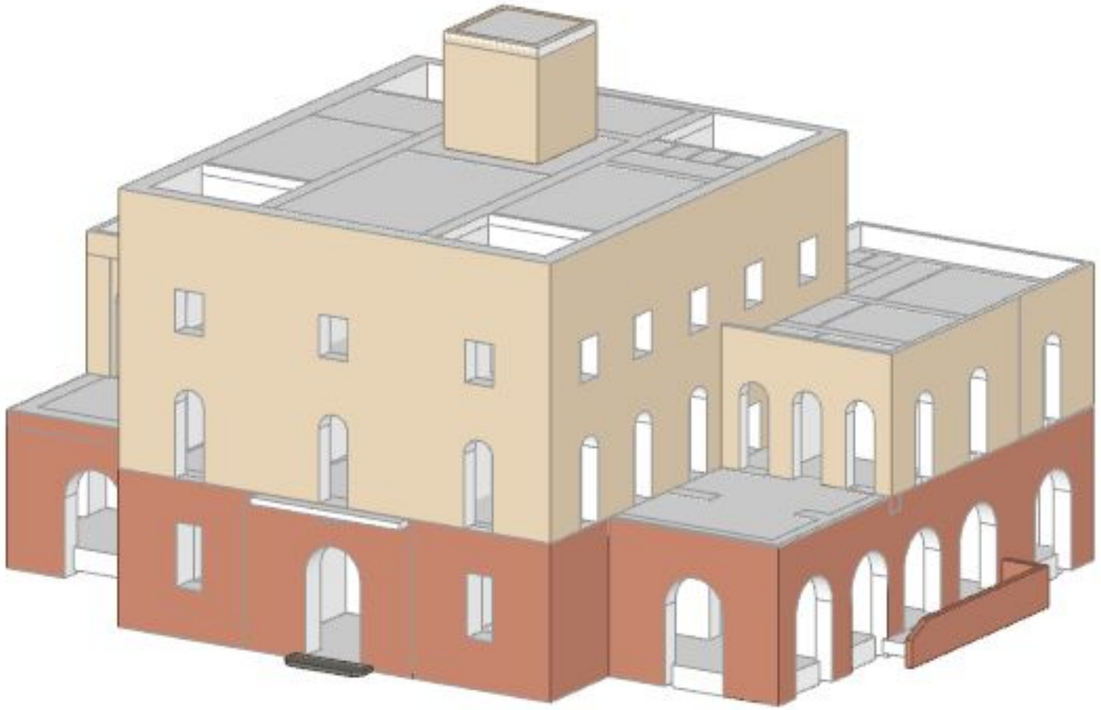

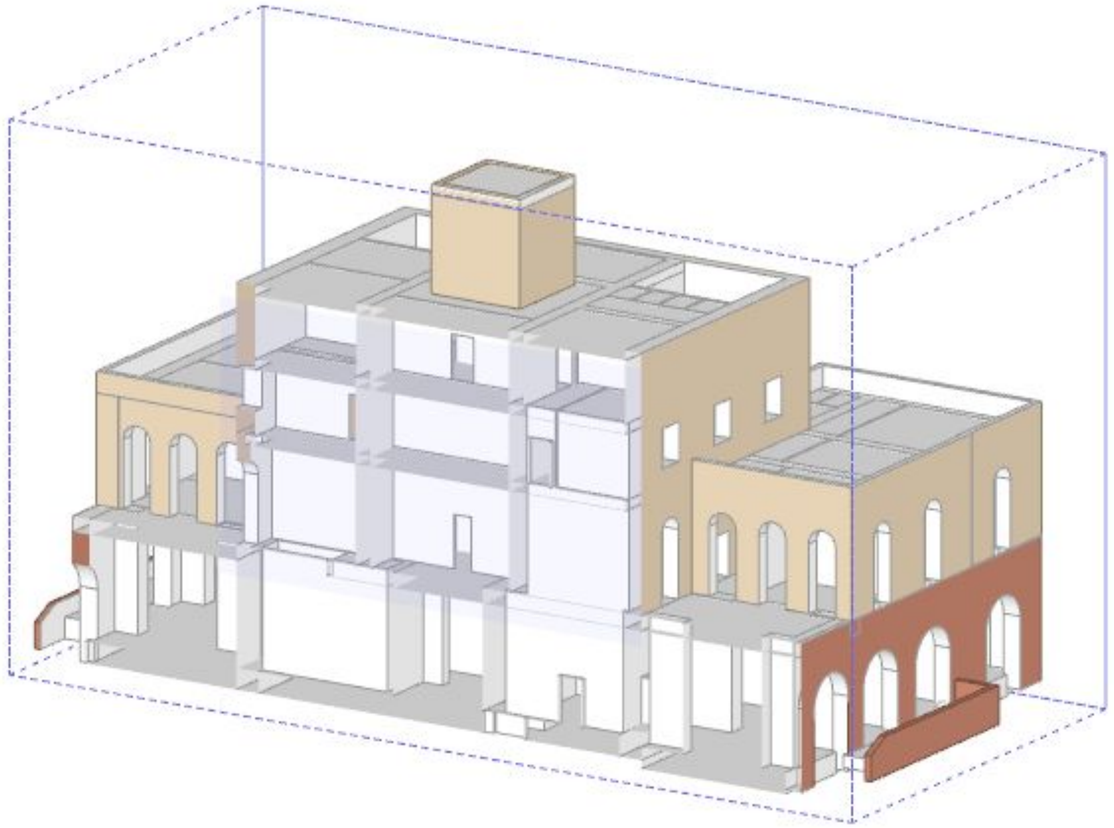

Kick off meeting CALECHE - Le bourget du lac | 11-12 October 2023

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Use-case 3: SWEDEN, Visby - Donner house

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General presentation of the use case

Localisation: Visby, island of Gotland (Baltic Sea), Sweden

Type: Originally a merchant building in the Hanseatic city of Visby, later used as bank and postal office. . Original basement and ground floor structure from 12th century. Main additions from 16th century, restored and transformed in several phases from the 18th century. Stone building with wood windows and tiled roof on wood construction.

Current use: Housing the regional tourist office and office spaces for regional/public business.

Heritage status: Protected heritage asset, with highest heritage designation (Swedish National Heritage Board), part of UNESCO World Heritage Site Visby.

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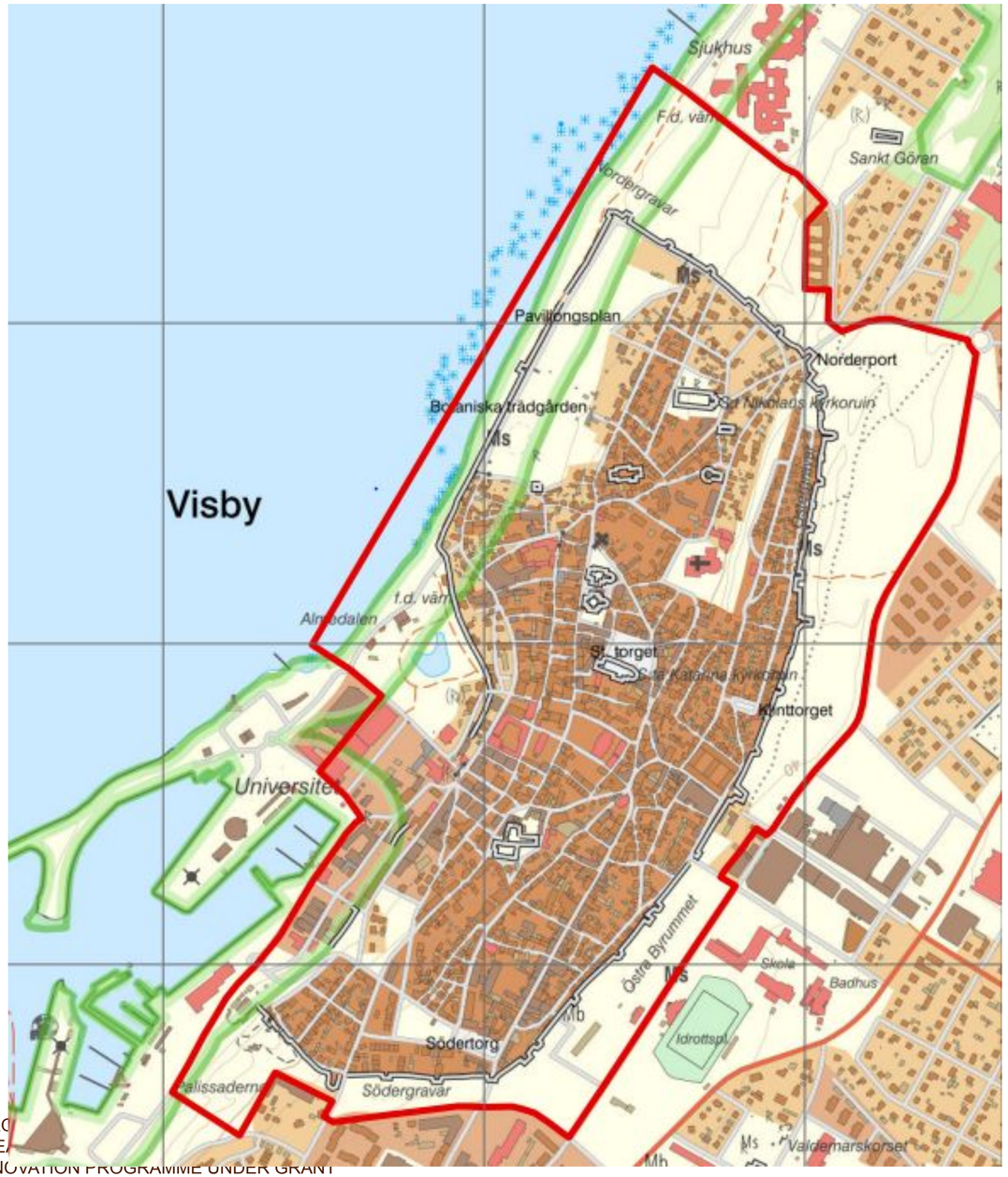

