

# 3ENCULT - Efficient Energy for EU Cultural Heritage

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## 3ENCULT

### Efficient Energy for EU Cultural Heritage

Project under negotiation

n°260262

Submitted under FP7-EeB.ENV.2010

Theme 6. Environment (including climate change)



## Historic buildings

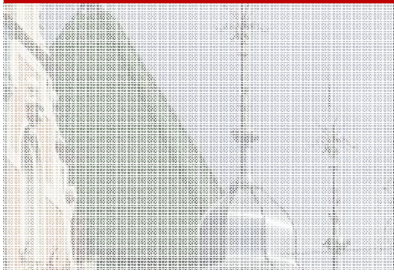
- ... are the trademark of numerous European cities
- ... are a living symbol of Europe's rich cultural heritage & diversity
- ... reflect the society's identity and need to be protected
  
- ... show a high level of energy inefficiency
- ... contribute with considerable CO<sub>2</sub> emissions to climate change
- ... do not always offer "comfort" - to people as well as to artworks



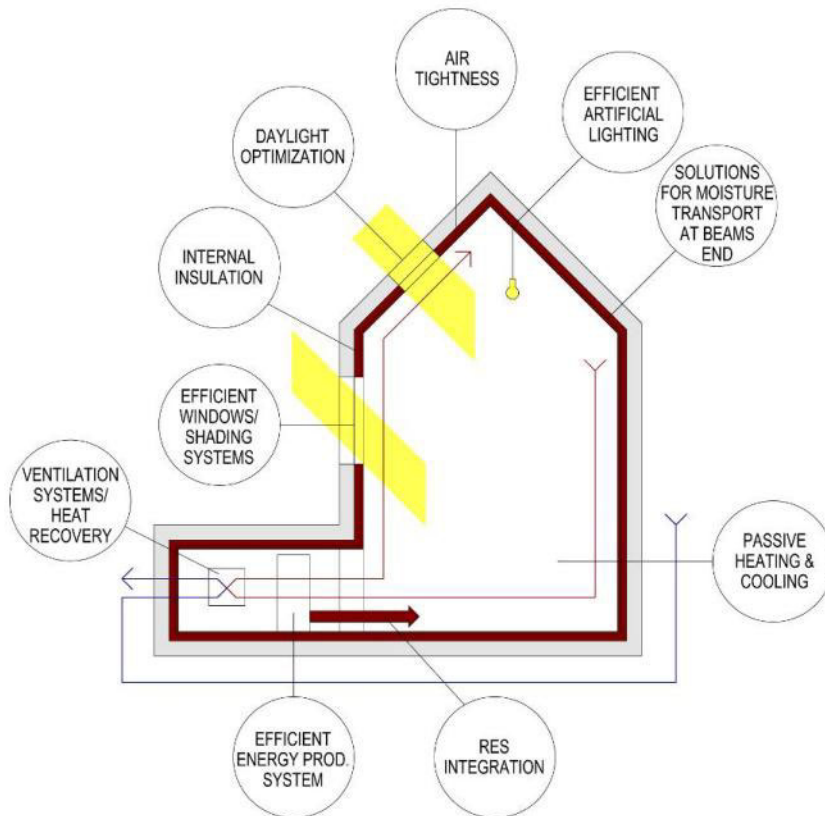
## Historic buildings

Talking in numbers:

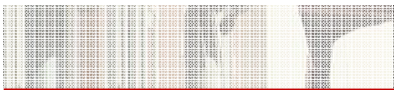
- 150 towns & urban fragments are World Cultural Heritage sites
- 55 million dwellings, home to 120 million Europeans, were built before 1945
- they need 1400 TWh of energy and emit 300 Mt of CO<sub>2</sub> (est.ed)
- contribute to the income from tourism - which stands for 5.5% of EU GDP and employs 6% of EU workforce
- Factor 4 to 10 of energy reduction is achievable, also in historic buildings, respecting their heritage value, if a multidisciplinary approach guarantees the implementation of high quality interventions, specifically targeted and adapted to the specific case



