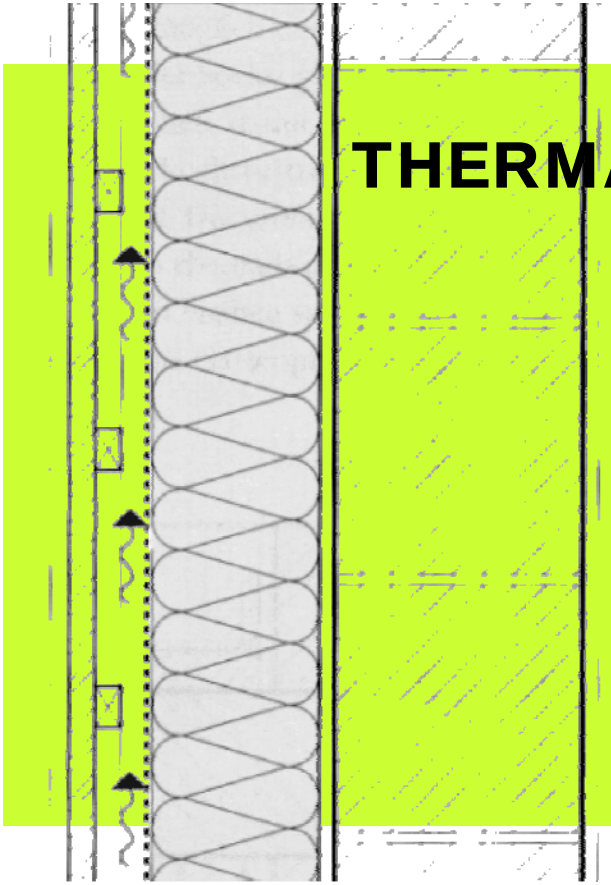
University of Natural Resources and Applied Life Sciences, Vienna
Department of Structural Engineering and Natural Hazards



THERMAL REFURBISHMENT –

assignment of the future

VITA NOVA 2

8.-22. July 2007

Klisura, Bulgaria

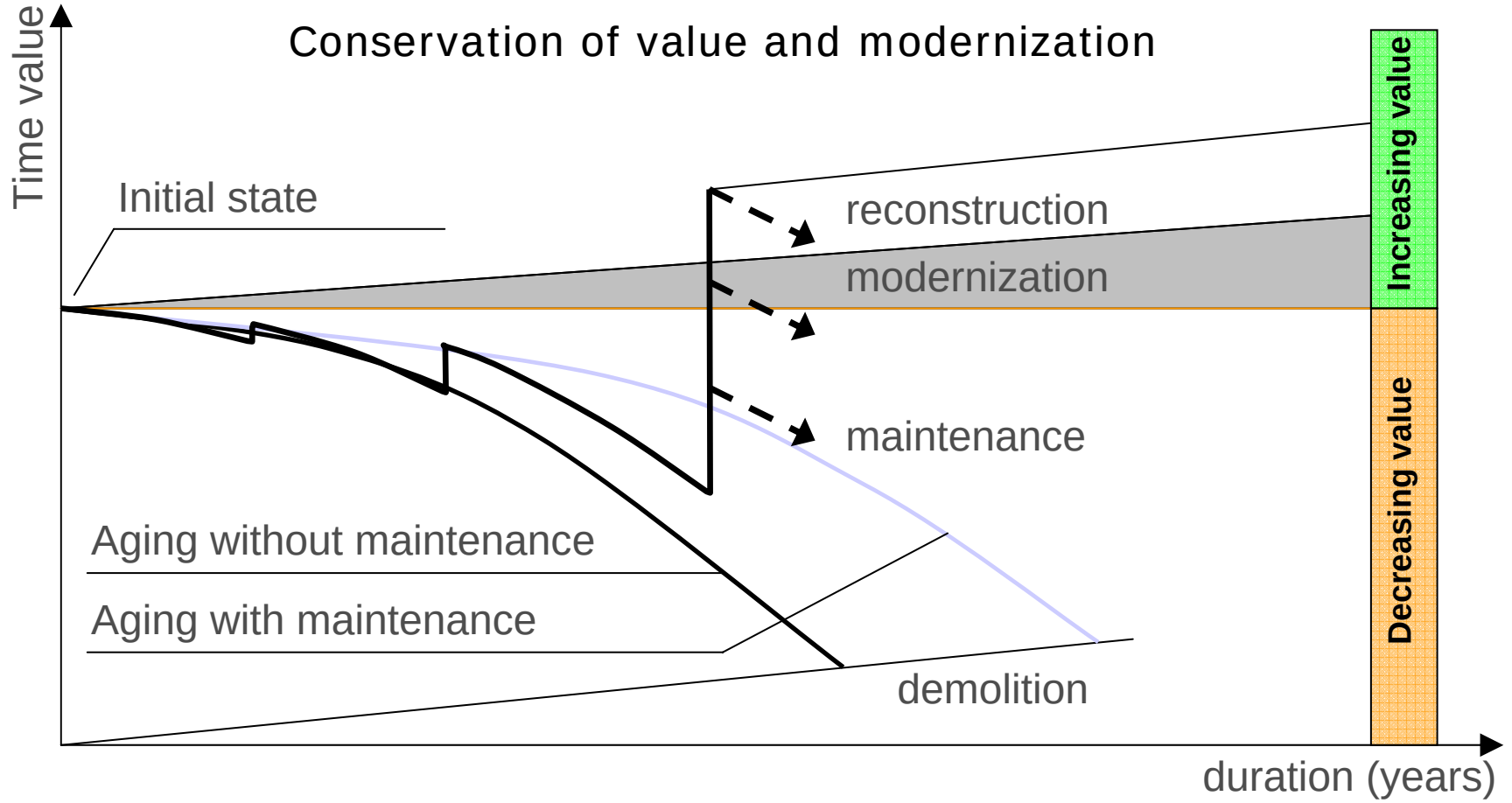
THERMAL REFURBISHMENT

When to modernize a building?

- Different requirements: Safety, health, increased comfort, high energy demand in future
- Different use
- Structural damages

-> impacts on the building (increasing or decreasing value)

THERMAL REFURBISHMENT



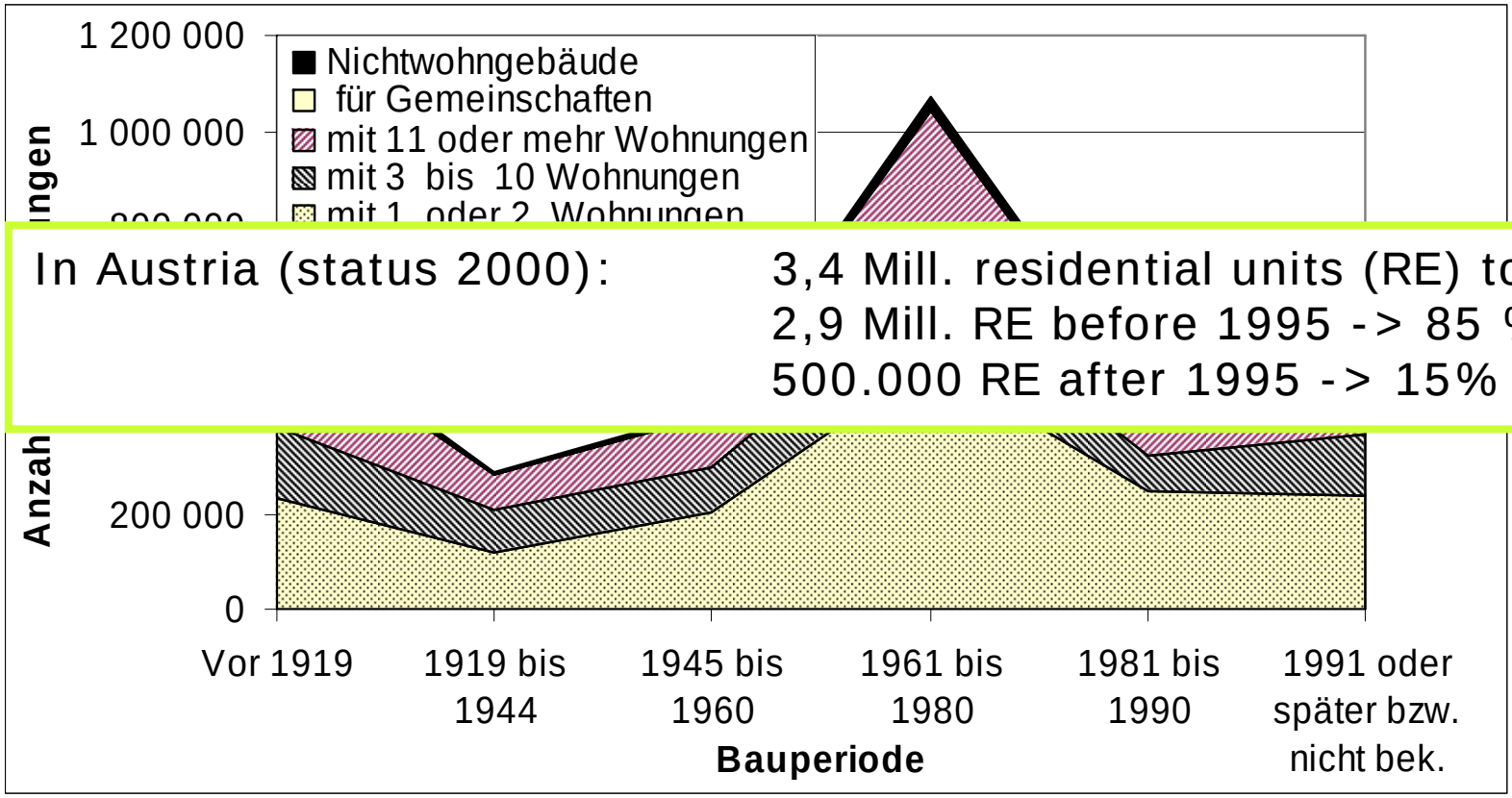
-> BEFORE demolition of building -> Proving alternatives
-> Combination of functional, architectural, aesthetic measures + thermal refurbishment measures

[Source: FECHNER, J. (Ed.) (2002) Altbaumodernisierung – Der praktische Leitfaden. Wien: Springer]

THERMAL REFURBISHMENT

Why are thermal refurbishment measures important?