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SWEDISH NATIONAL HERITAGE BOARD
RIKSANTIKVARIEÄMBETET

UPPSALA UNIVERSITET

Region Gotland

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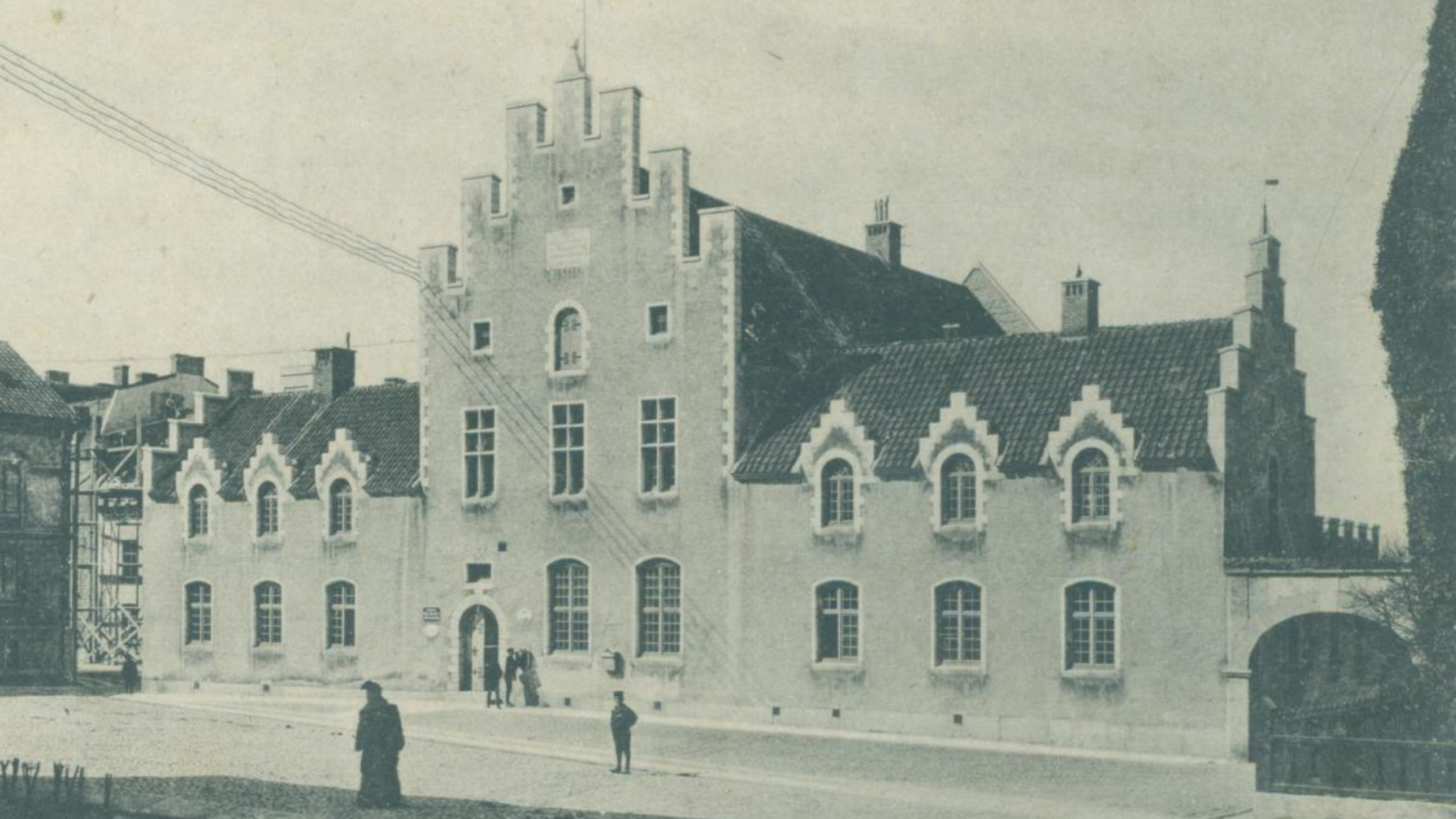
CARING FOR OUR BUILT HERITAGE
SUSTAINABLY PRESERVED


DONNERSKA HUSET



CALECHE

Renovation status of the use-case

- **What has been done so far?**
  - Energy optimization (EPC) 2017
  - Renovations, ongoing – started 2020:
  - recolouring of façade plaster
  - window refurbishment with linseed oil paints and existing glass.
  - roof refurbishment, cleaning and remounting of ceramic tiles (dating from 1600 to modern), replacements where needed.

- **What are the ambitions for the building?**
  - Increased energy efficiency to meet regional and national goals of minimized carbon footprint in maintenance.
  - To offer satisfying commercial and office space for public tennants, with high acceptance from end users.

- **What will be done in the framework of the project?**
  - Challenge common practice in BIPV implementation and energy performance.
  - Last phase of renovations planned Q3-Q4 2024.
  - Impact of CALECHE on actual works will depend on timing, with tasks preferrably scheduled early in the project for the Visby use case.

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CALECHE

Thank you for your attention

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SUSTAINABLE PLACES 2024

Sustainable and resource-efficient solutions for cultural heritage

Future-proofing Heritage Townhouses by Optimising Comfort and Energy in Time and Space

Horizon EU project HeriTACE

Arnold Janssens, Eline Himpe

Sustainable Places 2024

23/09/2024

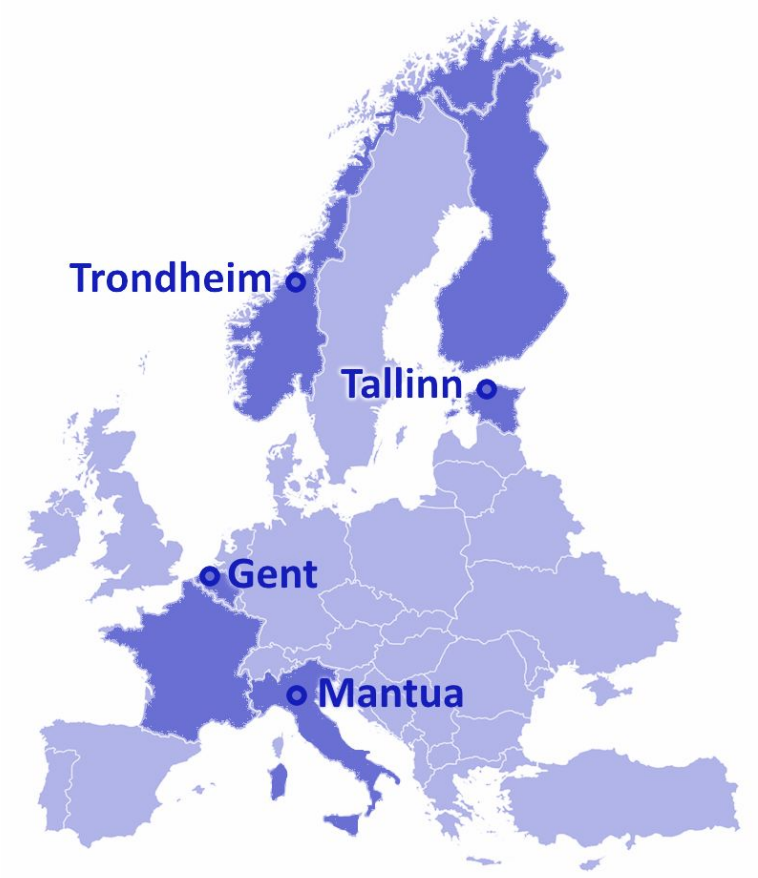
HeriTACE

UNIVERSITEIT GENT

Funded by the European Union

HeriTACE project

- Horizon Europe ‘Research and Innovation Action’
  - Future-proofing historical buildings for the clean energy transition
- 2024-2028
- 4,5 MLN EUR
- Coordinator: Ghent University, Building Physics research group
- Partners: 17 partners from 6 EU countries
  - Universities, authorities, SME’s and industry
  - Building conservation & design, building & energy engineering