## Objective 1: Passive and active energy retrofit solutions



- Develop passive and active solutions, as result of **open and constructive dialogue** among stakeholders in several fields
- Starting with materials and products already **available** on the market and from solution already applied for new buildings.
- This with the aim to ensure the **widest possible dissemination** of the achieved results all around Europe

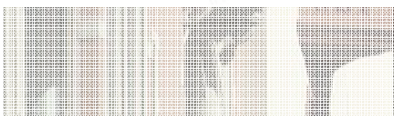
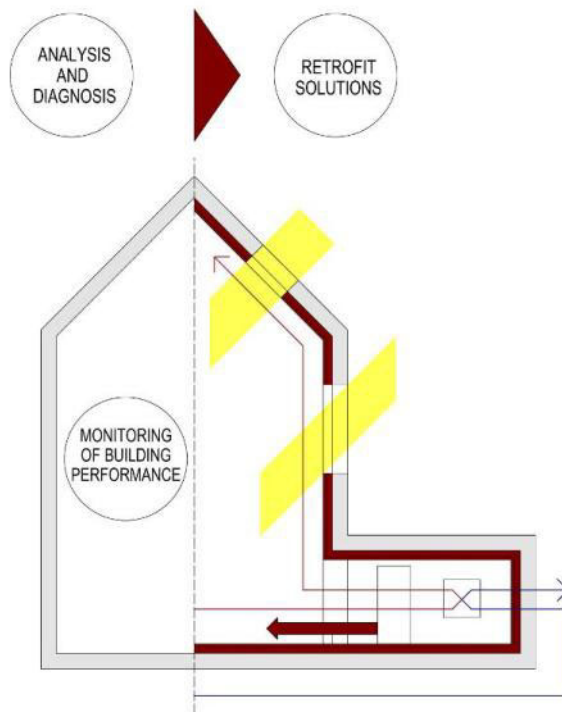




## Objective 2: Diagnosis and Monitoring instruments

Define **diagnosis and monitoring instruments**

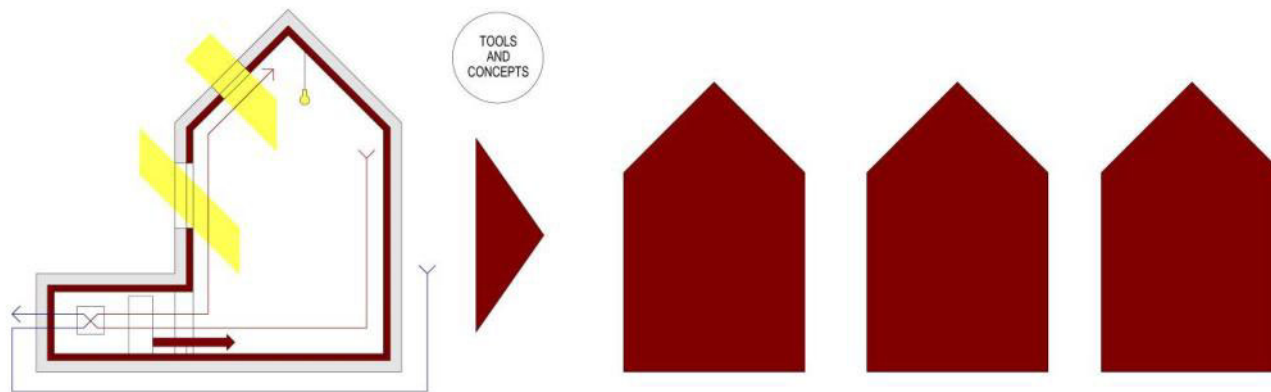
- to study historic buildings and find out the best technological and constructive energy retrofit solutions
- to support their commissioning
- to assess the actual performances of buildings once retrofitted and
- to monitor such performance.



