






1. Public Weigh House, Bozen/ Bolzano (Italy)
Two principal renovations were carried out in the "Waaghaus", a 13th Century building of Romanesque origins located in Bolzano/ Bozen. "Portici": firstly, a prototype of **highly energy-efficient window** compatible with the heritage of the building was installed, and secondly, a **capillary-active interior insulation** was introduced. A **monitoring system** collected data on the temperature and humidity before and after the renovations.
Use: exhibition and cultural functions
Owner: Stiftung Südtiroler Sparkasse (foundation)

2. Palazzo d'Accursio, Bologna (Italy)
The core of the Town Hall, the seat of the municipal government, dates back to the 13th Century and was expanded over the centuries. The renovations allowed the reopening of the prestigious Sala Urbana within the Municipal Arts Collection Museum, and included: **thermal insulation** of the building envelope; installation of **high performance windows**; installation of an **energy saving lighting system**; and installation of **wireless sensors** to monitor the internal climate.
Uses: museums and seat of the local government
Owner: Municipality of Bologna

3. Palazzina della Viola Bologna (Italy)
This heritage light brick masonry structure (16th C.), enriched with frescoes and rare wooden ceilings, is closely linked with its environment. Its requalification has integrated an extended multidisciplinary **non-destructive structural & energetic diagnose** with **microclimate innovative WSN monitoring** of the refurbishment as well as of **post-intervention in-use phases**. The respectful renovation included all the **plant systems** and has cared to preserve delicate artifacts and to improve work space comfort.
Use: meeting place, info office and university department
Owner: University of Bologna

4. Fæstningens Materialegård, The Material Court of the Fortress, Copenhagen (Denmark)
This restoration of the Material Court 1756 is an ambitious project, aiming at reducing the building's energy consumption and CO_2 emissions without violating the heritage value of the building. The project has been performed as a **multidisciplinary process** with advisors from different fields; building physics, heritage value, architecture, energy consumption and CO_2 emission.
Use: public office space
Owner: Realdania Byg

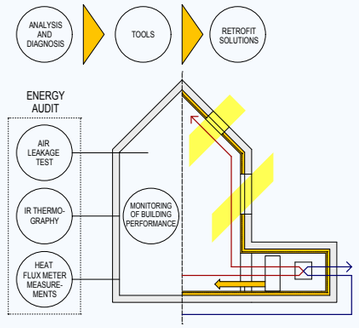
5. Höttinger School - Innsbruck (Austria)
The listed building is an important example of modern architecture in Tyrol (1929-1931). A number of renovations were carried out and tested on two prototype class rooms, which will be further extended to the entire building: **capillary active internal insulation**; improvement of the thermal performance of original windows; **window integrated shading** and **daylight redirection lamellae**; **LED & fluorescent luminaries** and **glarefree daylight redirecting lamellae**; sound absorbers; and **ventilation** air distribution via textile diffuser.
Use: Primary School
Owner: Innsbrucker Immobilien

6. Warehouse City Potsdam & other (Germany)
In four different historical constructions in which four different interior insulation systems have been installed. Each system consists of a specially adapted **glue mortar**, a **thermal insulation**, and the **surface moisture regulation plaster**. Focus was placed on the performance comparison of different solutions for interior insulations: Classicism house in Potsdam, Wilhelminian building in Dresden, Baroque building in Görlitz and Renaissance building in Freiberg.
Use: residential buildings
Owners: Speicherstadt; Frank Zinsser; Janet Conrad; H. Neuhaus

7. Industrial Engineering School-Béjar/Salamanca (Spain)
The Industrial Engineering School of Béjar is a building of the University of Salamanca, built in 1968, and used for academic purposes. Two renovations have been effected regarding the control algorithms: lighting and HVAC systems. Thus, a **redistribution of the better lighting system**, as well as an **advanced optimised control** for lamps and cooling have resulted in an improvement of the comfort and reduction of the energy consumption, integrating both ZigBee and BMSS.
Use: Technical Engineering School
Owner: Universidad de Salamanca

8. Strickbau Appenzell (Switzerland)
The Old Strickbau in Appenzell is a typical alpine building of the 17th Century. The retrofitting interventions involved the **internal insulation of cellar, ceiling and walls** with wood fibre panels, the installation of **wood-based dowels** to improve air tightness, electrical heating and humidifier to control room climate during heating periods. A simulation for the optimization of existing situation of windows in the four insulated rooms was performed. The renovations are controlled in real time by **continuous monitoring**.
Use: Residential building
Owner: Ueli Fässler

Analysis and Diagnosis

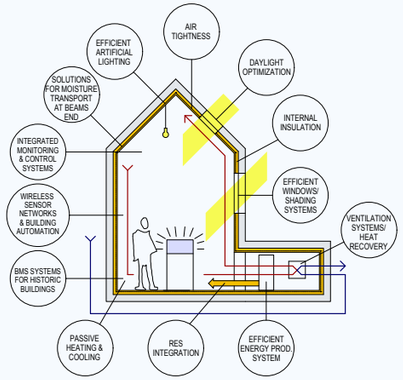


Position paper on energy efficiency and conservation criteria
Report on methodology and checklist
Guideline for the implementation of monitoring system

Tools and concepts

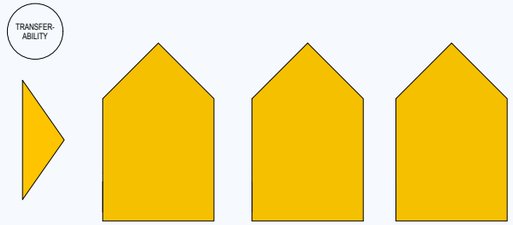
Inventory system based on the "Raumbuch" concept
Calculation tool for project design
Certification criteria and procedures

Retrofit solutions



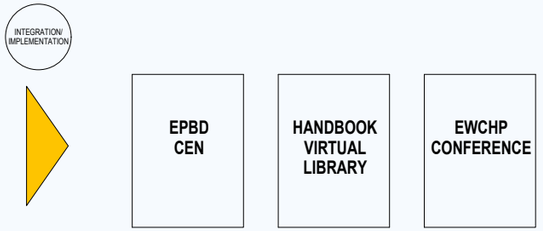
Report on conservation compatibility of developed solutions
Development of high energy efficient heritage compatible prototypes

Energy efficient districts



Recommendation for local governments
Integration of low emission and urban sustainability concepts
E-Guides, workshops and study tours for local governments

Standard implementations
Publications and trainings materials



Relation historic buildings EPBD and EPBD CEN
Integration of historic buildings in the EPBD standard

Virtual library
Handbook
Frequent asked questions
EWCHP conference

The mulltidisciplinary exchange starts with a comprehensive diagnosis, supports the design process, and ends with the implementation of an integrated monitoring & control system.

3ENCULT aims at developing necessary solutions, by adapting existing solutions to the specific issues of historic buildings and developing new solutions and products.

Case studies accompany and stimulate the research activities and at the same time allow for access to pre-existing solutions.

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3encult

EFFICIENT ENERGY FOR EU CULTURAL HERITAGE

3ENCULT bridges the gap between the conservation of historic buildings and climate protection. The project demonstrates the feasibility of reducing energy demand by Factor 4 to 10, depending on the case and heritage value.

One fourth of Europe's building stock was constructed before 1945 – although not all of these sites are listed as being official cultural heritage, the vast majority constitutes Europe's historical treasures and should be treated with care.

The basic principle of 3ENCULT is to include all stakeholders in the design process of the energy retrofit of a historic building.