- High amount of old buildings with high energy demand



In Austria (status 2000): 3,4 Mill. residential units (RE) total
2,9 Mill. RE before 1995 -> 85 %
500.000 RE after 1995 -> 15%

Overview of buildings listed after periode of construction and type of building in Austria (status 2000)

[Source: Statistik Austria (2004)]

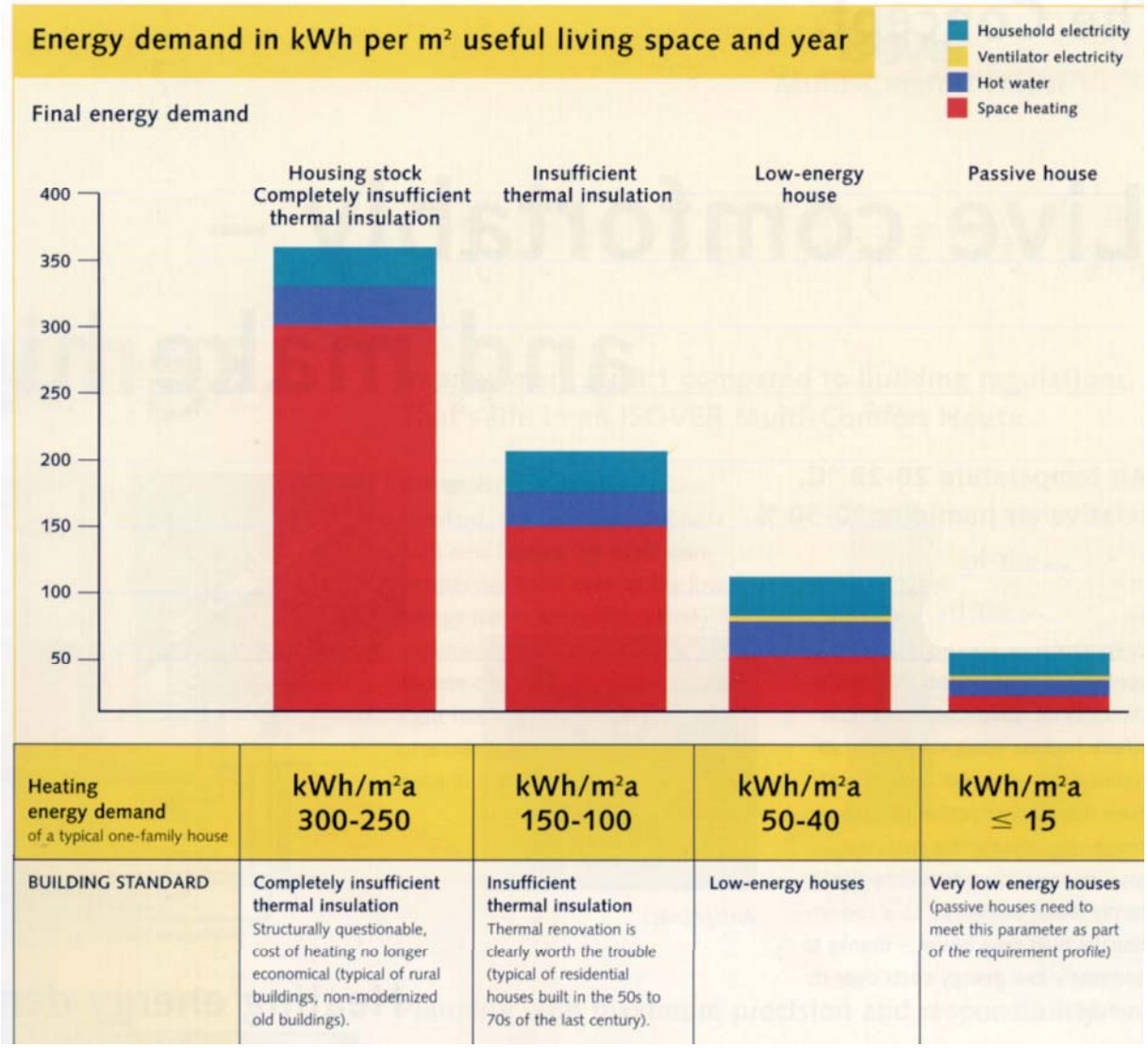
THERMAL REFURBISHMENT

Year of construction | One-family house | Town house | Multifamily residence

Heating energy demand [kWh/m²a]

[Source: GABRIEL, I., LADENER, H. (Ed.) (2004) Vom Altbau zum Niedrigenergiehaus. 4. Edition. Staufen: Ökobuch]

THERMAL REFURBISHMENT



Heating energy demand of a typical one-family house	kWh/m²a 300-250	kWh/m²a 150-100	kWh/m²a 50-40	kWh/m²a ≤ 15
BUILDING STANDARD	**Completely insufficient thermal insulation** Structurally questionable, cost of heating no longer economical (typical of rural buildings, non-modernized old buildings).	**Insufficient thermal insulation** Thermal renovation is clearly worth the trouble (typical of residential houses built in the 50s to 70s of the last century).	Low-energy houses	Very low energy houses (passive houses need to meet this parameter as part of the requirement profile)

[Source: ISOVER (2007) Built for the future: The ISOVER Multi-Comfort House.]

THERMAL REFURBISHMENT

Heating energy demand of a typical one-family house	kWh/m²a 300-250	kWh/m²a 150-100	kWh/m²a 50-40	kWh/m²a ≤ 15
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BUILDING ELEMENT	**Typical U-values and insulation thicknesses**			
External walls (massive wall of 25 cm) Insulation thickness	1.30 W/(m²K) 0 cm	0.40 W/(m²K) 6 cm	0.20 W/(m²K) 16 cm	0.13 W/(m²K) approx. 30 cm
Roof Insulation thickness	0.90 W/(m²K) 4 cm	0.22 W/(m²K) 22 cm	0.15 W/(m²K) 30 cm	0.10 W/(m²K) 40 cm
Floors to ground Insulation thickness	1.0 W/(m²K) 0 cm	0.40 W/(m²K) 6 cm	0.25 W/(m²K) 10 cm	0.15 W/(m²K) 26 cm
Windows	5.10 W/(m²K) Single glazing	2.80 W/(m²K) Double glazing, insulation glass (air-filled)	1.10 W/(m²K) Double glazing, thermal insulation glazing	0.80 W/(m²K) Triple glazing, thermal insulation glass, special frame
Ventilation	Leaky joints	Open the windows	Exhaust air unit	Comfort ventilation with heat recovery
CO_2 emission	60 kg/m²a	30 kg/m²a	10 kg/m²a	2 kg/m²a
Energy consumption in liters heating oil per m² living space and year	30-25 liters	15-10 liters	4-5 liters	1.5 liters

[Source: ISOVER (2007) Built for the future: The ISOVER Multi-Comfort House.]

THERMAL REFURBISHMENT

Why are thermal refurbishment measures important?

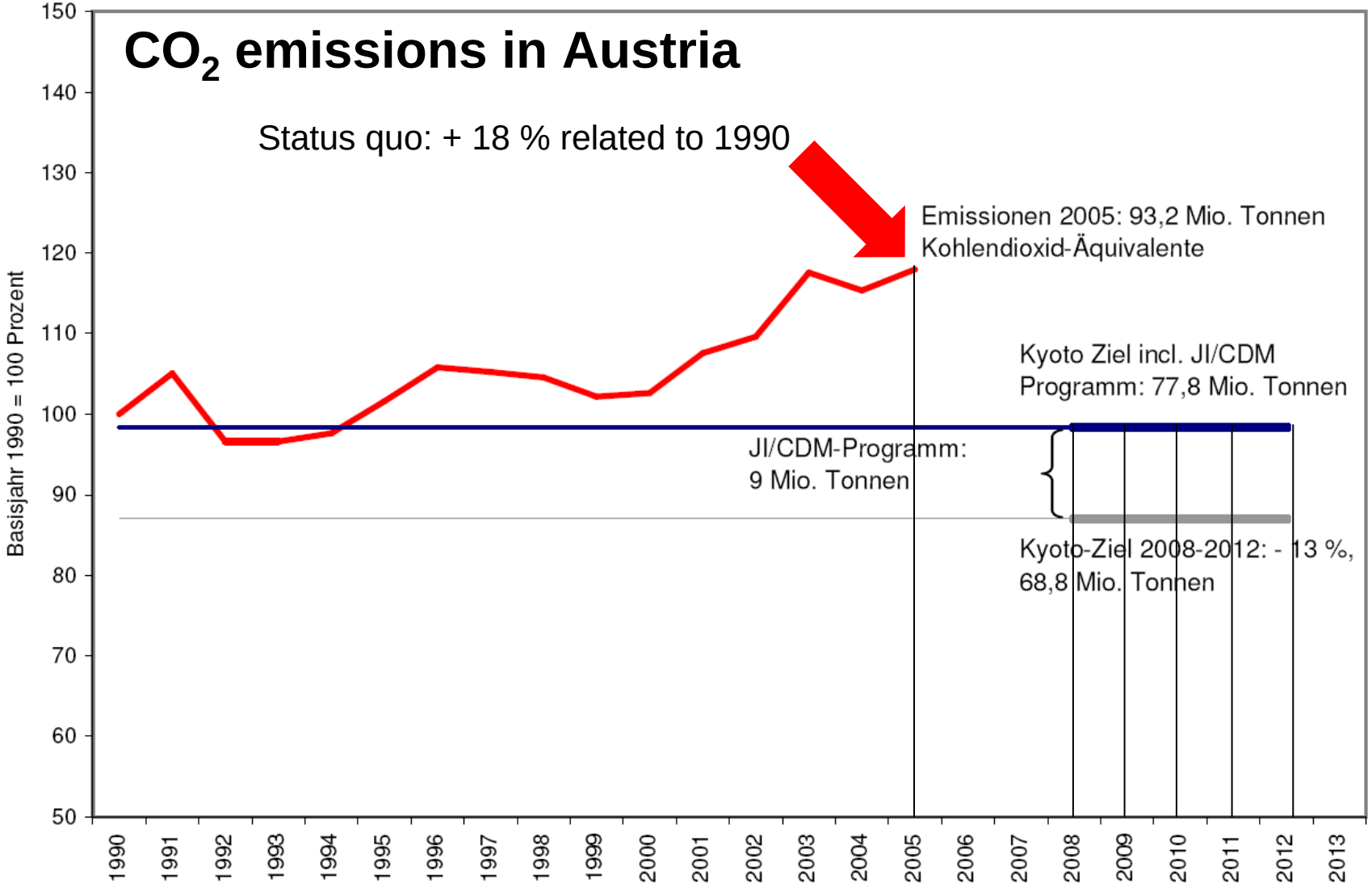
- High amount of old buildings with high energy demand