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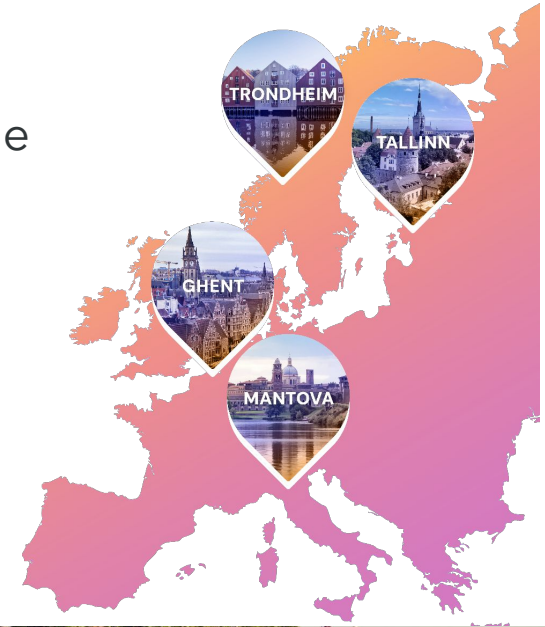
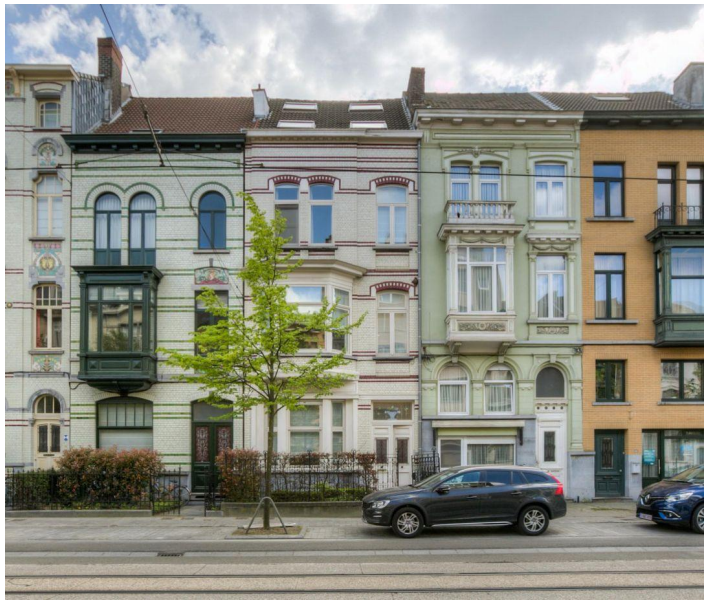
Heritage Townhouses

- 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
- 4 Case study cities





HeriTACE

Objectives

An overall holistic renovation approach for heritage townhouses:

1. A holistic assessment model and transdisciplinary processes to create a holistic vision and plans
2. Optimal and integrated design approaches, replicable through standardised guidelines

Specific innovations for heritage buildings:

3. Durable insulation and air tightness solutions
4. Optimised and smart controlled HVAC concepts
5. Integrated local R²ES based energy supply solutions