## Objective 3: Tools and concepts - the urban context

### Develop tools and concepts

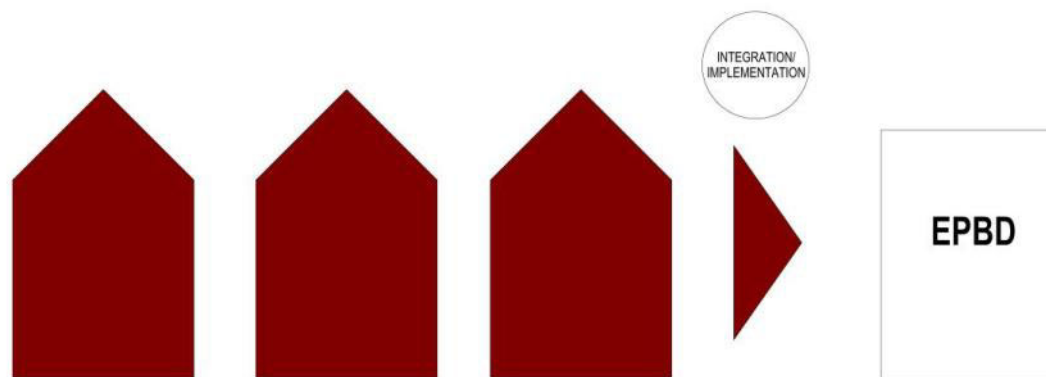
- supporting the implementation in different urban context
  - ensuring their effective transferability to historic buildings located in different locations
- calculation software, solutions inventories, dedicated internet portal, monitoring systems, assessment approaches.



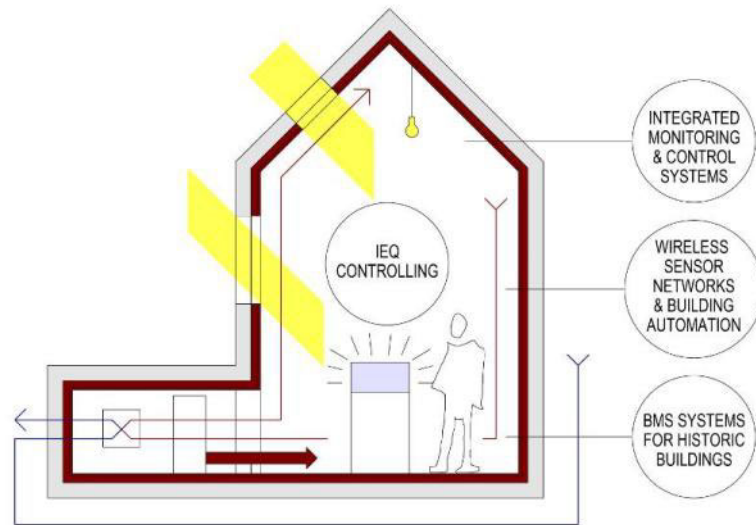
## Objective 4: Integration of the present regulation framework

Issue position papers suggesting possible integrations and/or implementations of the present regulation framework for improving energy efficiency of historic building in urban areas and in particular:

- EPBD - Energy Performance of Building,
- EIA as well as the SEA Directives and SUIIT guidelines



## Objective 5: IEQ controlling



- Define a methodological approach in order to use the developed monitoring system also for **IEQ controlling** in historic buildings where cultural heritage collections are located (comfort for users and “comfort” for heritage collections).



