SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Renovating Historic Buildings Towards Zero Carbon

SHC Task 59 / EBC Annex 76

IEA SHC Workshop: Integrating Solar in Buildings – What We’ve Learned & What’s Next

Alexandra Troi, Eurac Research

IEA SHC “virtual national day”
Online meeting, 15th June 2021

TASK 59
RENOVATING HISTORIC BUILDINGS TOWARDS ZERO ENERGY

There is a need

one of the greatest challenges the continent faces is converting the historic buildings in **Europe's centuries-old cities** for a sustainable future

European climate commissioner and EU executive vice-president Frans Timmermans

We will set up **a new European Bauhaus** – a co-creation space where **architects**, artists, students, engineers, designers work together to **make that happen**

Ursula von der Leyen, State of the Union Adress 2020

Whom we addressed

- **Architects** and consultants
- Building **owners**
- **Heritage** authorities
- Developers and contractors
- Policy makers

Task structure

A. Knowledge Base

B. Multidisciplinary planning process

C. Conservation compatible retrofit solutions

D. Demonstration and dissemination

A – Knowledge Base

Task lead: e7 / Austria

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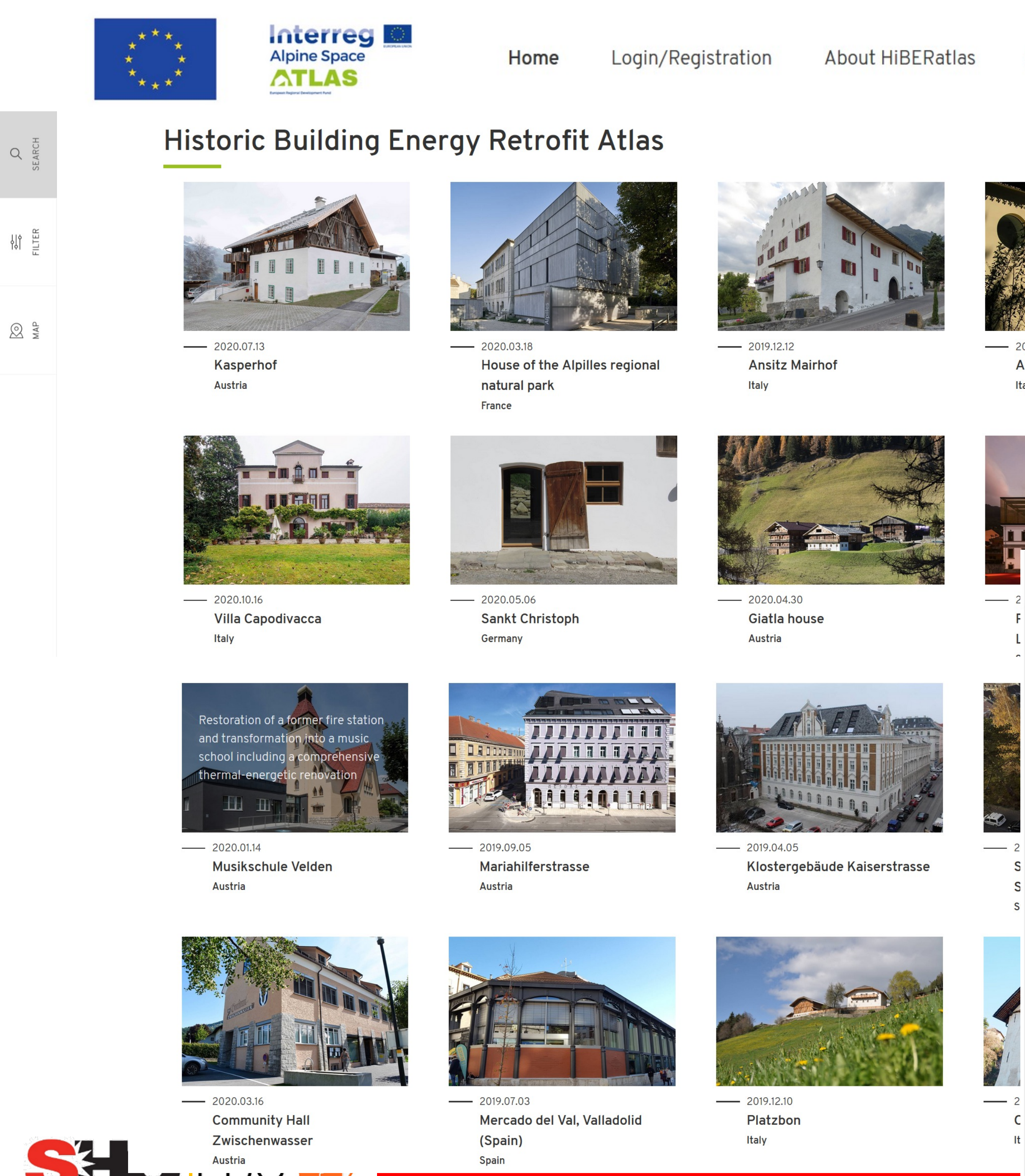
Some highlights – House Breuer, House Maurer, Freihof Sulz

- Original construction was carried out using old techniques wherever possible.
- The **outer wooden façade** has been preserved in its entirety: wooden construction with 24 cm of isofloc insulation -> U-value 0,17 W/m²K
- **Solar thermal and PV system** are integrated in the roof

- The living space changed from a 4-apartment house with 370 m² for an average of 5 people to a 7-apartment house for 12 residents
- Insulation of **Holzstrick** from inside with 100 mm and outside behind the shingles 50 mm (U-value: (0,20 W/m²K)