Principal users

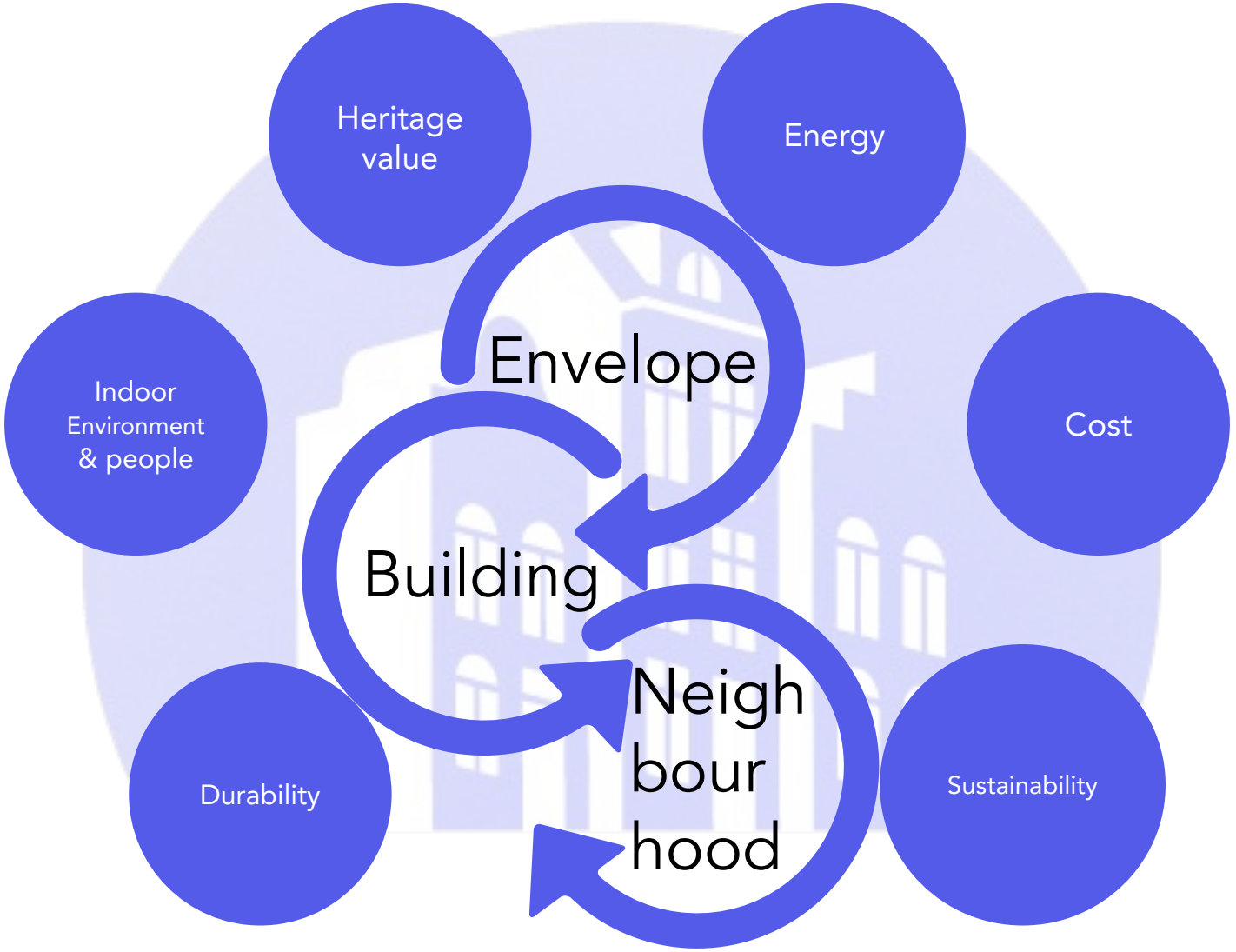
conservation and climate authorities

Building design and conservation professionals, building owners

Industry (building materials, HVAC, energy systems); contractors

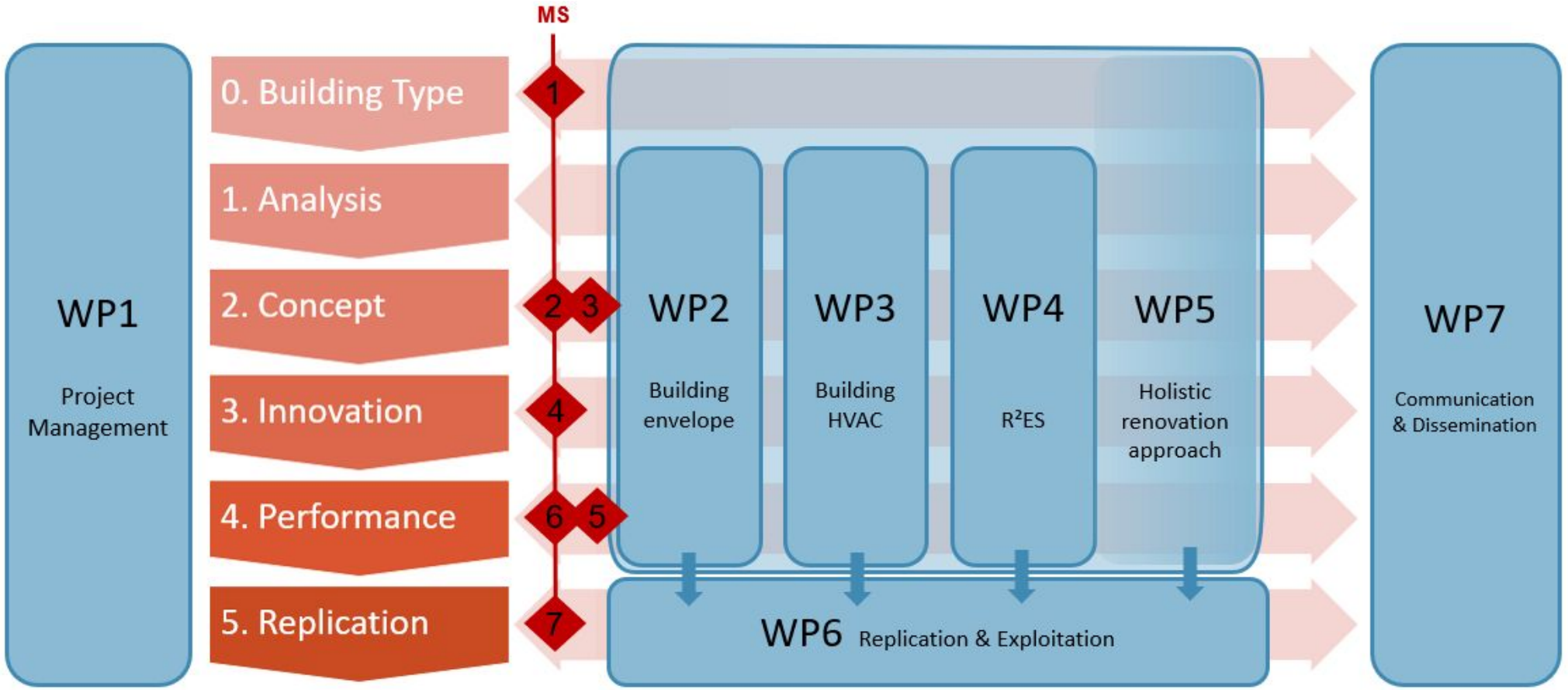
HeriTACE

Holistic and Multi-Scale renovation approach



HeriTACE

HeriTACE work plan



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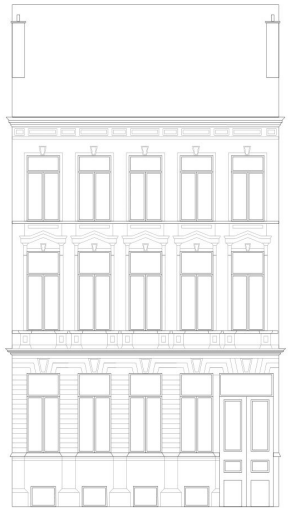
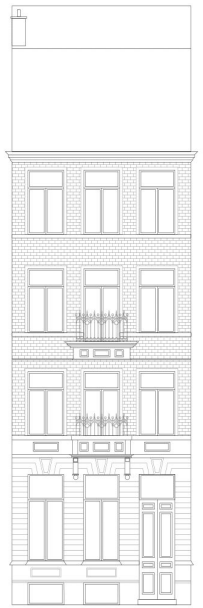
Heritage Townhouse Archetypes: Belgium

middle-class townhouse



private mansion



multi-family townhouse

modest house

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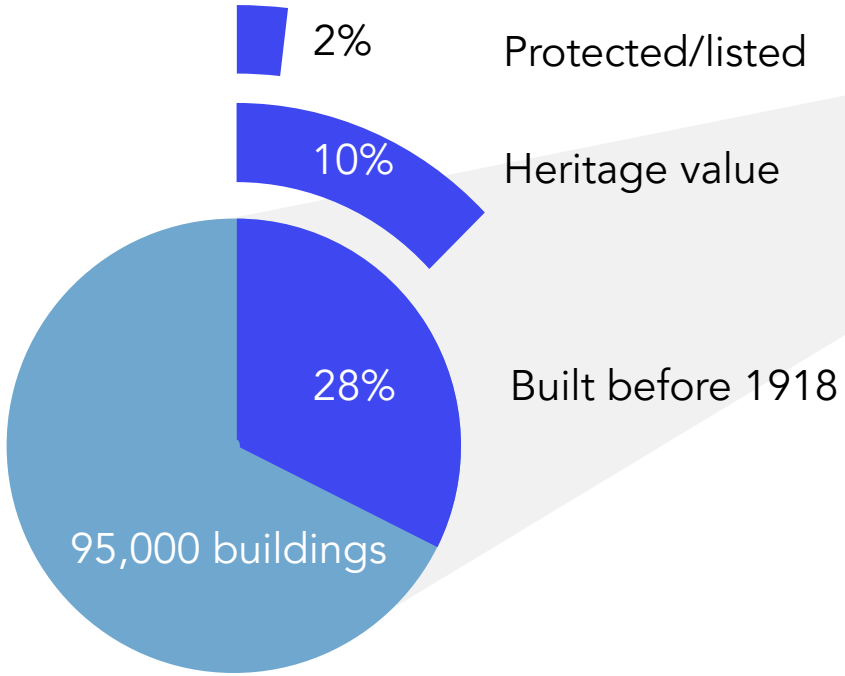
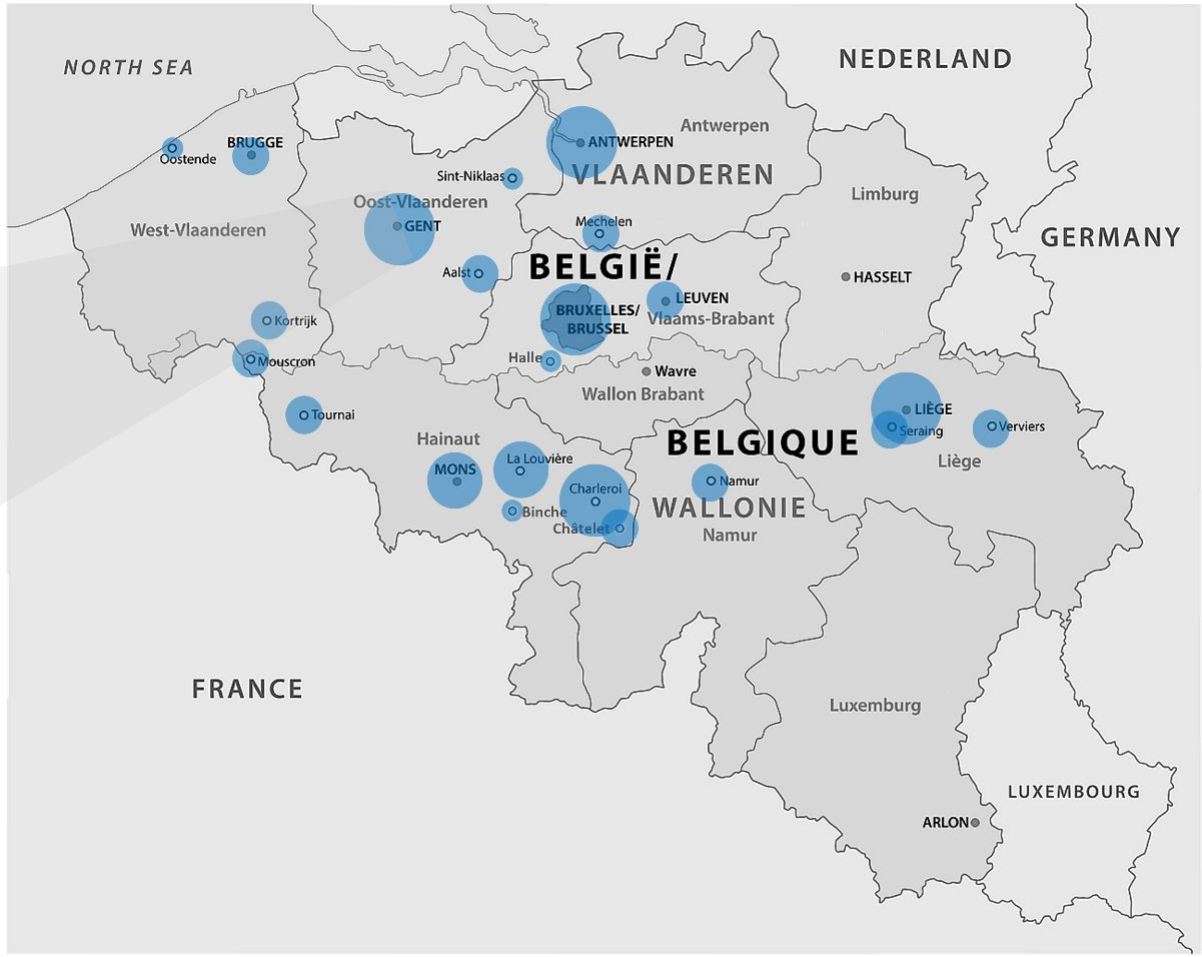
Heritage Townhouses