## Project Consortium

The direct project partners cover:

- Conservation experts
- Technical experts
- Urban development experts
- Industry partners
- Implementation experts and stakeholder associations

Furthermore **Local Case Study Teams**, with one project partner as focal point and scientific partner, gather building owner, representatives from the offices for the protection of historic monuments, representatives from other local bodies concerned (e.g. city council) as well as the architects and engineers in charge of the retrofit works

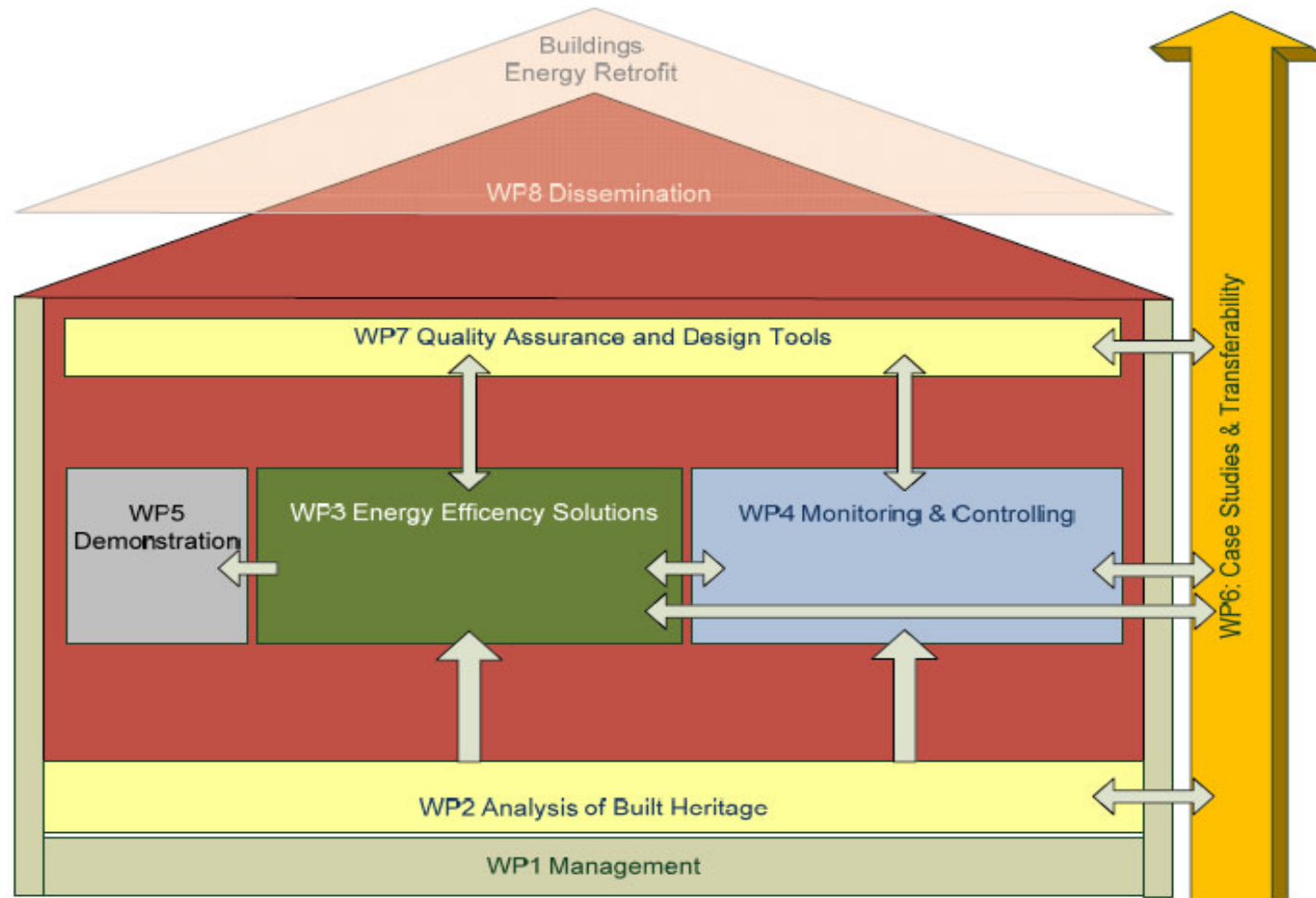
# 3ENCULT - Efficient Energy for EU Cultural Heritage