-> Save more energy + CO_2 emissions through thermal refurbishment of old buildings than with new buildings

- Use of renewable energy sources

-> CO_2-neutral, sustainable, ecological and save to have them in the future

THERMAL REFURBISHMENT



[Source: Kyoto-Fortschrittsbericht, Umweltbundesamt 2007]

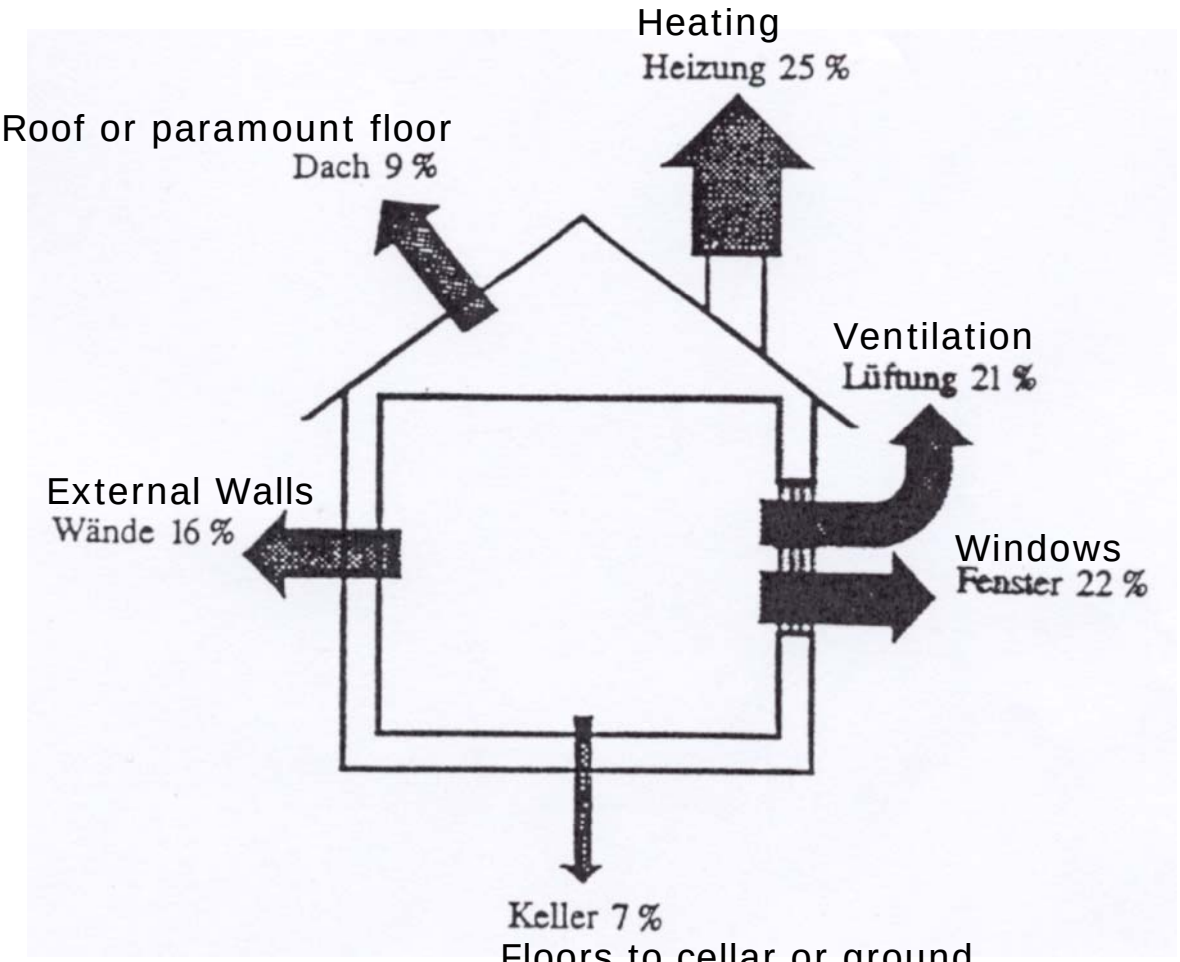
THERMAL REFURBISHMENT

Aims

- to reduce heating costs
- to upgrade habitation comfort

THERMAL REFURBISHMENT

Where is the heat lost?



Heat losses of building components
in contact with outer air

[Source: WUPPERTAL INTSITUT FÜR KLIMA, UMWELT, ENERGIE (1996)
Energiegerechtes Bauen und Modernisieren. Basel: Verlag für Architektur]

THERMAL REFURBISHMENT

Measures of thermal refurbishment

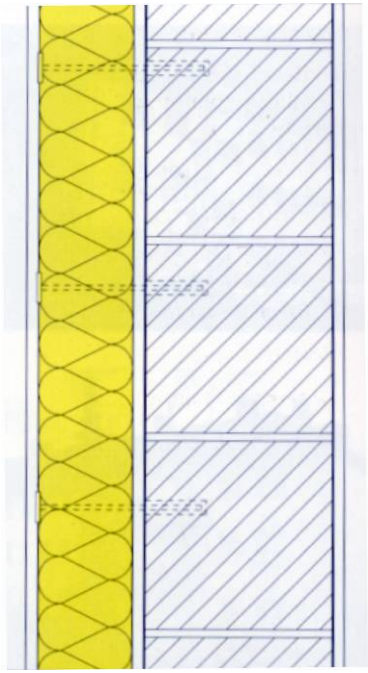
- Improvement of the insulation of opaque building components in contact with outer air
- Improvement of the windows
- Modernization of the building maintenance

[Source: WUPPERTAL INTSITUT FÜR KLIMA, UMWELT, ENERGIE (1996) Energiegerechtes Bauen und Modernisieren. Basel: Verlag für Architektur]

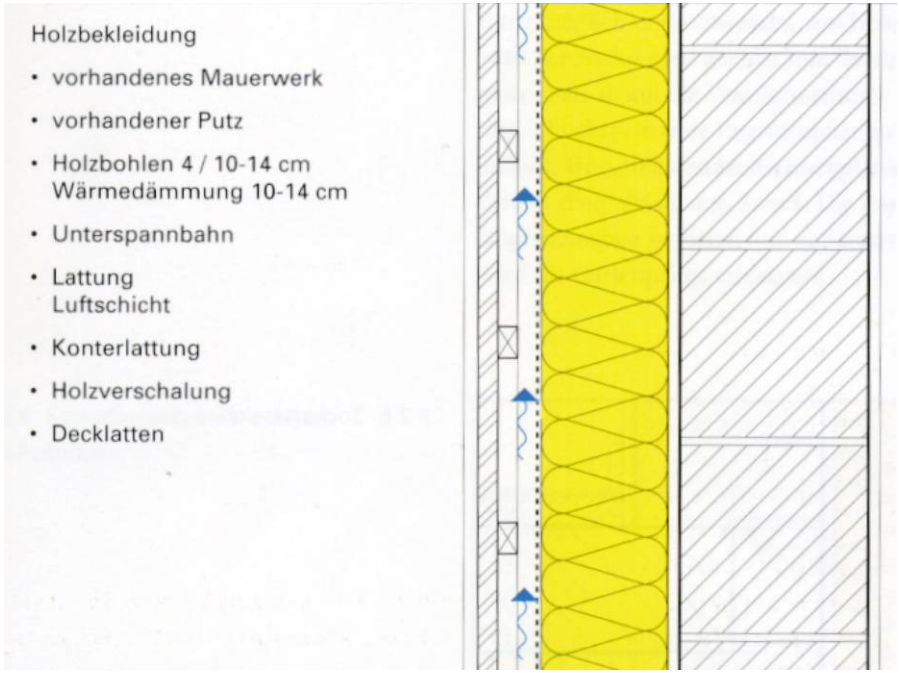
THERMAL REFURBISHMENT

Improvement of the insulation of opaque building components

- External walls (insulation thickness 10-25 cm)
  - Insulation placed directly on the external wall
  - Ventilated facade