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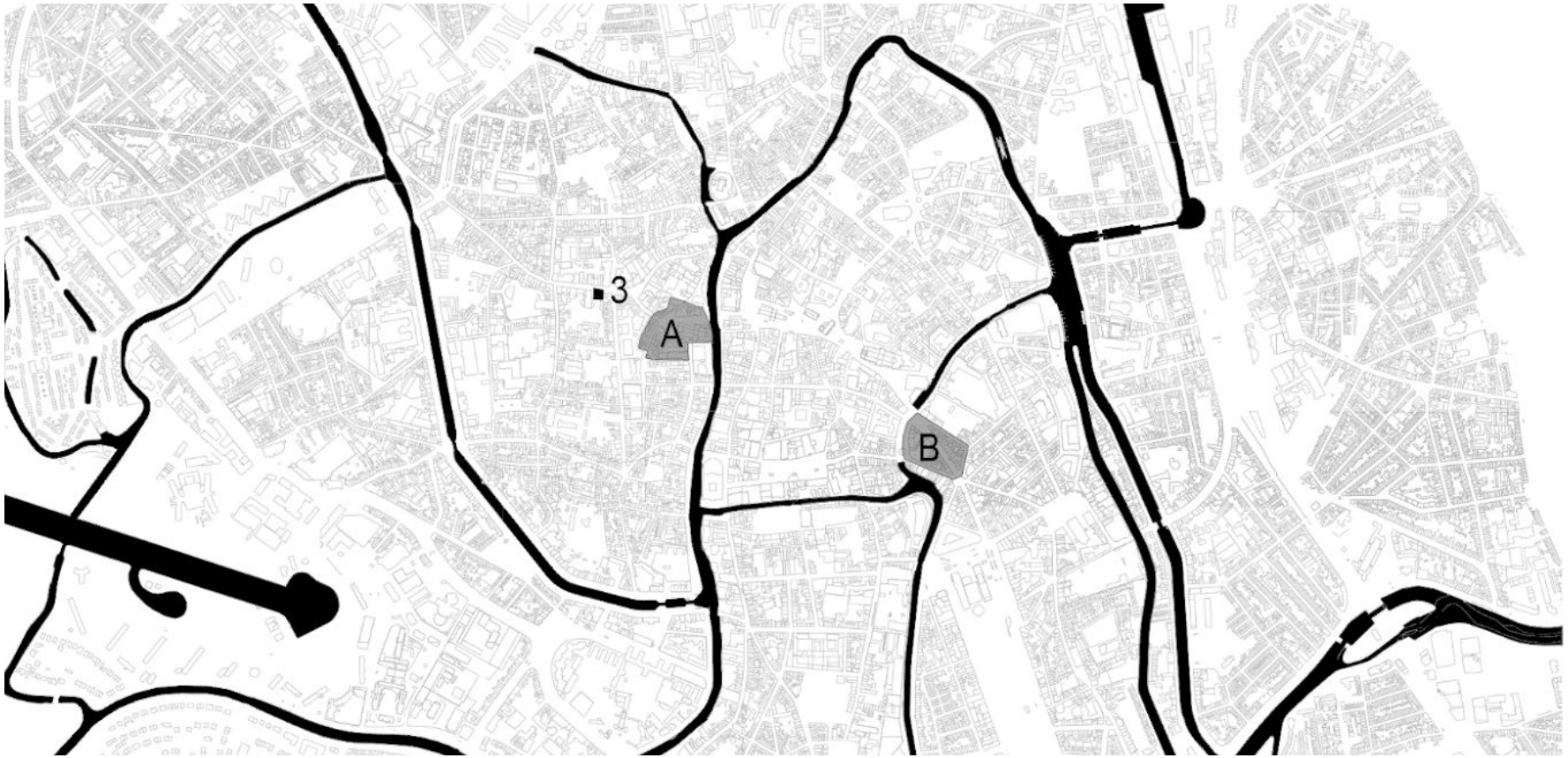
Case-study Neighbourhoods in Ghent



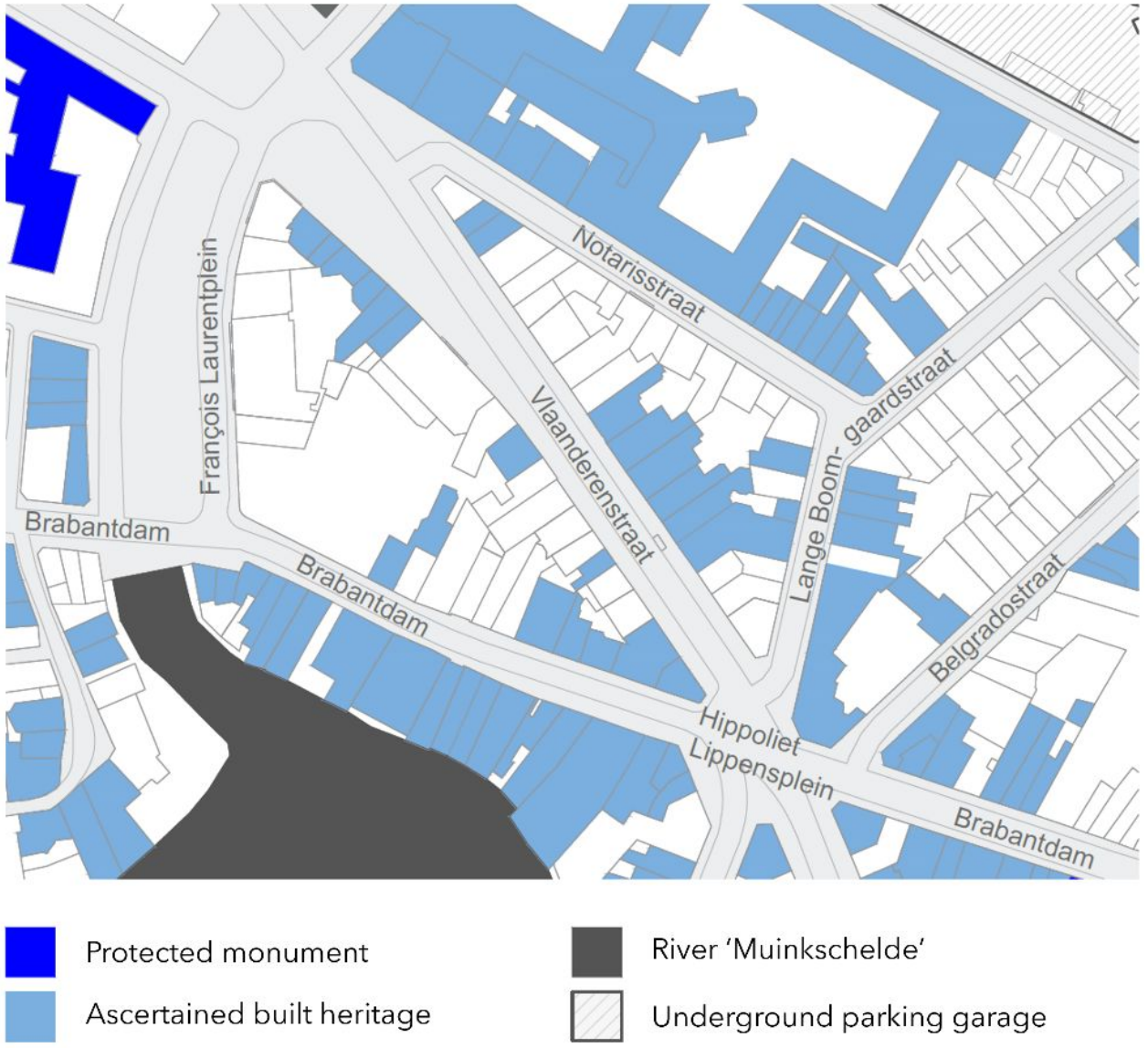
A

Sint-Michiels plein

B

Vlaanderen-straat

Vlaanderenstraat



HeriTACE

THANK YOU

Get in touch for more information!

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www.heritace.eu

@HeriTACEproject

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Next-generation Solutions for Cultural Heritage Buildings

Sustainable Places 2024

Scalable and Resource-Efficient Solutions for Cultural Heritage

Antonia Vronti, SingularLogic

24/09/2024

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Outline

- Project’s Aim
- CH Pilot Sites
- INHERIT Methodology
- Social, Scientific, Technological Layers Explained

CALECHE

CALECHE project

Approach proposed towards PV integration acceptance on historic buildings and first applications in the CALECHE project use cases.

Presentation: **Philippe THONY (CEA INES)**

Partners involved: Ya Brigitte ASSOA, Etienne WURTZ, Arnaud JAY (CEA INES),
Laure-Emmanuelle PERRET, Joëlle FAHRNI, (LMNT)
Keith BOXER, Rickard NYGREN (WHITE)
Marco LARCHER, Dario BOTTINO (EURAC)

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OUTLINE

1. INTRODUCTION

2. APPROACH PROPOSAL FOR PV INTEGRATION ON HISTORICAL BUILDINGS

3. DESCRIPTION OF USE CASES

4. FIRST APPLICATIONS TO USE CASES IN FRANCE, ITALY AND SWEDEN

5. CONCLUSION AND OUTLOOKS

1. Introduction

CONTEXT:

Renovation of historic buildings needed : to **increase lifetime** by restoration or partial replacement of areas.

and to **lower energy costs** (PV modules to reduce electricity bill, or optimized thermal insulation and windows to reduce building heating and cooling loads).

However, various barriers exit due to **local social acceptance and importance to preserve local Heritage**.

PV modules on a partially protected single family house of Bergheim (France)

The Reichstag at Berlin modified by Norman Foster

Conference room of the Vatican

OBJECTIVES:

Thus, in the CALECHE project, an Approach to ease the acceptance of PV systems on historic buildings is developed.

- Aiming the **customization** of PV modules with printing and surface treatment OR the **selection** of suitable products.
- Development of a **Repository** of relevant existing products on the market (Sample Box).
- Application to **4 use cases** in France, Italy, Switzerland and Sweden and showcase on small **mock-ups**.

2. Approach proposal for PV integration on historic buildings

1- Study of possibility for PV integration into roof and façade or nearby.

- ✔ Surveys addressed to local Authorities and to public, if relevant (regulations, expectation, local definition of Heritage values, main actors, validation steps, areas protection levels on site …).
- ✔ Assessment of best areas for PV systems (shadings, orientation, slope, layouts and electrical performance prediction…).

2- Identify colors and textures and material trends of the building and nearby

- ✔ Identification of any existing esthetical trends on the building and the site.
- ✔ **Heritage Value Assessment** of materials with related standards (CSN EN 16883 “Conservation of cultural heritage - Guidelines for improving the energy performance of historic buildings”…),
- ✔ Assessment of materials colors and textures.
- ✔ Test of optical properties on samples, if relevant.