- Characterized by an **integrative planning process.**
- Special focus on sustainability in the sense of economical and careful use of scarce resources as well as the sensible use of **ecological building materials** are considered.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Historic Building Energy Retrofit Atlas
2020.07.13
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Austria
2020.03.18
House of the Alpilles regional natural park
France
2019.12.12
Ansitz Mairhof
Italy
2019.03.29
Ansitz Kofler
Italy
2020.11.03
Casa Rossa Chemnitz
Germany
2020.04.28
Rebecco Farm
Italy
2020.01.10
St. Franziskus Church - Ebmatingen, Switzerland
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Switzerland
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Villa Capodivacca
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2020.05.06
Sankt Christoph
Germany
2020.04.30
Giatla house
Austria
Restoration of a former fire station and transformation into a music school including a comprehensive thermal-energetic renovation
2020.01.14
Musikschule Velden
Austria
2019.09.05
Mariahilferstrasse
Austria
2019.04.05
Klostergebäude Kaiserstrasse
Austria
2020.03.16
Community Hall Zwischenwasser
Austria
2019.07.03
Mercado del Val, Valladolid (Spain)
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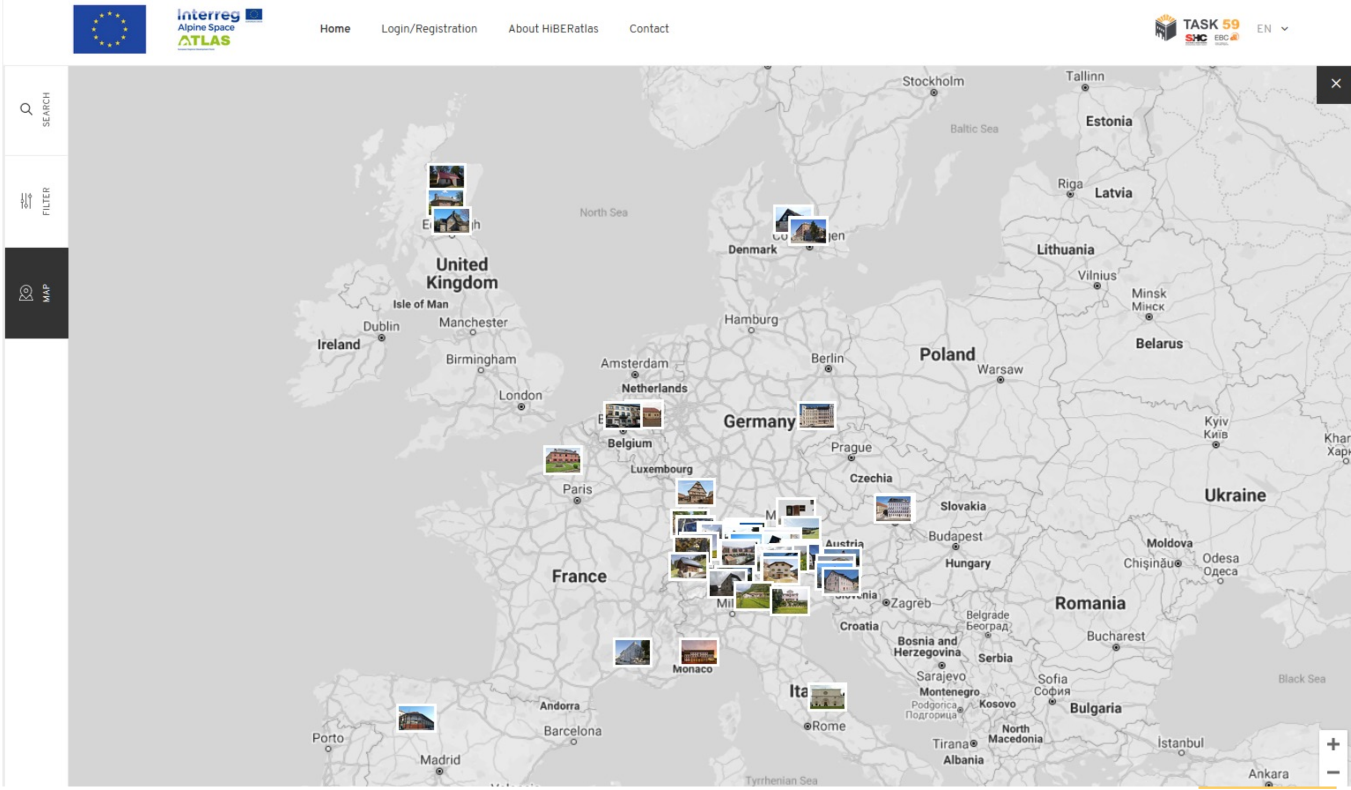
Platzbon
Italy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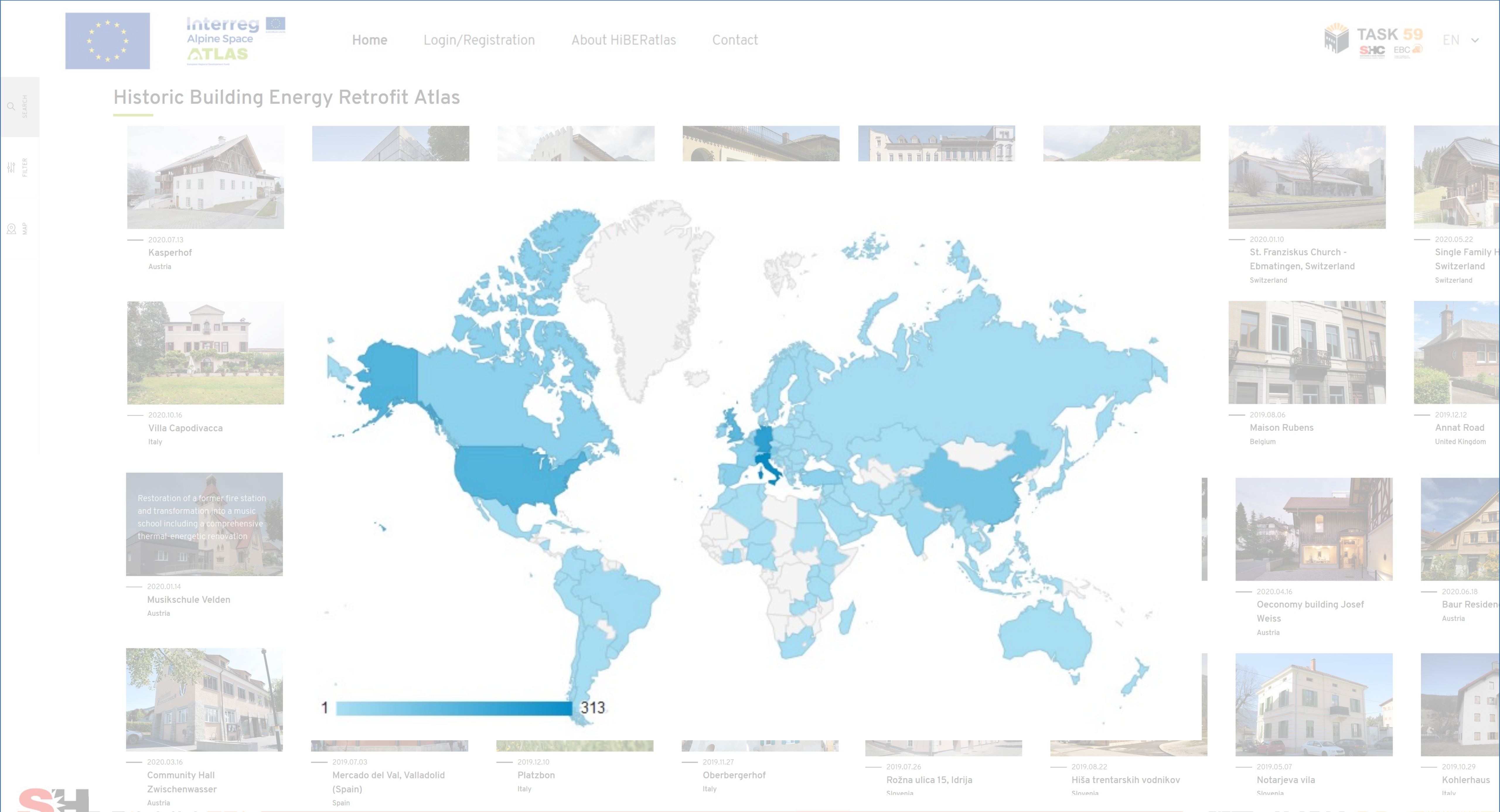