Project Consortium			Status of organisation						Case study	Review			
			Research	Public body	Association	SME	Industry	other		"Technical solutions"	"Urban context"	"Conservation"	"Dissemination"
1	EURAC research	EURAC	IT	x						x			
2	The Royal Danish Academy of Fine Arts	KA	DK	x						x		x	
4	Universität Innsbruck	UIBK	AT	x						x			
5	ARUP	ARUP	UK					x					
6	Universität Darmstadt	TUDA	DE	x						x			
7	Cartif	CARTIF	ES	x						x			
8	Bartenbach Lichtlabor	BLL	AT				x						
9	TU Dresden	TUD	DE	x						x		x	
10	Comune di Bologna	COBO	IT		x					x		x	
11	Passivhaus Institut	PHI	DE				x						
12	TNO	TNO	NL	x									x
13	Università di Bologna	UNIBO	IT	x						x		x	
14	Artemis	ARTEMIS	IT				x					x	
15	IDK	IDK	DE				x					x	
16	Elettronica Gelbison	GELBISON	IT				x					x	
17	Grupo Unisolar	G1S	ES					x				x	
18	Menuseries Andre	ANDRE	FR				x					x	
19	Remmers	REMMERS	DE					x				x	
20	ATREA s.r.o.	ATREA	CZ				x					x	
21	youris	youris	BE						x				x
22	ICLEI	ICLEI	EU			x						x	x
23	FIEC	FIEC	BE			x							x
24	REHVA	REHVA	BE			x							x

# 3ENCULT - Efficient Energy for EU Cultural Heritage

## Project structure





## Case studies

- The research activities are **accompanied** and **stimulated** by the involvement of different case studies.
- At the same time, the different case studies will allow the **assessment** of the developed solutions.
- From here an analysis will be conducted to generalize proposed solutions, identify **replicable factors** and the context where replication is possible.
- 3ENCULT will contribute to the **diagnosis**, **support the design** and **planning phase** and **give feedback** with its monitoring
- The project **cannot**, however, contribute financially to the **intervention itself**.

It was thus important to select case studies, where the owners are committed to implement dedicated solutions and where the planned intervention's time schedule matches the project's time schedule.



## Case studies - selection criteria

- **DIFFERENT KINDS OF UTILISATION**
  - Reflects typical utilisations in urban areas and ranges from **residential** use over **commercial** and **office** use to **educational** use for a school and university. Furthermore, in order to cover also the special case of the preservation of cultural heritage collections in historic buildings, a building with **museum** use was also inserted, in several other buildings the preservation of frescoes in the interior is an issue.
- **DIFFERENT KINDS OF BUILDING STRUCTURE AND EPOCH**
  - The buildings date from **different epochs** - ranging from middle age (13<sup>th</sup> century) to the 20<sup>th</sup> century. As regards the buildings structure, the most common types ranging from **stone**, over **masonry** and **clinker** to **wooden** structures are covered. Both very “heavy” buildings with **high thermal inertia** are present and lighter constructions with **large transparent areas** - having both their specific advantages and issues.



## CS1: Public weigh house Bolzano (IT)

- **Object**  
Building of Romanesque origins (13<sup>th</sup> century). Rehabilitation intervention necessary. Use: commerce, residential, (exhibition). Owner: Stiftung Südtiroler Sparkasse (foundation)
- **Proposed activities**
  - diagnosis & support for architecture competition
  - support during planning phase (insulation, windows, energy system)
  - transfer to concept on urban scale



## CS2: Palazzo d'Accursio Bologna (IT)

- **Object**  
13<sup>th</sup> century nucleus, developed over centuries. Use: museum, public administration. Owner: Comune di Bologna
- **Proposed activities**
  - diagnosis & NDT
  - support during planning phase (insulation, windows, HVAC, lighting?)
  - transfer to concept on urban scale