Insulation external wall



Ventilated facade

[Source: WUPPERTAL INTSITUT FÜR KLIMA, UMWELT, ENERGIE (1996) Energiegerechtes Bauen und Modernisieren. Basel: Verlag für Architektur]

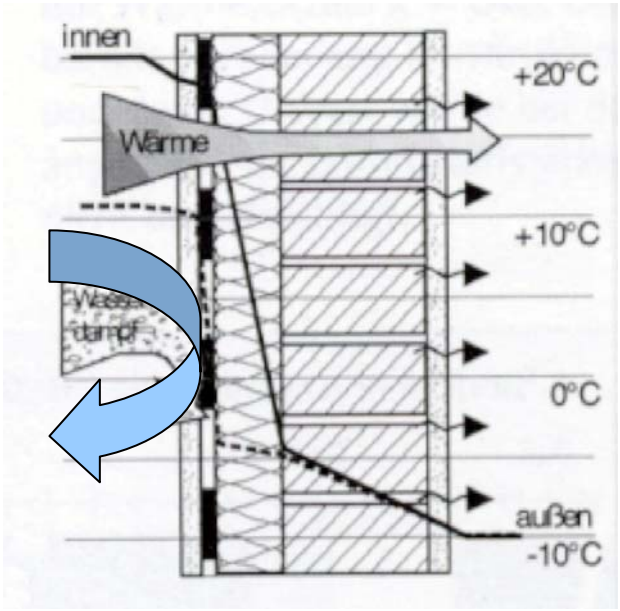
THERMAL REFURBISHMENT

Improvement of the insulation of opaque building components

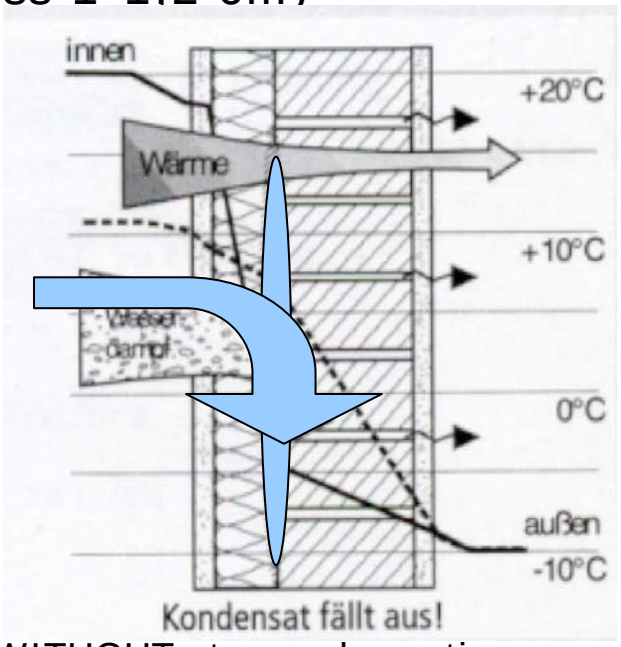
- External walls

  - Insulation placed directly on the interior wall (only for historically protected buildings, insulation thickness 5-10 cm)

  - insulation-plaster (insulation thickness 1-1.2 cm)



Insulation interior wall WITH steam absorption



... WITHOUT steam absorption

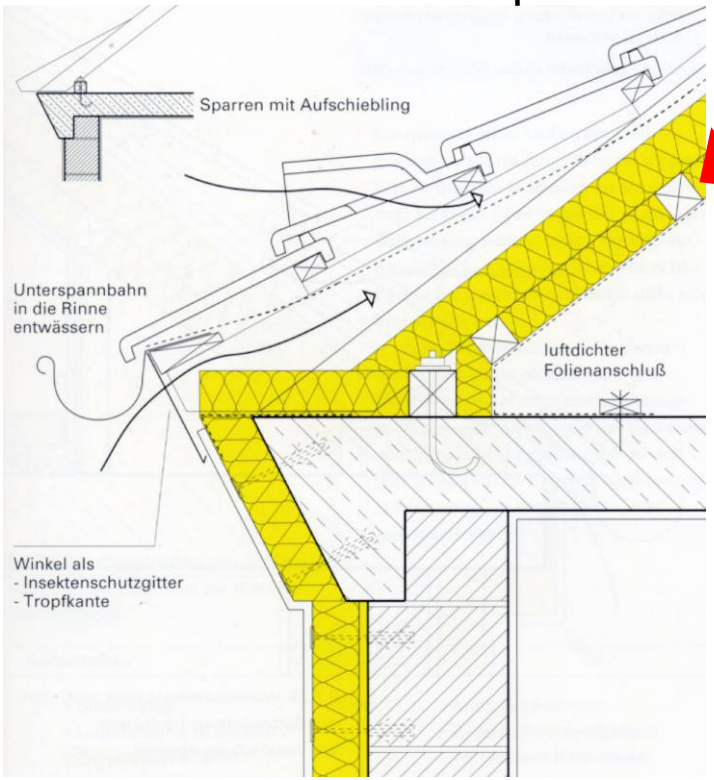
[Source: GABRIEL, I., LADENER, H. (Ed.) (2004) Vom Altbau zum Niedrigenergiehaus. 4. Edition. Staufen: Ökobuch]

THERMAL REFURBISHMENT

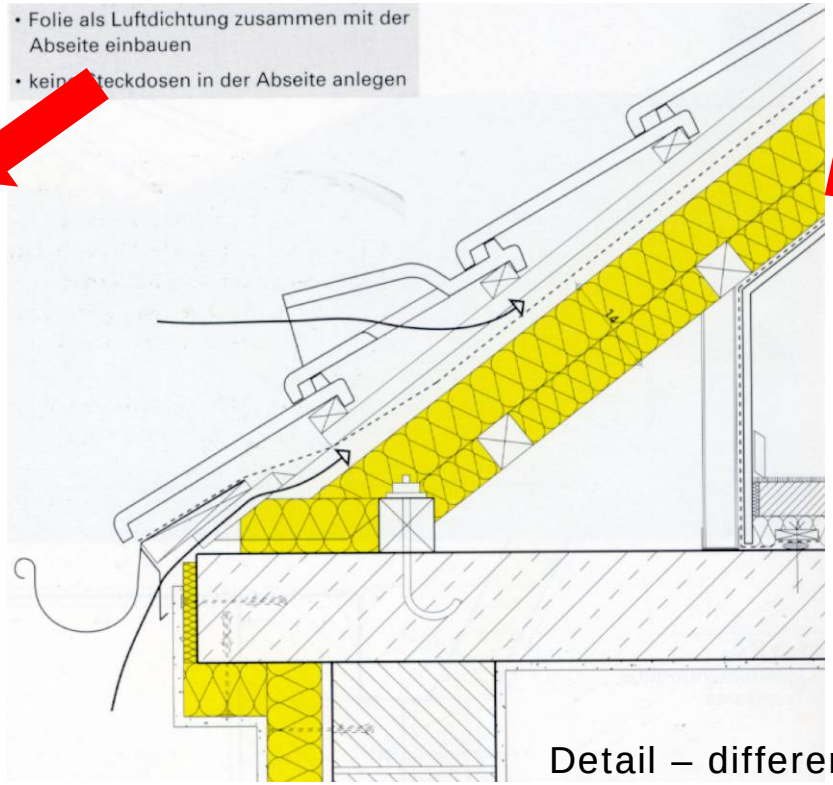
Improvement of the insulation of opaque building components

- Roof (insulation thickness 12-22 cm)

  - Insulation placed between and under rafter



Detail – different cullis



Detail – different cullis

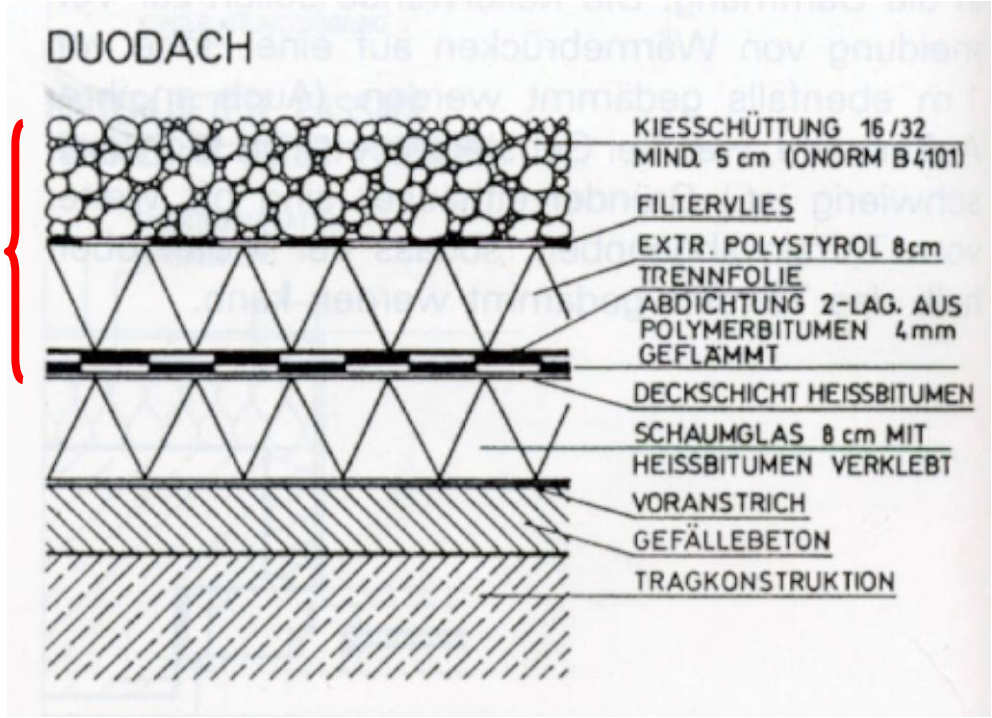
[Source: WUPPERTAL INTSITUT FÜR KLIMA, UMWELT, ENERGIE (1996) Energiegerechtes Bauen und Modernisieren. Basel: Verlag für Architektur]