3- Identify existing products in the repository (Sample Box)

- ✔ Research of existing products fulfilling specifications (PV modules and fixations / customized glass and encapsulant with low impact on solar absorptivity / materials with specific properties / colored interconnection…)
- ✔ Select PV system on the market, if relevant.

4- Design of suitable PV prototypes.

- ✔ Design based on gathered data, if relevant.
- ✔ Iterative validation by local Authorities
- ✔ Modification if required, and installation.

Approach proposal for the CALECHE project

3. Description of use cases

Use case 1: ITALY, Ercolano - Villa Matarazzo

Constructed in 1880, enlargements in 1914;

Flat roof ; masonry structure and steel and brick slabs

Use-case 2: SWITZERLAND, Le Locle et La Chaux-de-Fonds/ cities

Housing and tertiary activity of the 18th century; Checkerboard streets;

Roof covering with flat and rounded tiles**; PV modules should be visible**,

Use case 3: SWEDEN, Visby - Donner house

Hanseatic League in the Baltic from 12th to 14th century

PV tiles on roof should be similar to standard tiles.

Use case 4: FRANCE, Grenoble, Museum of Natural History

Neo classical architecture; Slat roof.

4. First applications to use case in France, Italy and Sweden

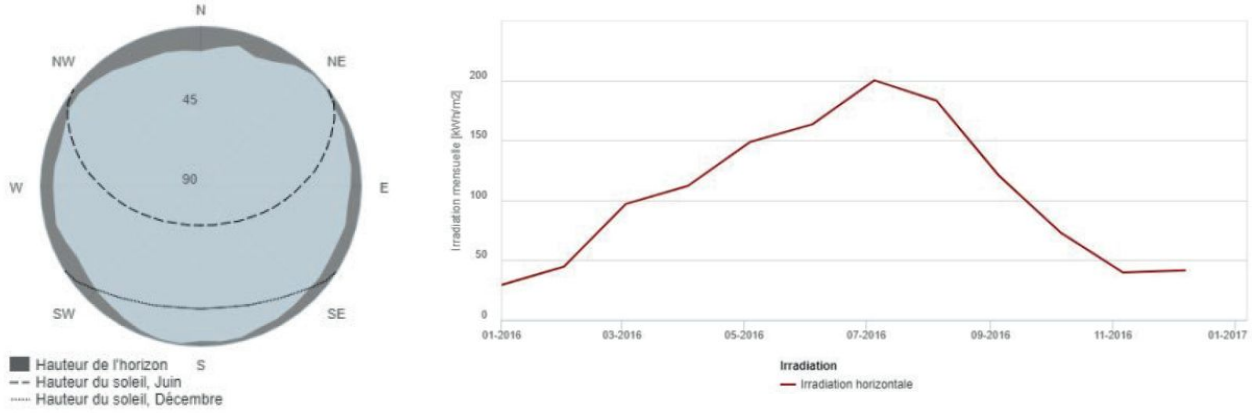
Use case at Grenoble

Possibility for PV integration and identification of materials: existing study (RL&A in 2020)

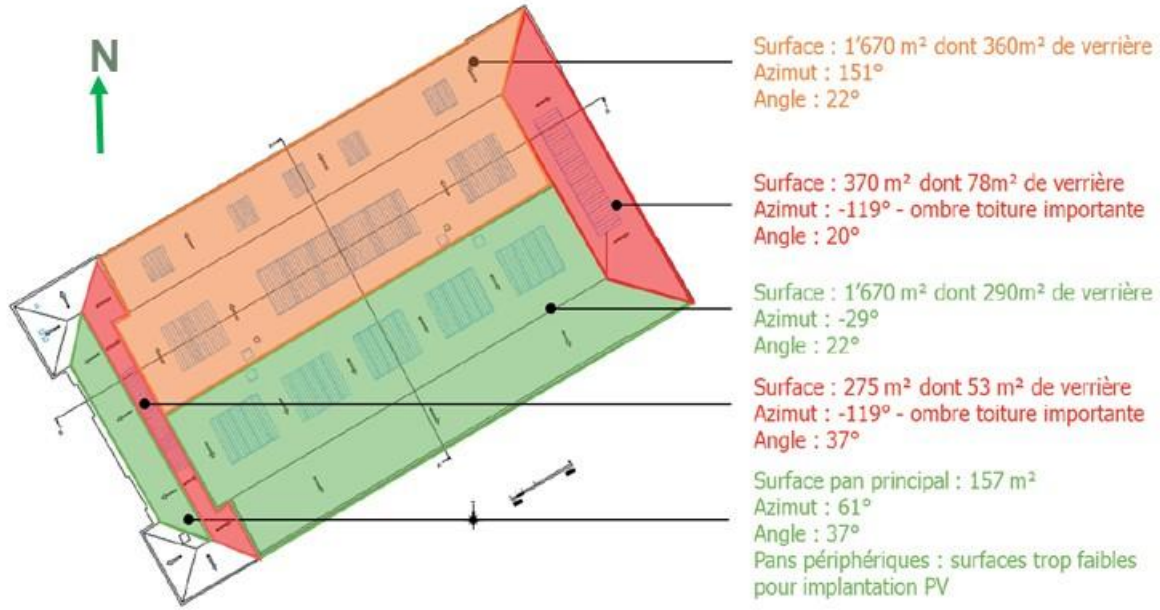
- Possible shading analysis using PVGIS tool.
  - Far shadings from surrounding mountains;
  - No shading from surrounding buildings;
  - Shadows from building itself.

- Relevant surfaces for PV integration
  - Optimal orientation at South-East and South-West;
  - Skylight and metal sheet.

Southwestern view of the building – source Google Earth



Horizon and monthly horizontal solar radiation –source Google PVGIS



Available roof areas for PV integration (green ones are the most suitable)

4. First applications to use cases in France, Italy and Sweden

Use case at Grenoble

Identified existing products and relevance from heritage point of view: existing study for self-consumption (RL&A in 2020)

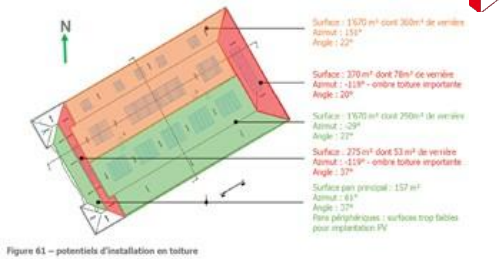


Photo	Nom	Surface disponible brute (m^2)	Rendement	Coût
	Panneaux verriers photovoltaïque à cellules au silicium cristallin	290 à 650 90% disponible	100 à 200Wc/m^2 selon densité 12 à 20%	++
	Panneaux verriers à cellules au silicium cristallin et découpe laser	290 à 650 90% disponible	40 à 80Wc/m^2 selon densité 12 à 20%	+++
	Panneaux au silicium cristallin – toiture plate et panneau faisant office d'étanchéité	1'380 à 3'430 70% disponible	230Wc/m^2 12 à 20%	+
	Couverture zinc avec panneaux silicium couche mince intégré	1'380 à 3'430 60% disponible	50Wc/m^2 12 à 20%	++

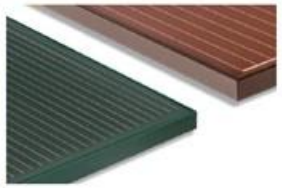
PV glass : Remain visible from the outside and from the attic, and keep a good production performance



PV glass: More discreet solution that does not leave them visible, but more expensive and less efficient


Opaque PV modules: Although color and maximum potential of building with complete roof covering by panels, **too imposing** vis-à-vis the exterior appearance of the building. Not conceivable from the heritage point of view.





PV zinc sheet: No more on the market for durability issue.

This step need to be updated based on a survey and Repository.

4. First applications to use cases in France, Italy and Sweden

Use case at Ercolano

Possibility for PV integration, identification of materials and existing products : first analysis

- Relevant surfaces for PV integration
  - On flat roofs on both buildings;
  - On the ground: carport.
- Possible PV products
  - Superimposed solution (south oriented or E/W);
  - Canopies;
  - Ground mounted systems.

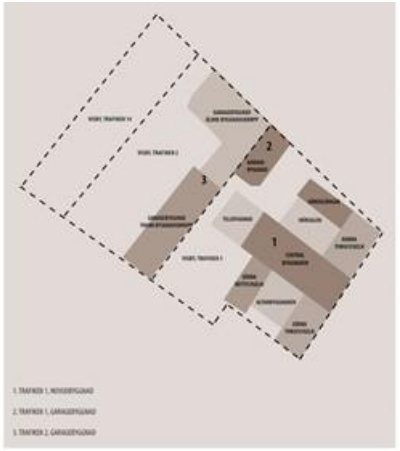
Heritage values should be evaluated based on a survey to owners.

4. First applications to use cases in France, Italy and Sweden

Use case at Visby

Possibility for PV integration, identification of materials and existing products : first analysis

- Heritage Value Assessment and Sensitivity Analysis (of areas protection levels)
- Relevant surfaces for PV integration
  - On roofs (1; 2)
  - On the ground (3; 4; 5; 7);
  - Adjacent building also assessed (6)
- Possible PV products
  - PV tiles;
  - Ground mounted systems.