## CS3: Palazzina della Viola Bologna (IT)

- **Object**  
15<sup>th</sup> century, lightened by double open gallery, enriched with frescoes and painted wooden ceilings. Intervention and functional requalification planned. Use: university. Owner: University of Bologna
- **Proposed activities**
  - diagnosis & NDT,
  - modelling
  - verification of intervention results



## CS4: University library Fiolstraede Copenhagen (DK)

- **Object**  
Constructed in mid 19<sup>th</sup> century, Architect JD Herholdt. Use: library - will be transformed to administration. Owner: University of Copenhagen
- **Proposed activities**
  - diagnosis & NDT,
  - support in planning phase
  - relation to context and site



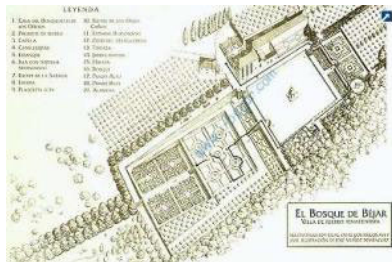
## CS5: Siegmair School Innsbruck (AT)

- **Object**  
Building constructed in 1960s, listed for architectural reasons. Mural paintings from Rehm, Diesner, Berger, Honeder et al. High energy demand (400kWh/m<sup>2</sup>a), severe overheating, air quality and moisture problems. Use: School. Owner: Innsbrucker Immobilien GmbH&Co KG
- **Proposed activities**
  - highly efficient passive house windows with integrated shading,
  - external insulation of walls and roof
  - ventilation system with heat recovery



## CS6: Warehouse City Potsdam (DE)

- **Object**  
Schinkelspeicher (19<sup>th</sup> century), refurbishment already completed, monitoring data available to 3ENCULT. Persiuspeicher (17<sup>th</sup> century), refurbishment planned. Use: Residential, offices, exhibition. Owner: Speicherstadt Potsdam
- **Proposed activities**
  - diagnosis of historical constructions
  - development of energy efficiency solutions (insulation, windows, energy system)



## CS7: Historic Building Bejar/Salamanca (ES)

→ Cover also hot dry summer climate

### ■ Objects

1. Salamanca University Building (19<sup>th</sup> century). Project in advanced state, (photovoltaic galleries, semi-transparent atriums, analyze air tightness ...)

### ■ Proposed activities

diagnosis of historical constructions, support in design phase



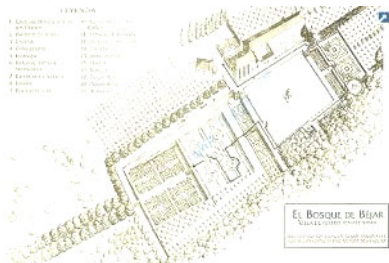
## CS8: Strickbau Appenzell (CH)

### ➤ Object

Old Strickbau-building in Appenzell/Switzerland (17<sup>th</sup> century)

“Strickbau”-buildings are prevalent in most alpine regions and consist of layered wooden beams, connected at the corners for stability and typically extending somewhat from the core block).

Permission to dismantle the old wooden building with the constraint to make it available to research for one year.



## CS7: Historic Building Bejar/Salamanca (ES)

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### ■ Proposed activities

diagnosis of historical constructions, support in design phase



## CS8: Strickbau Appenzell (CH)

### Proposed activities

This allows for outstanding activities!

- to analyze behaviour of wooden constructions after **extreme interventions**
- to use **destructive analysis techniques** usually not applicable on historic wooden buildings.
- to realise **different thermal and moisture conditions**



## Strategic impact

### 3ENCULT TRIGGERS SIGNIFICANT ENERGY SAVING IN HISTORIC BUILDINGS

- Build upon experience, solutions based on already market available products
- Demand side fostered with ICLEI, involving a network of engaged municipalities
- Supply side prepared addressing FIEC's and REHVA's associated enterprises

### 3ENCULT LEADS TO SUBSTANTIAL CO<sub>2</sub> REDUCTION

- ECTP vision: 30% retrofitted by 2030, 100% by 2050
- Factor 4 reduction = 225 Mt of CO<sub>2</sub> less! (4.5 % of EU-27 emissions in 1990)

### 3ENCULT IMPROVES LIVING CONDITIONS WITHIN HISTORIC URBAN AREA

- Better indoor comfort (perceived temperature, avoided air draught, daylight ...)