THERMAL REFURBISHMENT

Improvement of the insulation of opaque building components

- Flat Roof (insulation thickness 16-25 cm)
  - already damaged flat roof -> complete new construction
  - flat roof ok -> additional insulation + construction upon

NEW insulation + construction



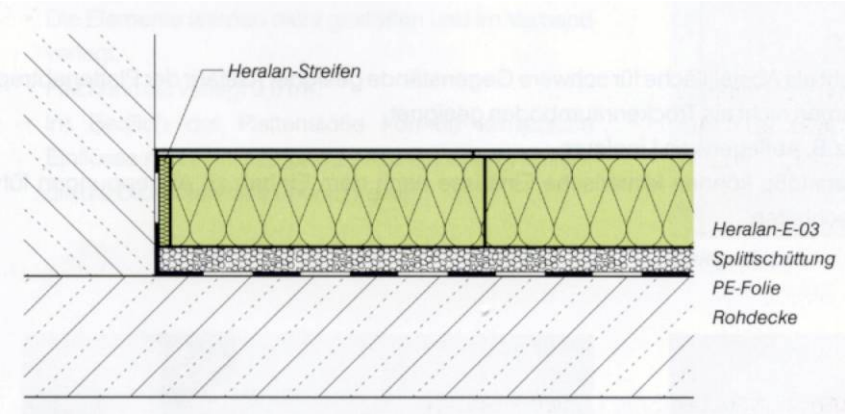
[Source: RICCABONA, C.(2003) Baukonstruktionslehre 5. Wien: Manz]

THERMAL REFURBISHMENT

Improvement of the insulation of opaque building components

- Paramount floor (insulation thickness 10-20 cm)

  - easiest + cheapest way of insulation



Laying methode

walkable floor

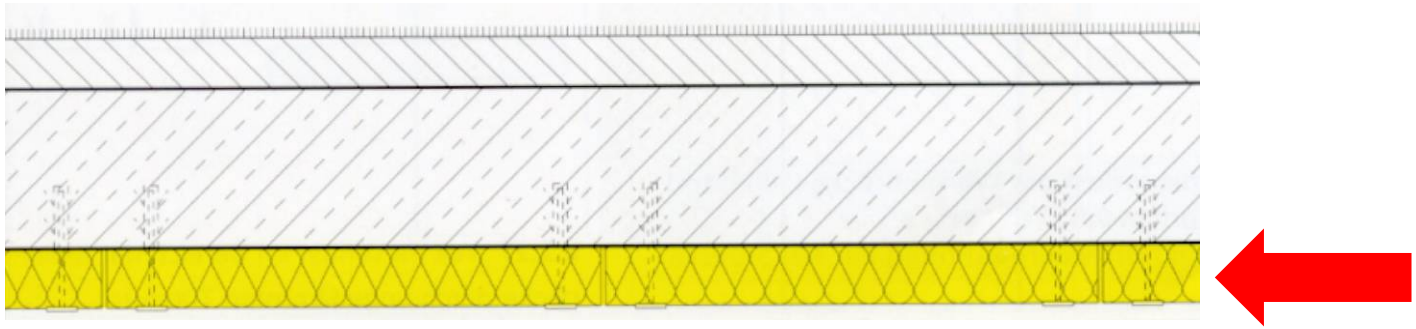
[Source: HERAKLITH Produktordner]

THERMAL REFURBISHMENT

Improvement of the insulation of opaque building components

- Floor to cellar (insulation thickness 6-12 cm)
  - Insulation placed under floor
  - pay attention to passing height in the cellar

Ground floor



Cellar

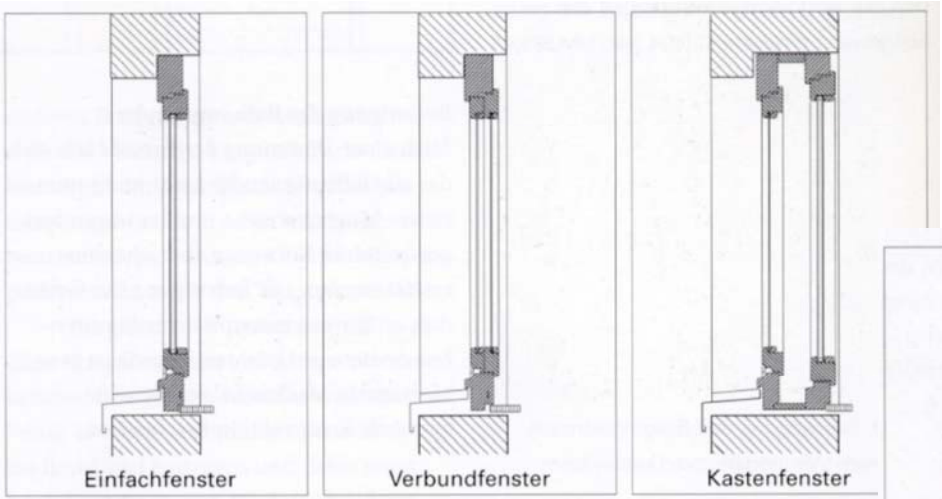
[Source: WUPPERTAL INTSITUT FÜR KLIMA, UMWELT, ENERGIE (1996) Energiegerechtes Bauen und Modernisieren. Basel: Verlag für Architektur]

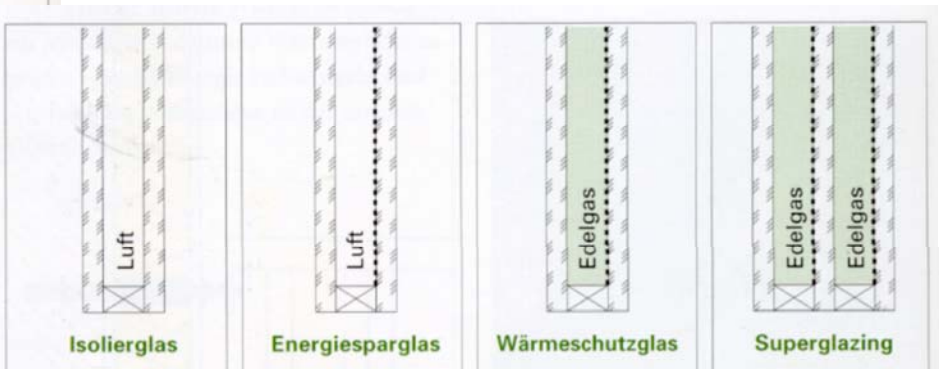
THERMAL REFURBISHMENT

Improvement of the windows

- 3 materials wood, PVC, aluminium
- 3 frame-constructions (single window, coupled window, double window)
- 4 glazing types

-> Usual wooden, single window with insulation glazing



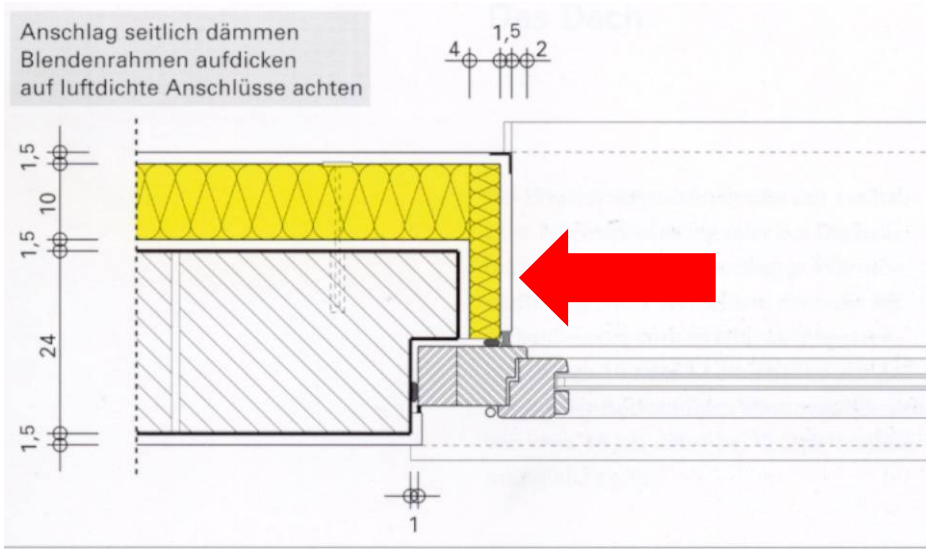


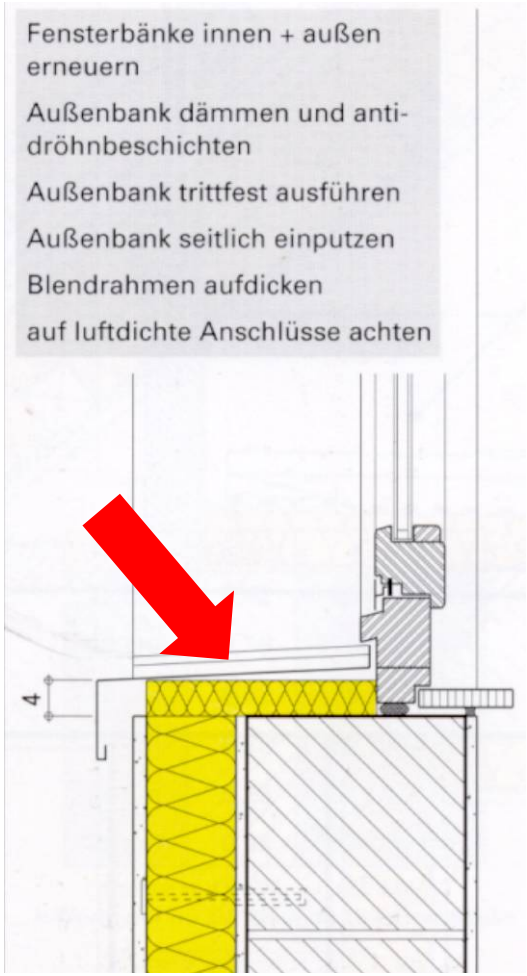
[Source: WUPPERTAL INTSITUT FÜR KLIMA, UMWELT, ENERGIE (1996) Energiegerechtes Bauen und Modernisieren. Basel: Verlag für Architektur]