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Villa Capodivacca
Italy
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Maison Rubens
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Annat Road
United Kingdom
Restoration of a former fire station and transformation into a music school including a comprehensive thermal-energetic renovation
2020.01.14
Musikschule Velden
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Oeconomy building Josef Weiss
Austria
2020.06.18
Baur Residen
Austria
2020.03.16
Community Hall Zwischenwasser
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Platzbon
Italy
2019.11.27
Oberbergerhof
Italy
2019.07.26
Rožna ulica 15, Idrija
Slovenia
2019.08.22
Hiša trentarskih vodnikov
Slovenia
2019.05.07
Notarjeva vila
Slovenia
2019.10.29
Kohlerhaus
Italy
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Task 59

Case Studies
Assessment Report
June 2021

IEA SHC TASK 59 | Renovating Historic Buildings Towards Zero Energy

2.1.1 Short description of the case studies

A multi-purpose used convent building in the heart of Vienna has been refurbished with particular attention to monument preservation and to a new solution for renovating Viennese-type box windows. The goal was to present a sustainable system solution with the energetic refurbishment of the existing building and the highly efficient loft conversion according to the requirements of the monument protection.

Klostergebäude Kaiserstrasse Vienna, AT	Building Period: 1850 - 1899 Renovation: 2013	Use: Residential (urban) Protection level: listed	Contact: e7 energy innovation & engineering

The renovation of the Mayrhof in Trins combines several best-practice solutions in one project. In particular, the use of a newly developed façade system and an extension using a house-in-house concept allow architectural and building physics aspects to harmonise with each other.

Farm house Trins Trins, AT	Building Period: 1600 - 1700 Renovation: 2019	Use: Residential (rural) Protection level: not listed	Contact: University of Innsbruck

The former farm house and later on home of the painter Angelika Kaufmann was almost 450 years old, when the architect and new owner Thomas Mennel decided to restore the building and play with it's given qualities. He kept the outward appearance and changed its internals into a spaceship full of places to experience, with its different light and shades - it is a playground and an oasis in the same.

Hof 6, Schwarzenberg Vorarlberg, AT	Building Period: 1600 - 1700 Renovation: 2013	Use: Residential (rural) Protection level: listed	Contact: Energieinstitut Vorarlberg

Exemplary sustainable renovation of a historic mountain hut at 1,432 meters above sea level in Aurach near Kitzbühel. The renovation resulted in a significant increase in the levels of comfort in a mountain hut exposed to severe weather conditions. The building is used all year round after renovation.

Kelchalm – Bochumer Hütte Tirol, AT	Building Period: 1800 - 1849 Renovation: 2013	Use: Hotel/Restaurant Protection level: not listed	Contact: University of Innsbruck

Modernization of a Gründerzeit building with the use of an aerogel insulating plaster. In addition to the restored façade, the exterior of the new attic storey is initially noticeable. he building received two major awards: the 1st prize of the 33rd Vienna Urban Renewal Prize by the National Guild Construction Vienna, and the State Prize for Architecture and Sustainability 2019 by the Federal Ministry for Sustainability and Tourism.

Mariahilferstrasse 182 Vienna, AT	Building Period: 1850 - 1899 Renovation: 2018	Use: Residential (urban) Protection level: not listed	Contact: e7 energy innovation & engineering

4.2.3 Ventilation

4.2.3.1 Overview of ventilation solutions

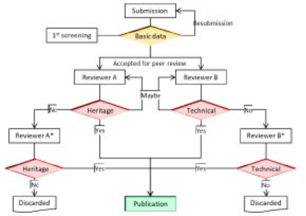
Table 14: Overview – ventilation solutions

No	Case study	Country	Building type	Intervention [to be completed]	Heat recovery
1	Klostergebäude Kaiserstrasse	AT	res|urban	Semi-centralised MVHR, distribution with exist shafts	yes
2	Farm house Trins	AT	res|rural	centralised MVHR with cascade system	yes
3	Hof 6,	AT	res|rural		
4	Kelchalm - Bochumer	AT	hotel	decentralised MVHR for laundry rooms	yes
5	Mariahilferstrasse 182	AT	res|urban	centralised MVHR with bypass	yes
6	House Maurer,	AT	res|rural		
7	House Breuer,	AT	res|rural	centralised MVHR	yes
8	Music school in Velden	AT	education	2 centralised (from attic and using existing chimneys)& 1 decentralised systems	yes
9	Hof Neuhäusl	AT	res|rural	centralised MVHR	yes
10	Community Hall Zwischenwasser	AT	offices	centralised MVHR with cascade system	yes
11	Freihof Sulz	AT	hotel	centralised MVHR	yes
12	Oeconomy building Josef Weiss	AT	res|urban	centralised MVHR for kitchen, restaurant & dining room	yes
13	Giatla Haus	AT	hotel	centralised MVHR with humidity control	yes
14	Rhine Valley House	AT	res|rural		
15	Baur Residence,	AT	res|rural		
16	Kasperhof	AT	res|rural		
17	Maison Rubens	BE	res|urban	centralised MVHR using chimneys	yes
18	Half-timberframed house in Alken,	BE	res|rural	centralised MVHR	yes
19	Doragno Castle, Rovio (CH)	CH	res|rural	centralised MVHR	yes
20	Solar silo	CH	offices	natural ventilation, manual via windows	no
21	Wohn- & Geschäfts-haus Feldbergstrasse	CH	res|urban	centralised MVHR	yes
22	Mehrfamilienhaus Magnusstrasse	CH	res|urban	centralised MVHR	yes
23	St. Franziskus Church	CH	other		
24	Kindergarten and apartments (PEB)	CH	res|urban	decentralised MVHR, night cooling	yes
25	Single family home Luisenstrasse - Bern	CH	res|urban	centralised MVHR with screed in built-in cupboards	yes
26	Single Family House -	CH	res|rural		
27	Glaserhaus in	CH	res|rural	natural ventilation via windows)	no
28	PalaCinema Locarno	CH	other	centralised MVHR, differentiated use sector	yes
29	Casa Rossa Chemnitz	DE	res|urban	Exhaust ventilation	no
30	Rathaus Bergrheinfeld	DE	offices	Centralised MVHR	yes
31	Farmhouse Straub	DE	res|rural		
32	Early work Sep Ruf	DE	res|rural		
33	Ackerbürgerhäuschen	DE	res|rural	centralised MVHR	yes
34	Ritterhof	DE	res|rural	centralised MVHR for part of the building	yes