Options Roof 1 & 2

Dyaqua customized

Nibra OBH

Validation steps and expectations should be identified based on a survey to local Authorities.

5. Conclusion and outlooks

- This approach will be improved based on an assessment of success stories and criteria to ease the acceptance of PV modules on historic building.
- An application will be performed also on the use cases in Switzerland.
- Market survey will be updated to identify new products to integrate in the Sample Box.
- A basic survey to address to local Authorities could be proposed for other historic buildings.

CALECHE project: Task 4.5 survey for information requirements on use cases

From responsible of use case to local authorities

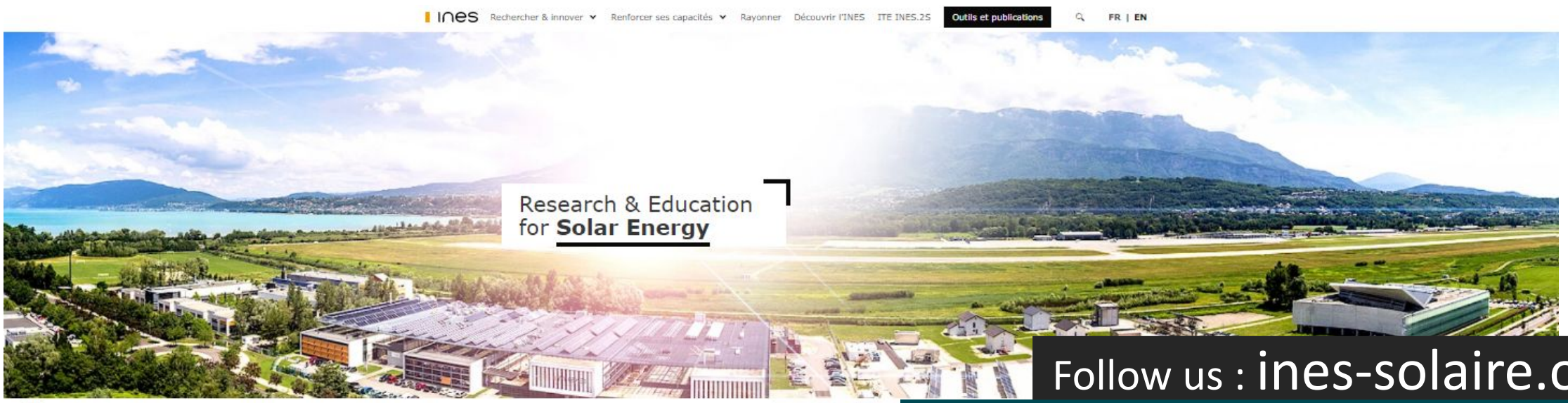
How to ease Your acceptance of a Photovoltaic (PV) project on historic building?

Step 1- Study of possibility for PV integration into roof, facade and site surroundings at your locality

	Yes	No
1.1. What are the steps (regulation, standards…) and documents to provide to propose a PV project for an historic building in your local area? **Step 1: Step 2: Step 3:**		
1.2. Are they some more critical zones (most protected or with more heritage values) on your historic building? Which one?		
1.3. Are they some existing documents on the statement of heritage significance (assessment of heritage material value) of your historic building?		
1.4. Are there any local policies regulating the permitting process for PV integration of solar technologies acceptance? Which one?		
1.5. Do you prefer building applied (a) (PV module added on initial roof elements with few modifications) or building integrated (b) PV solutions (PV module replacing initial roofing elements) on your historic building?  (a) (b)		
1.6. What could be your main expectations for a PV integration into historic building for the most protected zones?		
Esthetic level preservation compared to initial building		
Restoration of building to identical initial shape and aspects		
Ease of installation and dismounting		
Additional profits (energy production, insulation, protection, among other)		
None		
1.7. What are the main actors or stakeholders involved in the decision process to consider for your historic building?		
Local Authorities		
Architects; Cultural heritage experts/antiquaries		
Public, neighbors		
Building owners		
Unesco		
Other…		
1.8. Based on your criteria, which are the three most common historical roof-materials used in most protected cultural heritage areas of your historic building? **1. 2. 3.**		
1.9. Could you accept a PV module installation in areas (ground and building) close to your historical building?		

1

Example of survey to be addressed to local Authorities in the CALECHE project.



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Le solaire photovoltaïque haut rendement à forte compétitivité

Photovoltaïque intégré X-IPV

Le solaire intégré pour toutes applications

Photovoltaïque et stockage au service du mix énergétique

Solutions pour l'intégration massive du photovoltaïque

Du bâtiment à la smart-city

Le bâtiment, nœud énergétique au cœur de la smart-city

Les Smart-grids multi énergies

Les réseaux intelligents au service des territoires

Économie et environnement

Vers une maîtrise de l'impact environnemental des dispositifs photovoltaïques

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Inherit

Cultural heritage buildings in Europe

- Were built in different eras and with different techniques
- Need preservation or renovation
- Are little accessible by citizen
- Could find new uses

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The project

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Our ambition

INHERIT will offer a methodology to make historic buildings **more sustainable, accessible and energy efficient**, while maintaining their cultural heritage value.

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Application to eight real-world pilot sites

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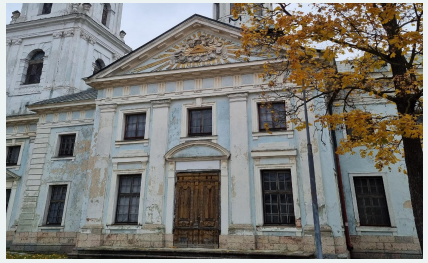
CH sites/pilots

INHERIT will be demonstrated and validated in 8 real-life CH sites across 8 countries. The geographical coverage of the selected heritage buildings aims to support the large-scale EU-wide replicability of the INHERIT solutions in different socio-economic, - cultural, -political contexts to maximise the impact of INHERIT across Europe

City Administration Headquarters
City of Jastrebarsko, Croatia

Le Printemps de Metz landmark building

ELLET building in Tripodon Street
City of Athens, Greece



Ave Sol Concert Hall
City of Riga, Latvia

Social residential building
City of Gdynia, Poland

Monastery ‘Ntra. Sra. del Prado’
City of Valladolid, Spain

City of Visby, UNESCO World Heritage Site
Gotland, Sweden

Ahmet Piriştina İzmir City Archive and Museum (APİKAM)
City of İzmir, Türkiye

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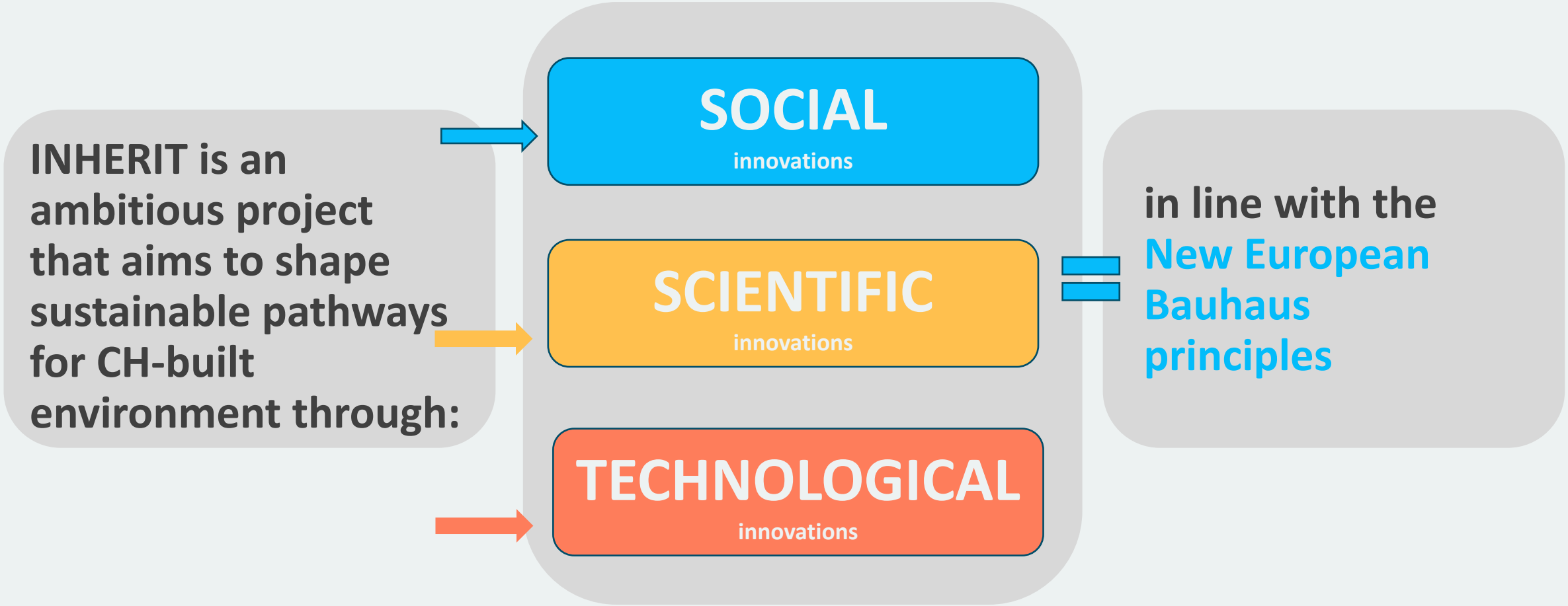
INHERIT methodology