THERMAL REFURBISHMENT

Improvement of the windows

- Insulation of the embrasure (insulation thickness 3-5 cm)





[Source: WUPPERTAL INTSITUT FÜR KLIMA, UMWELT, ENERGIE (1996) Energiegerechtes Bauen und Modernisieren. Basel: Verlag für Architektur]

THERMAL REFURBISHMENT

Examples of

- Modernization
- Reconstruction

-> including thermal refurbishment measures

BG und BRG HAINZINGERGASSE

Hainzingergasse 37, 1180 Vienna

OLD BUILDING MODERNISATION – SCHOOL RECONSTRUCTION

1.808 m² before

4.986 m² after

OBJECT DATA

Type:	School Building Reconstruction and Rebuilding
Constructor:	BIG GmbH
General Planning:	Treberspurg & Partner ZT GmbH
Completed:	2000
Dimension:	ca. 5.000 m²
Netto Building Costs:	ca. 7,27 Mio. EURO

RECONSTRUCTION

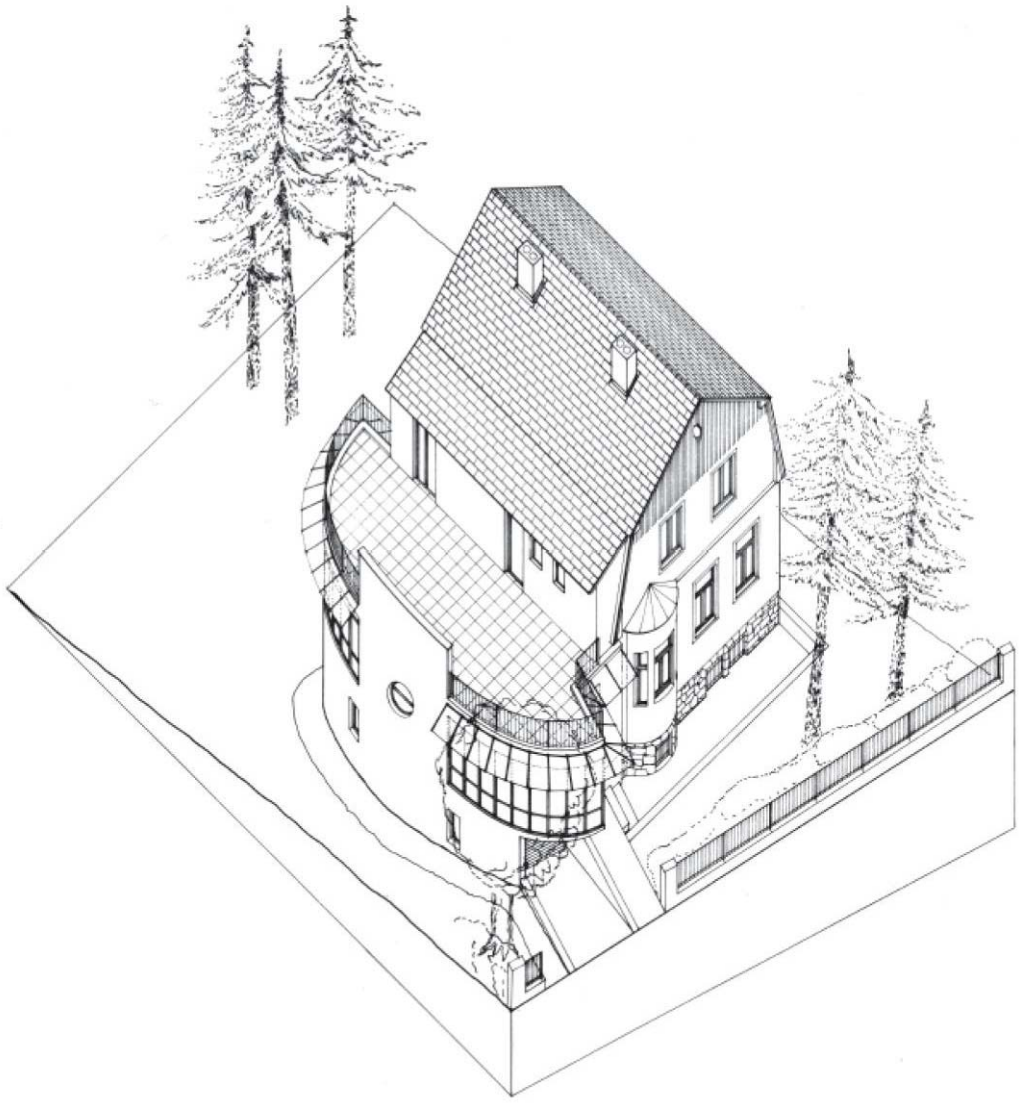
One-family house „Koch“

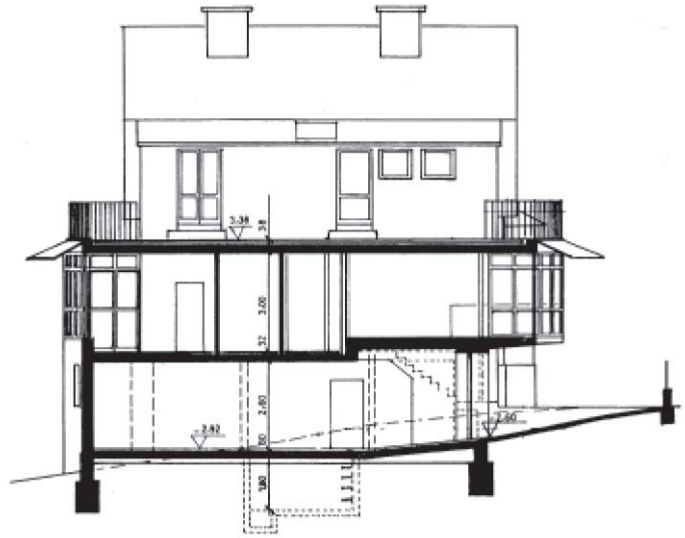
A-1130 Vienna, Hagenberggasse 44
Completed 1985

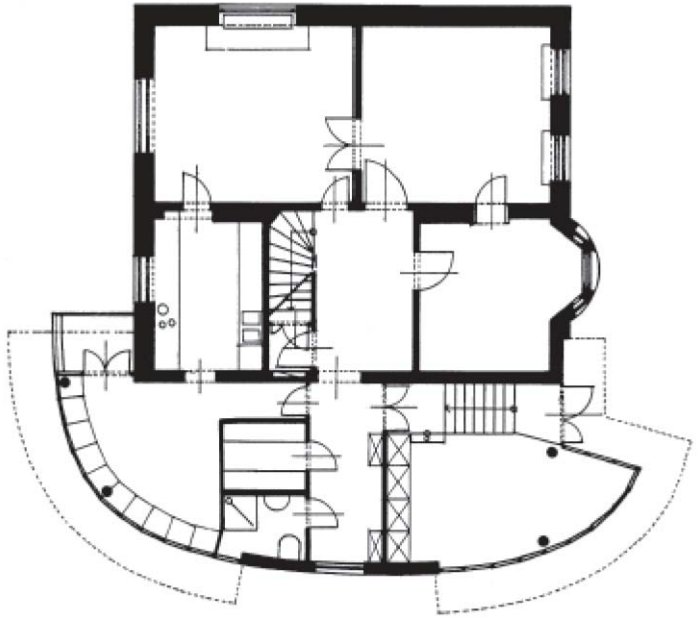
Architect:	Arch. DI Dr. Martin Treberspurg
Size:	188 m²
Heating energy demand:	65 kWh/(m²a)

Before reconstruction
Heating energy demand: 340 kWh/(m²a)

After reconstruction
Heating energy demand: 65 kWh/(m²a)







Winter garden

RECONSTRUCTION

One-family house „Reznicek“

A-3423 St. Andrä-Wördern, Lower Austria, Am Rain 17
Completed 1990

Architect:	Arch. DI Dr. Martin Treberspurg
Size:	165 m²

Before reconstruction
Heating energy demand: 370 kWh/(m²a)

After reconstruction
Heating energy demand: 45 kWh/(m²a)

RECONSTRUCTION

One-family house „Varga“

A-3001 Mauerbach, Lower Austria, Hochstraße 10
Completed 2000

Architekt:	Arch. DI Dr. Martin Treberspurg
Size:	2 residential units + secondary rooms
	before reconstruction ca. 160 m²
	after reconstruction ca. 275 m²
Heating energy demand:	40 kWh/(m²a)

Before reconstruction
Heating energy demand: 300 kWh/(m²a)

After reconstruction
Heating energy demand: 40 kWh/(m²a)

RECONSTRUCTION

Wintergarden and reconstruction of Terrace

A-1030 Vienna, Am Heumarkt 3 b
Completed 1993

Architect:	Arch. DI Dr. Martin Treberspurg
Size:	ca. 30 m² Wintergarden

Original state in ca. 1910

Before reconstruction 1992

After reconstruction

RECONSTRUCTION OF A MONUMENTAL PROTECTED BUILDING

Austrian Nationallibrary

A-1010 Vienna, Neue Hofburg
Completed 2004

General planning and building supervision:	Frank & Partner Architekten Treberspurg & Partner Architekten
Size:	Reading hall 718 m² , Readinglounge and Foyer