### 3ENCULT LEADS TO IMPROVED QUALITY MANAGEMENT OF HISTORIC CITIES

- ICLEI works with committed local governments (Cities for Climate Protection - CCP campaign) on replicable factors to be fed back to the Leipzig charter process



## Strategic impact

### 3ENCULT FOSTERS SUSTAINABLE RENOVATION AND LONG TERM CONSERVATION OF OUR BUILT HERITAGE

- Real protection by integration in everyday life - irrespective of formal protection
- Comprehensive diagnosis for sustainable conservation and selection of compatible (or even beneficial) measures
- SUIT - concept of “active conservation”

### 3ENCULT CONTRIBUTES TO EUROPE’S ECONOMIC RECOVERY

- Smart investment (European Recovery Plan)
  - Action 9: energy efficient systems and material in new and renovated buildings to reduce radically their energy consumption and CO<sub>2</sub> emissions
  - Action 6: set demanding targets
- Demonstration and guidelines, how to use existing products and materials
  - large number of construction enterprises across Europe
- Development of very specific solutions
  - with a number of innovative European enterprises



## Strategic impact

### **3ENCULT PRESERVES THE BASIS FOR CULTURAL TOURISM, A SIGNIFICANT ECONOMIC FACTOR IN EUROPE**

- By providing solutions for the conservation-compatible retrofit of historic buildings, 3ENCULT supports the preservation of the diverse urban landscape in Europe, our typical ‘Old towns’, historic grown structures and public spaces.

### **3ENCULT HELPS IMPLEMENT THE EU ENVIRONMENTAL IMPACT ASSESSMENT DIRECTIVES WHEN APPLIED TO HISTORIC BUILDINGS**

- Enhancement hypothesis for SUIT “Summary Guidance and the Active Conservation principle”, introducing energy issues and more detailed standard references and thresholds in a well framed methodological approach.



## Strategic impact

### 3ENCULT CONTRIBUTES TO EUROPEAN ENERGY POLICY

- EU climate action and renewable energy package - 2020 goals
- EPBD: proposal for a more differentiated approach with the aim to integrate historic buildings
- CEN: contribution to the development of 2<sup>nd</sup> generation standards related to EPBD
- RES integration

### 3ENCULT SUPPORTS THE STRATEGIC RESEARCH AGENDA OF THE EUROPEAN CONSTRUCTION TECHNOLOGY PLATFORM (ECTP) AND ITS FOCUS AREA IN CULTURAL HERITAGE (FACH)

- ECTP-Priority A: healthy and safe indoor environment
- ECTP-Priority C: efficient and clean buildings
- ECTP-Priority D: avoid demolition and improve LCA
- ECTP-Priority F: assessment, diagnosis and monitoring (F1), use of RES (F4) and sustainable management (F5) of cultural heritage



## Strategic impact

...CONTINUES...

### 3ENCULT SUPPORTS [...] FOCUS AREA CULTURAL HERITAGE (FACH)

- to create a global map of different refurbishment and renovation options
- to assess technologies of “energy optimised buildings”, RES

Contribution to three key targets of FACH vision for 2030

- Promotion of energy efficiency in historic buildings
- Reduction in dependence on fossil fuel
- Contribution in reduction of CO<sub>2</sub>

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Thank you for your attention!

For further information:

Enrico Esposito, Artemis  
[e.esposito@artemis-srl.it](mailto:e.esposito@artemis-srl.it)

Coordinator:  
Alexandra Troi, EURAC research  
[alexandra.troi@eurac.edu](mailto:alexandra.troi@eurac.edu)