1.2 Quality assurance (review process) (Franziska)

Ensuring the quality of the best-practices displayed in the database is crucial to help eradicating any concern about professionals' expertise. The implementation of a review process that can assess the validity of the projects and, most importantly, the way they are documented becomes necessary. The ultimate goal of the review process is not to reject proposed examples but to ensure their robustness and to improve the way they are presented. The review model takes inspiration from the academic peer-review process. Every best-practice gathered during the project was and will be assessed by the experts participating in the Task 59 following this methodology to test the feasibility of such review process. At the end of the Task 59 project, the lessons learned will be used to adapt and improve the reviewing model.

Figure 1: Review process in Task59



After checking the completeness of the information provided, the best-practice is assigned to at least two members with different expertise: Heritage or Technical. If a case study is rejected by one of the reviewers, this is submitted to an alternative reviewer for a second opinion. A second rejection will mean that the project should not be included in the database.

For the review a template was developed, that was tailored to heritage and technical focus. It was asked for an overall evaluation according to Heritage Compatibility and Technical feasibility. Furthermore, there is the possibility to mention other positive aspects of the project, like economic and environmental aspects, robustness and others.

Table 1 Extract of the review template, first part with key information

1.) Overall evaluation (the overall evaluation should be completed for all aspects 1.1 – 1.3 by all reviewers regardless of their expertise):			
*1.1) What is your overall assessment of the project regarding **Heritage Compatibility**? Please select one of the categories below and write a short explanation*			
Recommended as role model	Recommended with limitations	Not recommended	Please justify your selection shortly! Further explanations can be found below.
O	O	O	

This key- information part of the template is followed by questions which are supposed to be answered more in detail, asking mainly for the completeness and comprehensibility of the documentations.

It turned out that most projects were rated yellow, what means the projects seemed suitable for the database, but the documentation had to be at least partially completed. Only one project received a red rating in the first review from the Heritage expert. After a second review, however, this project was also given a yellow rating and asked to provide additional information. Only one of the evaluated projects received a green rating in both aspects, heritage and technical, with the first review.

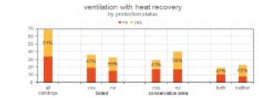


Figure 52: Ventilation with heat recovery by main use in absolute numbers (left) and share (mid) as well as by both considering main and secondary use (right)

35 buildings with MVHR correspond to slightly more than half of all the documented good practice buildings. Th fact that looking specifically at listed buildings, 47% have been equipped with a ventilation with heat recovery, induces, that it might be slightly but not considerably more difficult to integrate a ventilation system in a listed building. The analysis looking at whether buildings are situated in conservation areas or are both – listed and in conservation areas – shows the same trend.

Figure 53: Ventilation with heat recovery by main use in absolute numbers (left) and share (mid) as well as by both considering main and secondary use (right)

Ventilation systems have more often be considered in retrofits of urban than rural residential buildings: the number of documented ventilation systems is with 12 each equivalent, but since overall less urban residential buildings have been documented, the share is with of 2 out of 3 retrofits with ventilation system highest there. This value is only topped, when looking explicitly at buildings with any kind of educational use: 2 out 3 with it as main use have ventilation system, including those with a secondary educational use the numbers rise to 4 out c – this shows a clear sensibility for indoor air quality in these cases.

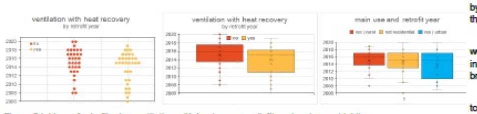


Figure 54: Year of retrofit – by ventilation with heat recovery (left) and main use (right)

The hypothesis, that recent retrofits might more often include MVHR since experience on how to implement it is rising is not supported by the collected data: the whisker plot of retrofits with and without MVHR actually shows that thos with MVHR are on average "older". This could, however, also be due to the fact that there is dominanc of rural residential restrofits in the documented recent cases, which as has been shown above are less likely to equipped with MVHR.

42	Rainhof	IT	steady state	0		60.0	0		
43	Villa Castelli	IT	steady state	0	230.2	18.3	0		32.4
44	Ansitz Kofler	IT	steady state	0		30.0	0		
45	Basilica di Collemaggio	IT	NA	0		3.1	0	191.5	3.1
46	House Pernter	IT	NA	1		26.5			
47	Kohlerhaus	IT		1		68.3	1		16.9
48	Ruckenzaunerhof	IT		0	360.0	110.0	0		
49	Ausserqrubhof	IT		0		107.0	1		42.2
50	Oberbergerhof	IT		0	230.0	135.0	1	260.0	181.0
51	Platzbonhof	IT	steady state	0		74.0	1		39.0
52	Mairhof	IT	NA	1	283.0	66.0	1	283.0	57.0
53	Obergasserhof	IT		0		99.0	1		36.2
54	Rebecco Farm	IT		1		89.3	1		
55	Villa Capodivacca	IT		1	338.0	319.0	1		361.9
56	House Moroder	IT		0	365.0	21.0	1	365.0	45.0
57	Huberhof	IT			151.0	129.0			
58	Notarjeva vila	SL	steady state	1		28.0	1		31.0
59	Rožna ulica 15, Idrija	SL		0		44.0			97.0
60	Hiša trentarskih vodnikov	SL	steady state	1		48.0			24.0
61	Idrija mercury smelting plant	SL		0					
62	Mercado del Val, Valladolid	SP	dynamic	0	61.7	20.0	0	1300.2	326.9
63	Correria 119	SP		0					
64	Ahmet Aga Mansion	TK		1		67.2	0		67.2
65	Necip Pasa Library	TK		1			0		
66	Downie's Cottage	UK	steady state	1		412.0	1	412.0	412.0
67	Hollyrood Park Lodge	UK		1			1	518.0	274.0
68	Annat Road	UK		1		285.0	1		285.0
69	Aspinall Courthouse	USA	dynamic	0		75.8	1	134.4	66.2
	Average			0.6	214.4	68.2	0.6	362.7	