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Social Layer

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Our methodology

Social layer:

- Use of **social sciences and humanities** to produce research evidence and ‘real world’ impact.
- **Multi-stakeholder approach**, to point out needs and interests
- **Co-creation process** based on Social Labs and Multi-stakeholder Forums

Scientific layer:

- Set-up of a **European common approach** to achieve a balance between sustainable building performance and heritage values preservation
- Use of an **Assessment & Monitoring Framework** to evaluate the cultural heritage sites
- Creation of the INHERIT Hub to **define affordable and viable solutions** to renovate heritage buildings

Technological layer:

- Use of existing technological solutions and tools to provide **11 services in 4 key areas:**
  - Data collection and sharing
  - Design and renovation
  - Monitoring, operation, and management
  - Preservation and maintenance
- **Combination of models and algorithms**, use of **ICT** (i.e. AI, IoT, Augmented Reality, Digital Twin)

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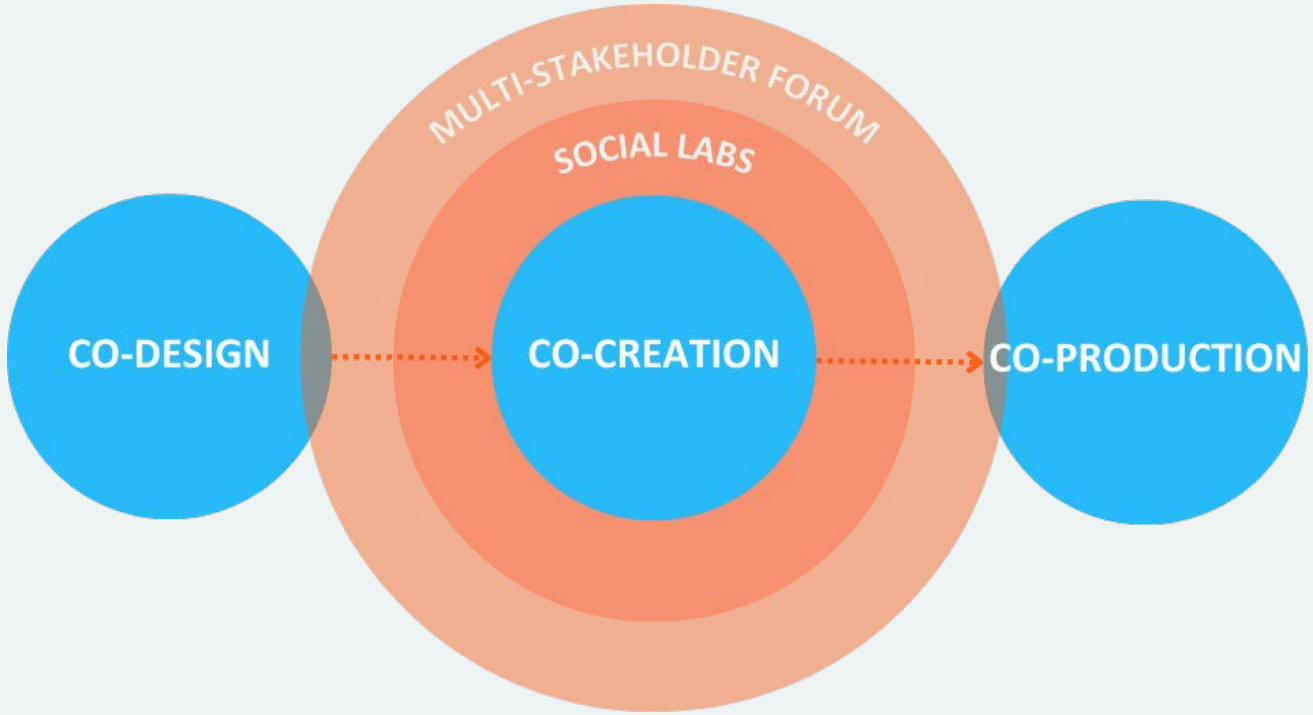
Collaborative Design Thinking as Methodology

- This method enables the collaboration between experts from the INHERIT consortium and end users or key stakeholders in the social labs and the MSF.
- The phases of this method are:

- **empathise**
- **define**
- **ideate**
- **prototype**
- **test**



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Scientific Layer

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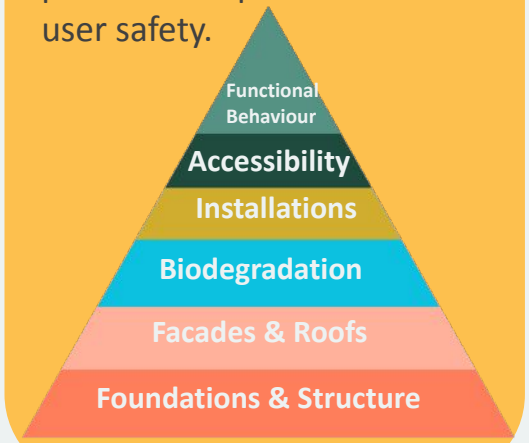
First Release of the INHERIT Assessment & Monitoring Framework

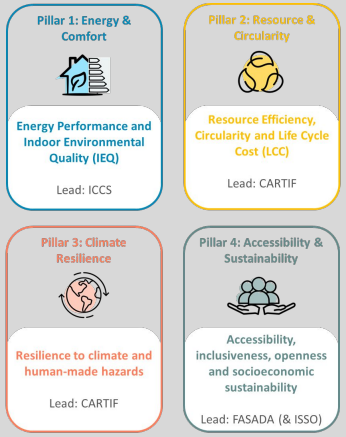
TECHNICAL INSPECTION

It emphasises the **structural safety and integrity of the building,** beginning with the foundations and structure to prevent collapse and ensure user safety.

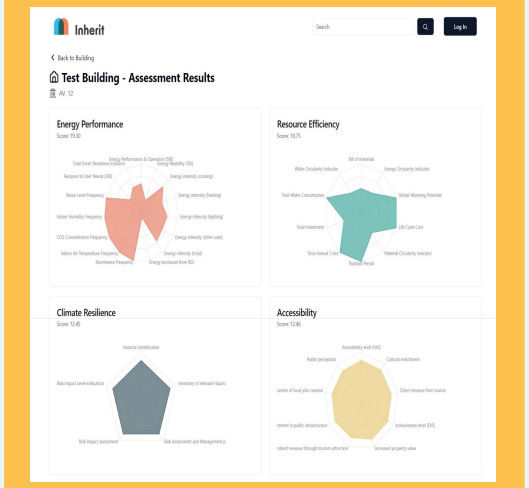


FRAMEWORK

Assessment and monitoring framework for assessing the current status of CH buildings, structured in **four pillars**.



TOOL



HUB OF MEASURES

The INHERIT Hub of Measures offers a valuable resource for managing and modernizing the CH sites

83 measures have been collected

37 measures can be applied to **CH with high level protection**

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Technological Layer

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Our methodology

Social layer:

- Use of **social sciences and humanities** to produce research evidence and 'real world' impact.
- **Multi-stakeholder approach**, to point out needs and interests
- **Co-creation process** based on Social Labs and Multi-stakeholder Forums

Scientific layer:

- Set-up of a **European common approach** to achieve a balance between sustainable building performance and heritage values preservation
- Use of an **Assessment & Monitoring Framework** to evaluate the cultural heritage sites
- Creation of the INHERIT Hub to **define affordable and viable solutions** to renovate heritage buildings

Technological layer:

- Use of existing technological solutions and tools to provide **11 services in 4 key areas:**
  - Data collection and sharing
  - Design and renovation
  - Monitoring, operation, and management
  - Preservation and maintenance
- **Combination of models and algorithms**, use of **ICT** (i.e. AI, IoT, Augmented Reality, Digital Twin)

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	INHERIT pilots		Pilot 1	Pilot 2	Pilot 3	Pilot 4	Pilot 5	Pilot 6	Pilot 7	Pilot 8
Data collection and sharing	Smartification & Data Exchange Platform	s.0								
Design & Renovation	Interactive screen use & AR-VR interfaces	s.1								
	Modelling & simulation environment	s.2								
	Decision support tool for optimal renovation planning	s.3								
Monitoring, Operation & Management	Indoor environmental quality & comfort optimisation	s.4								
	Energy forecasting & data-driven intelligent management	s.5								
	Digital twin for heritage facilities' real-time monitoring	s.6								
	Real-time insights on activity and mobility patterns	s.7								
Preservation & Maintenance	Preventive maintenance with H-BIM	s.8								
	GIS-based solution for sustainable heritage maintenance	s.9								
	Heritage buildings environmental climate scenarios	s.10								

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Roadmap

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Planned replication activities

Creation of **new international standards** for cultural heritage management

Replication of INHERIT methodology in other cultural heritage sites

Development of new decision models and guidelines for policy makers

Adaptation and tailoring of INHERIT solutions to other buildings with specific needs

Sharing of collected data

Development of training materials and a **capacity building programme**

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Consortium

A consortium of 18 partners from all over Europe

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Thank you!

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