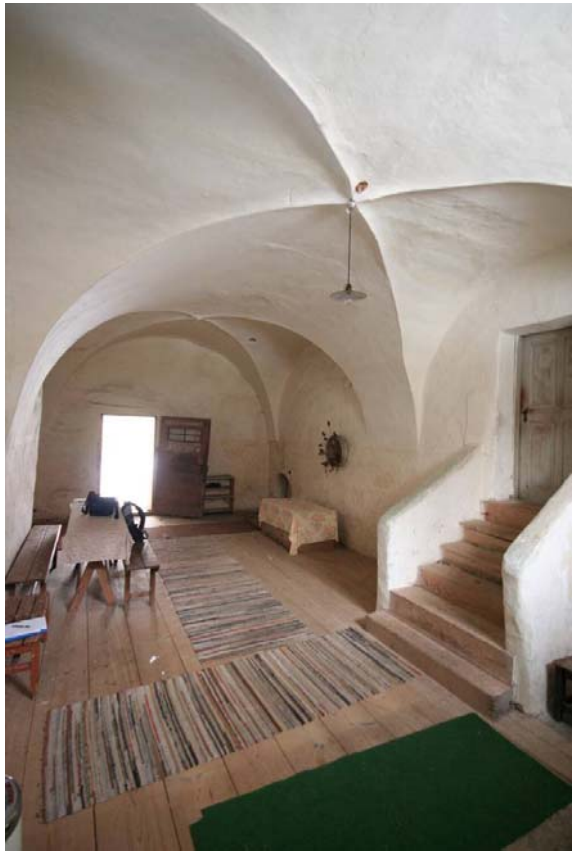
Reading lounge


Servicedesk
Benützungskarten

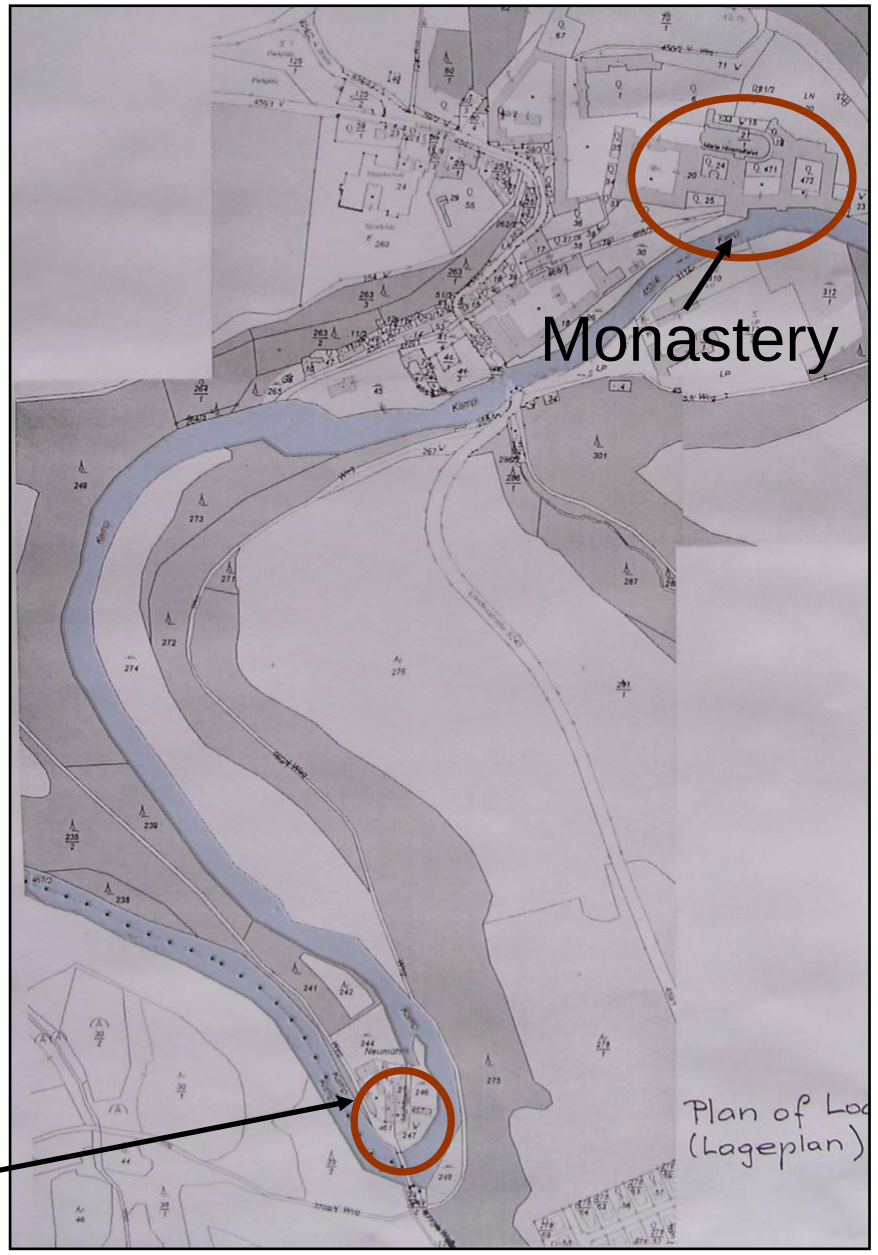
VITA NOVA 1 – MONASTERY ZWETTL
RECONSTRUCTION OF THE „NEW MILL

Task

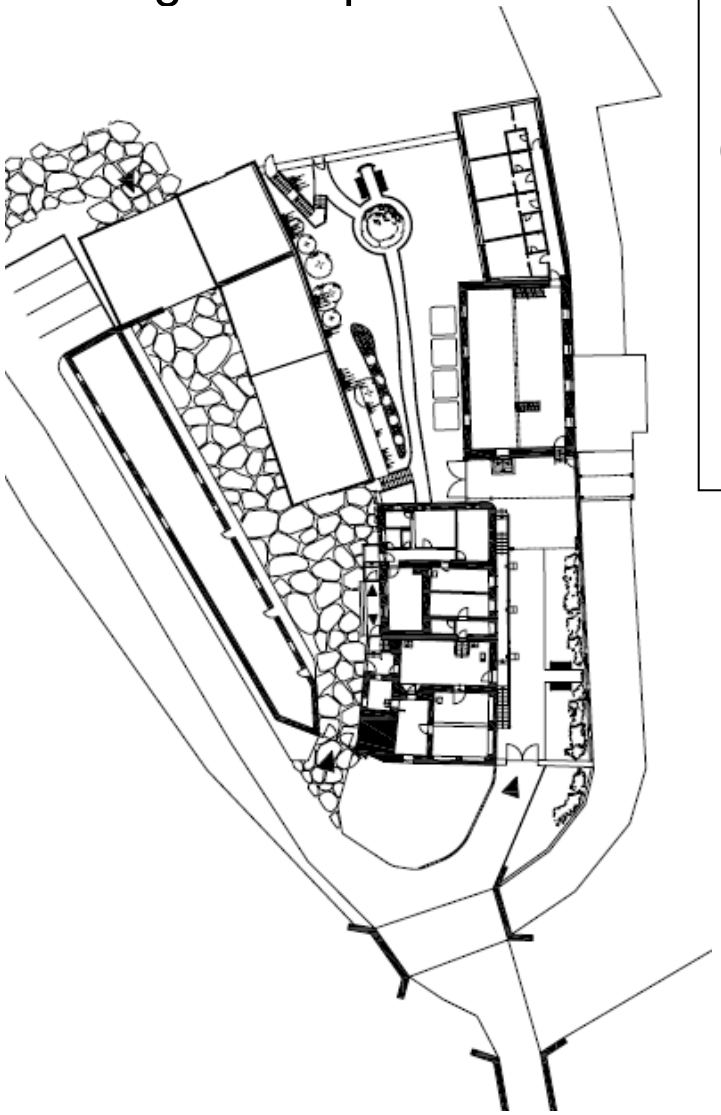
1. Inventory of the building
2. Design of a new using-concept for hermits
3. Plans for reconstruction