A summary of the energy use (for space heating) of the entire sample before and after the retrofits is presented in Figure 69. The results in the first plot on the left show graphically a significant reduction in the demand of energy for space heating, but also a much more concentrated distribution of results. When looking at the histograms of both subsamples (before -middle- and after -right-), further detailed information can be accessed. After the renovation, most of the cases documented have a energy demand between 25 and 75 kWh/m²y.

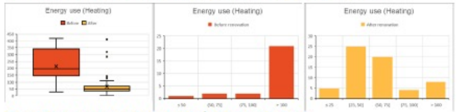


Figure 71. Energy use for space heating in kWh/m².y before and after retrofit

These results are obviously heavily influenced by the climatic conditions. In order to minimise this uncertainty a detailed analysis of a subsample with homogeneous climatic conditions was performed. Of the documented cases, the climate Cfb (Temperate oceanic climate; coldest month averaging above 0 °C, all months with average temperatures below 22 °C, and at least four months averaging above 10 °C) is by far the most representative (38 out of 69). The plots in Figure 70show the same analysis for the subsample. The distribution of results of the case studies in climate Cfb is almost identical to that of the entire sample, with a great majority of cases above 100kWh/m²y before the renovation and between 25 and 75 kWh/m²y afterwards.

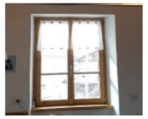


Figure 30: **Mairhof**. All windows were replaced.

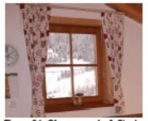


Figure 31: **Obergasserhof**. Single-leaf and double-glazed new windows.

Figure 32: **Platzbonhof**. Triple-glazed windows improved energy efficiency.

Figure 33: **Aussergrubhof**. Larch wood double-glazed windows.

Figure 34: **Ruckenzaunerhof**. New windows selected in close cooperation with monument office.

Figure 35: **Mercado del Val**. The new glazed façade increased daylighting levels.

In the remaining 24 solutions, e.g. **Ansitz Kofler**, **Bauernhof Trins**, **Maison Rubens**, **Half-timberframed house in Alken**, **Oberbergerhof**, **Timber-Framed house in Alsace** and **Rainhof** all new windows were handcrafted to match the originals as far as possible. This meant typically that the frame would be an exact replica of the original except for the fact that it was adjusted to allow for another type of glazing, i.e. double- or triple-layer low energy glazing instead of the typical single-layer glazing. The change of the glazing reduces heat losses significantly making the windows perform more or less like today's standard.

In the west façade of **Ansitz Kofler**, where the wall was insulated from the outside, the ancient openings were reconstructed. In order to allow for the most efficient position of the new window in a line with the insulation layer, the sub-frame had to be placed just "outside" the original stonewall. In order to avoid thermal bridges, the roller-shutter casings were installed on the wall in the insulation layer and the sub-frame was completely covered by the mineral wool panels. In order to achieve an airtight connection between sub-frame and the main frame of the window, jointing tape was applied.

In **Bauernhof Trins**, the windows were completely replaced. The new wooden windows in the local style were pre-installed in the custom-made wooden wall elements. The optimized position of the window frames in the insulation layer increases thermal comfort and reduces the risk of condensation through minimized thermal bridges.

For **Maison Rubens**, the windows were replaced with new ones of oak wood. The new windows are identical to the original and has the original shape. Most of the windows have been replaced and only the ones on the front façade at first floor were kept because they already had double-glazing.

In the **Half-timberframed house in Alken**, the windows were in a very bad state. There were windows (remains) from the 17th, 19th and even 20th century. In some places the windows were also missing. The remaining wooden joinery in the half-timbered house has been completely replaced by typologically appropriate new joinery. The new windows have double-glazing and in order to accommodate this, the profile thickness has been adjusted slightly.

In **Oberbergerhof**, most of the windows have been replaced. The bifora windows (mullioned windows with two lights) from the late renaissance were preserved in the middle room on the second floor. The windows in the apartment were renewed, while four new windows were added to the roof on the top floor. In the knight's hall, the old, historical windows have been preserved and not changed. When replacing the windows, special care was taken to ensure that the view of the courtyard was not changed. Therefore, it was only possible to provide the

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C – Conservation compatible retrofit solutions

Task lead: UIBK / Austria

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→knowledge of a wide group of experts

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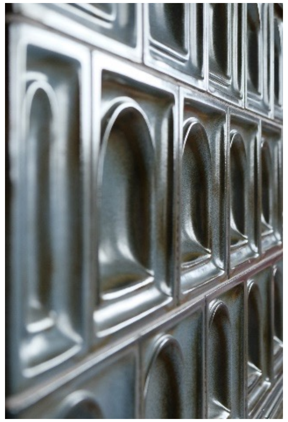
Windows

Solar

Ventilation



Heating

C – Conservation compatible retrofit solutions

Task lead: UIBK / Austria

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- **What** is the solution?
- **Why** does it work?
  (compatibility with conservation, technical function, energy improvement)
- Description of the **context**
  (What is special about the building and its surroundings?)
- **Pros** and **Cons** of the solution
- Additional Information
  (Publications, Links to further information)

2 A Replacing inner glass (includes vacuum and insulation glazing) (LI-MI)

Author: Dagmar Exner

What is the solution?

This method can only be used for constructions with several window layers (one behind the other), such as coupled or box-type windows. The historic window construction including window frame and outer glazing is conserved and restored. The solution foresees to replace the historical inner usually single glass panes with insulating glass or vacuum glazing. In order to fit insulating glazing, the rabbet and/or frame of the inner window often has to be enlarged on the outer side with a wood lath. This medium impact solution is combined with 1B. The Ug-value can be improved significantly and the historical appearance from outside can be preserved. It must be ensured that the existing hinges can bear the additional weight of the new glazing.

In the case of the windows of the Knablhof, the historic window construction consisted of box-type windows from 1930/34. Airtightness of the windows was improved by milling a groove and integrating a seal on the inner side of the window frame. To reduce transmission heat losses, the single glazing of the inner window sashes was substituted by a double-glazing. So that the historical narrow frame can hold the thicker glazing pane, it was reinforced on the outside by a wooden strip (see drawing). The insulating glazing was fixed again on the outside with putty (of linseed oil). The window frames were restored on-site by renewing the paint with linseed oil. The outer window sashes are painted with linseed oil paint in ochre according to the specifications of the monument office, while the inner window sashes are not painted with linseed oil paint as there is a risk that the linseed oil could damage the butyl of the insulating glass. Damaged outer panes were repaired with intact historical inner panes. Thus, all exterior windows have exclusively historical glazing.

When renovating the box window with this method, care must be taken to ensure that the seal of the inner window is done in an accurate way. At the same time, the outside window must be well ventilated enough to be able to remove moisture in the space between the panes. If room air enters the window cavity, the risk of condensation is high. The window manufacturer used a system from Zoller-Prantl for the renovation. The special gaskets patented by the company enable even warped window frames to be closed completely airtight. Thus, no humidity can penetrate the interior of the box window.

Why does it work?

Conservation: The retrofit solution corresponds to the requirements of the heritage authority preserving the historic window construction and respecting all other criteria on color and proportions. Visual changes were foreseen only on the inner view on the window: the replacement of the historic single glazing in the inner window sashes into the thicker double-glazing with better energy performance required the enlarging of the inner window frames with a wooden strip. Besides that, the float double-glazing has another optic than the historic glazing. The integrated seal on the inner side of the window frame is only visible when the inner window sashes are open. Thus, the window appearance and proportions didn't change at all from the outside and only slightly on the inside. Moisture safety: The window construction after retrofit is generally moisture safe. Through the double-glazing in the inner window sashes, we have higher surface temperatures on the pane and thus less condensation risk. Surface temperatures in the angle between window frame and reveal are already higher in case of a box-type window. In case of the Knablhof interior insulation in the window reveal, avoids additionally condensation all around the window frame. The window manufacturer used special seals and a special manufacturing of the grooves which make it possible to make even slightly warped window frames completely airtight. Thus, no vapor can penetrate into the intermediate space between the two-window layer and condensate on the inner surface of the outer glazing. Energy improvement: Ventilation heat losses through leaky windows were decreased by improving the airtightness through a seal on the inner side of the window frame and between the two inner window sashes. Transmission heat losses were decreases by the exchange of the inner glazing into a double-glazing (Ug = 1,10 W/m²K after; Ug = 5,75 W/m²K before); the overall Uw-value was thus improved from 2,36 W/m²K to 1,26 W/m²K.

Description of the context:

The Knablhof is a residential house located in Mareit in South Tyrol (North Italy) on a sea level of about 1.000 m. The building is very characteristic for the village. Built in 1819 it is one of the oldest buildings of the village in the village center. It was built as former chandlers' house with a connected barn and stable. Before the renovation, the house was uninhabited for 40 years. The heritage preservation office has formulated clear requirements for the building, which is under monument protection, which were taken into account during the retrofit. Conservation

Figure 14: Knablhof (box-type window) – before and after renovation.

Figure 15: Knablhof (box-type window) – view from inside after renovation

Figure 16: Knablhof (box-type window) – details after renovation

C – Conservation compatible retrofit solutions

Task lead: UIBK / Austria

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Around 40 solutions

Internal insulation, frame infill insulation, cavity insulation, reversible systems and innovative solutions

Nearly half of the solutions are assigned to “internal insulation”

Around 16 solutions

Classified according to the type of window (single window, box-type window, etc.)

Further distinction according to the historical impact

Around 40 Solutions

Plants attached to the roof, roof integrated, attached to the wall, façade integrated

Free-standing solar plants and solutions for the integration into the landscape

18 Solutions for ventilation

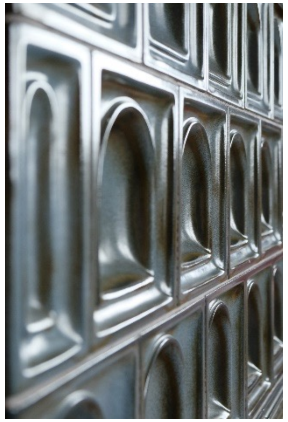
25 Solutions for heating which are divided in heating production and heating distribution

Walls

Windows

Solar

Ventilation



Heating

C – Conservation compatible retrofit solutions

Task lead: UIBK / Austria

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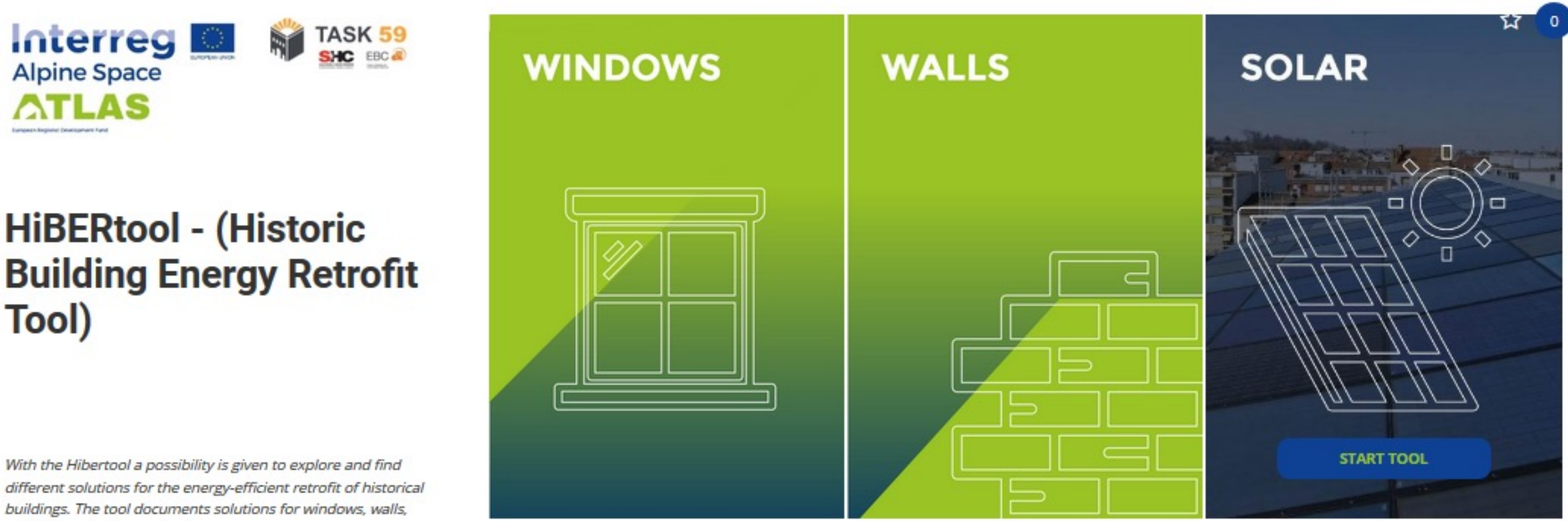
→ in a report, but also in a guidance tool with decision tree



C – Conservation compatible retrofit solutions

Task lead: UIBK / Austria

Compatibility assessment following EN 16883 → Link to SubTask B

Scale Grade and Colours
High benefit (deep green)
Low benefit (light green)
Neutral (white)
Low risk (yellow)
High risk (red)

Assessment category	ROOF ATTACHED BAPV-BAST		ROOF INTEGRATED BIPV-BIST	
	Strengths	Weakness	Strengths	Weakness
Technical compatibility	Hygrothermal risk (2)		Hygrothermal risk (12)	
	Structural risk (2)		Structural risk (12)	
		Water proof (2)	Waterproof (12)	
	Reduction efficiency risk (2)			Reduction efficiency risk (12)
	Fire safety (2)			Fire safety (12)
	Design and installation (2)		Design and installation (12)	
	Connections (2)		Connections (12)	
	Reversibility (2)			Reversibility (12)
Heritage significance	Risks of visual impact (2)			Risks of visual impact (12)
	Risk of spatial impact (2)			Risk of spatial impact (12)
		Risk of material impact (2)		Risk of material impact (12)
Economic viability	Operating costs (1)		Operating costs (2)	
	Economical return (1)		Economical return (5)	
	Capital costs (2)			Capital costs (9)
	Economic savings (2)		Economic savings (6)	
Energy	Energy performance (2)		Energy performance (12)	
	Life cycle energy demand (1)			Life cycle energy demand (2)
IE quality	IE conditions suitable (2)		IE conditions suitable (10)	
Impact on the outdoor environment	Greenhouse gas emission (1)	Natural resources (2)	Greenhouse gas emission (5)	Natural resources (3)
Aspects of use	Effects of RES on users (2)			Effects of RES on users (10)
	Effects of change of use (2)			Effects of change of use (10)
	Easy to manage and operate (2)			Easy to manage and operate (4)

B – Multidisciplinary planning process

Task lead: Uppsala University / Sweden

EN 16883 → is a procedural standard

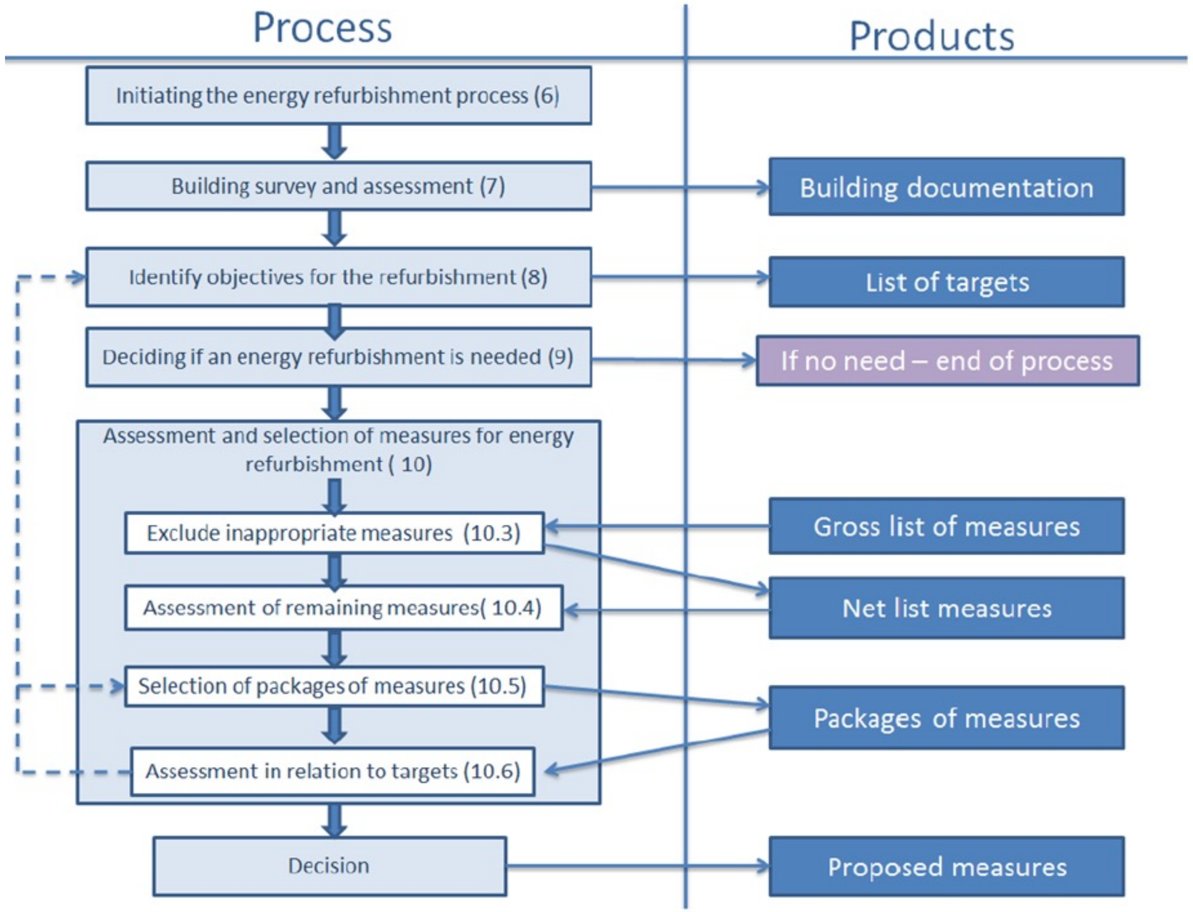
→ Factsheets

→ Feedback for future improvement

→ Handbook – „a guide for the guide“

complement the standard with examples and tools

written with two examples, a small building and a big one through the whole process



D – Demonstration and dissemination

Task lead: Historic Environment Scotland / United Kingdom

D – Demonstration and dissemination

Task 59 | Renovating Historic Buildings Towards Zero Energy

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Blog

- Non-destructive techniques and tools for the thermal characterisation of historic buildings
  April 2021 -- S. Álvarez-Díaz - CARTIF Technology Centre
- Webtool to help owners and design professionals to characterize the qualities and needs of historical residential buildings with heritage value
  March 2021 -- D. Stiernon, S. Altomonte - Université Catholique de Louvain
- Brightly colored solar modules for building facades: State of development of MorphoColor® technology
  February 2021 -- T. Kroyer, A. Dinkel - Fraunhofer ISE
- BIPV in dialogue with history
  January 2021 -- C. S. Polo Lopez, P. Corti, P. Bonomo - SUPSI
- Thermal performance of historical masonry structures: experimental data and numerical modeling
  December 2020 -- A. Lo Faro, V. Constanzo, G. Evola, F. Nocera - Universita di Catania
- Embedding thermal comfort into retrofitting design
  November 2020 -- A. Petsou - University College London
- SBE21 Heritage Conference, the final event of Task59
  October 2020 -- D. Herrera, A. Troi - Eurac Research
- Old buildings can't be energy efficient, right?

Task 59 | Renovating Historic Buildings Towards Zero Energy

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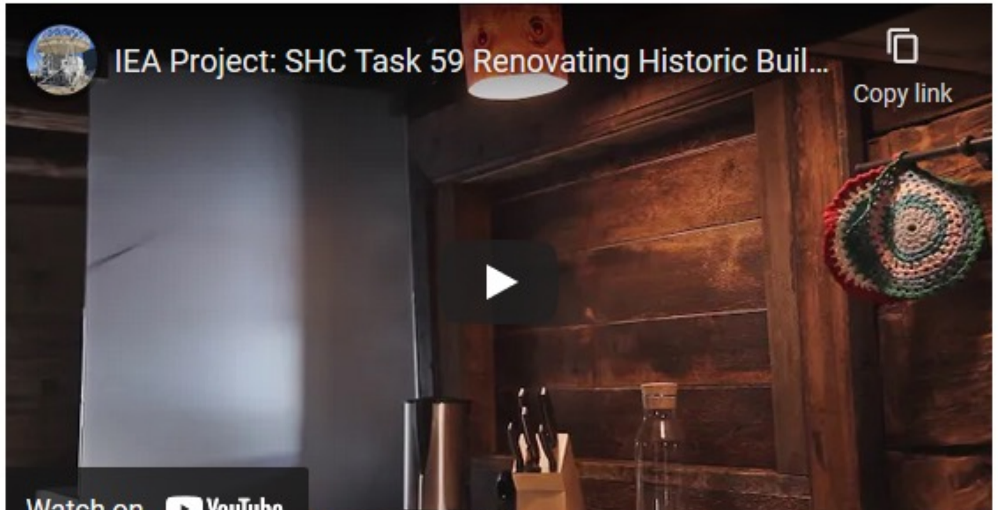
Videos

European Congress on the Use, Management and Conservation of Buildings of Historical Value

The following videos were recorded October 16-17, 2019 at the Hofburg in Vienna (Austria) during the above event:

OVERVIEW



HOME > RESOURCES > THE TOURING EXHIBITION > WHAT IT IS

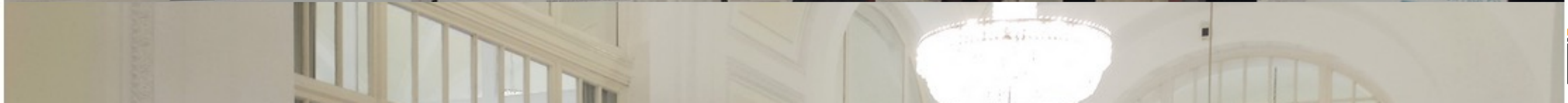
What It Is

Book the Touring Exhibition for your event!

The Touring Exhibition shows some exemplary case studies of energy retrofits in historic buildin[...] developed as part of the HiBER ATLAS best practice database. The ultimate goal is to inspire owners [...] properties to maintain and improve our built heritage.

The exhibition is made up of 12 individual banners, one introductory panel and 11 examples of retrofitted buildings across Europe. Take a closer look at them here.

The exhibition is travelling around the world, with some dates already fixed. For more information on where and when to see the exhibition in action, and how to book it for your own event, please visit the Touring Exhibition calendar.



Task News View All ›

05 MAY

SBE21 conference spotlights historic NZEBs

The SBE21 Heritage conference in mid-April involved a deep exchange of ideas between researchers, architects and practitioners about how to reduce the...

read more ›

13 APR

On-Site Registration available for SBE21

From the 14th to the 16th of April 2021, it will be possible to register "on-site". The "on-site" day-by-day registration...

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19 JUN

SBE Heritage conference calls for papers

The SBE conference's 2021 edition will be held under the title SBE Heritage in Bolzano, Italy, between 14 and 16 April 2021.

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19 MAY

Call for Proposals: SBE21 Heritage

The conference will be dedicated to the sustainable improvement of the built heritage, a research area that has grown significantly over the last 10 years...

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Recent Publications View All ›


Risk-Benefit Assessment Scheme for Renewable Solar Solutions in Traditional and Historic Buildings


Conservation-Compatible Retrofit Solutions in Historic Buildings: An Integrated Approach


How Can Scientific Literature Support Decision-Making in the Renovation of Historic Buildings? An Evidence-Based Approach for Improving the Performance of Walls


Integration of Energy-Efficient Ventilation Systems in Historic Buildings—Review and Proposal of a Systematic Intervention Approach


Energy and Buildings
Sustainable church heating: The Basilica di Collemaggio case-study


Building and Environment
Microclimatic monitoring of the Duomo (Milan Cathedral): Risks-based analysis for the conservation of its cultural heritage

… and finally the word to the Netherlands

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