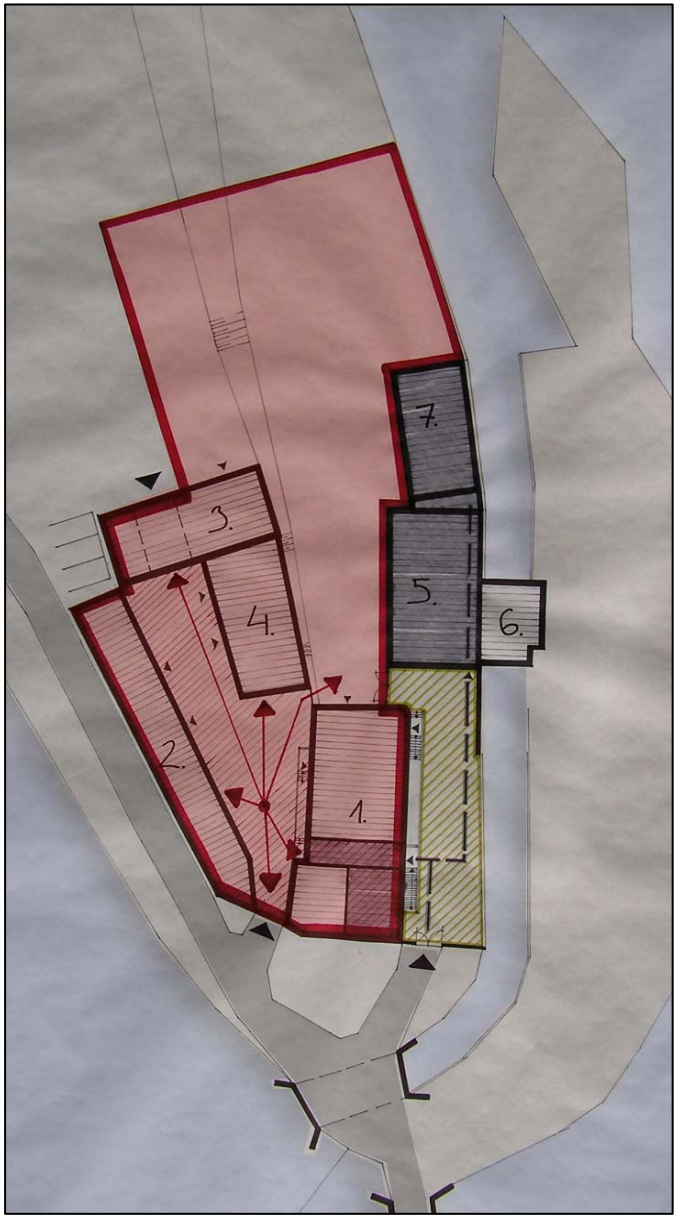
Map of location



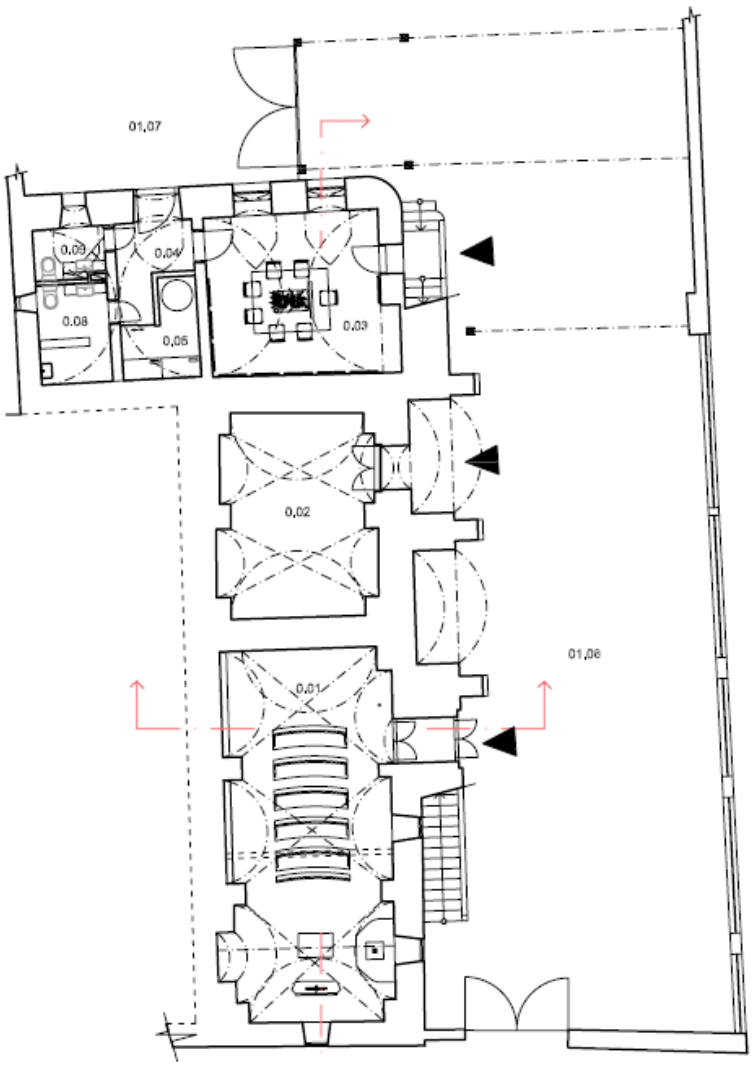
Design of a new using-concept



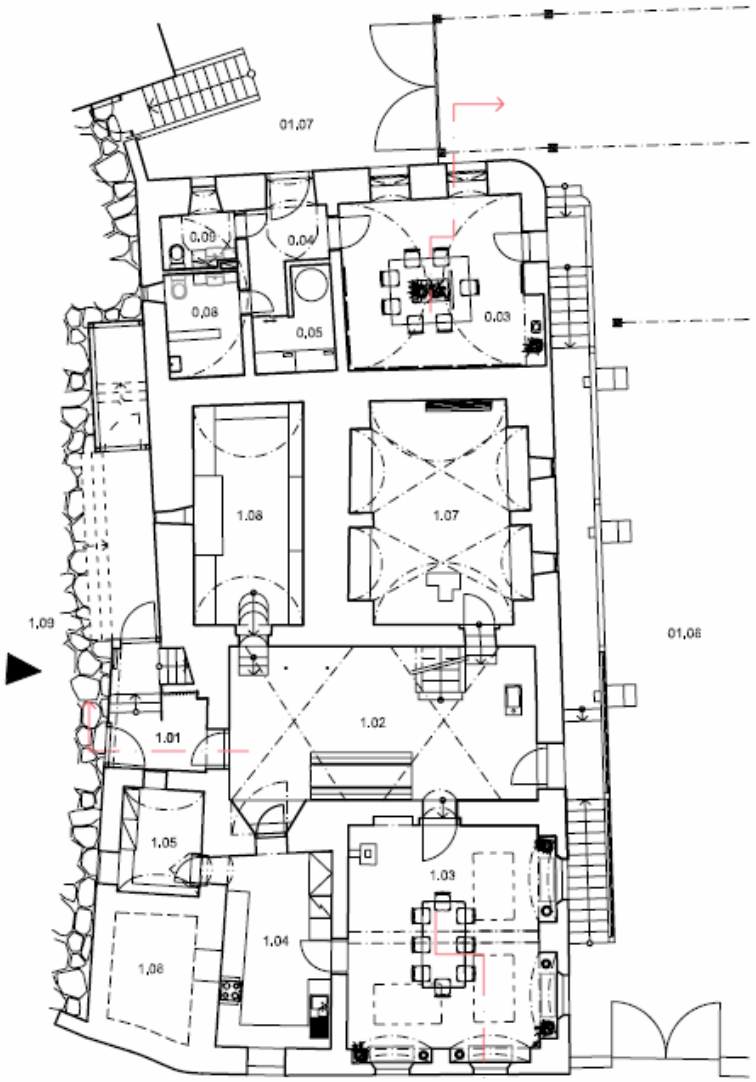
- Nr.1: Main Building
- Nr.2: Workshop
- Nr.3: Stable for donkeys
- Nr.4: Shed
- Nr.5: Former Mill
- Nr.6: Electric utility
- Nr.7: Guest house



Plans of reconstruction – ground plans

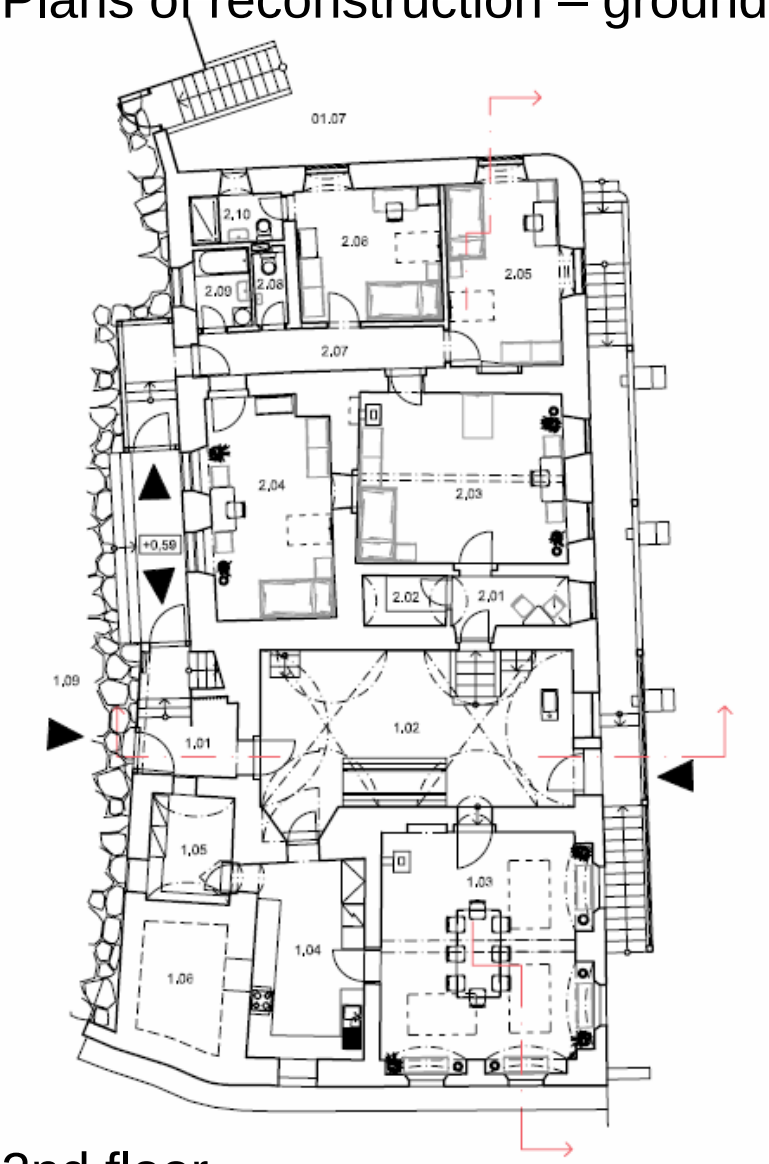


basement

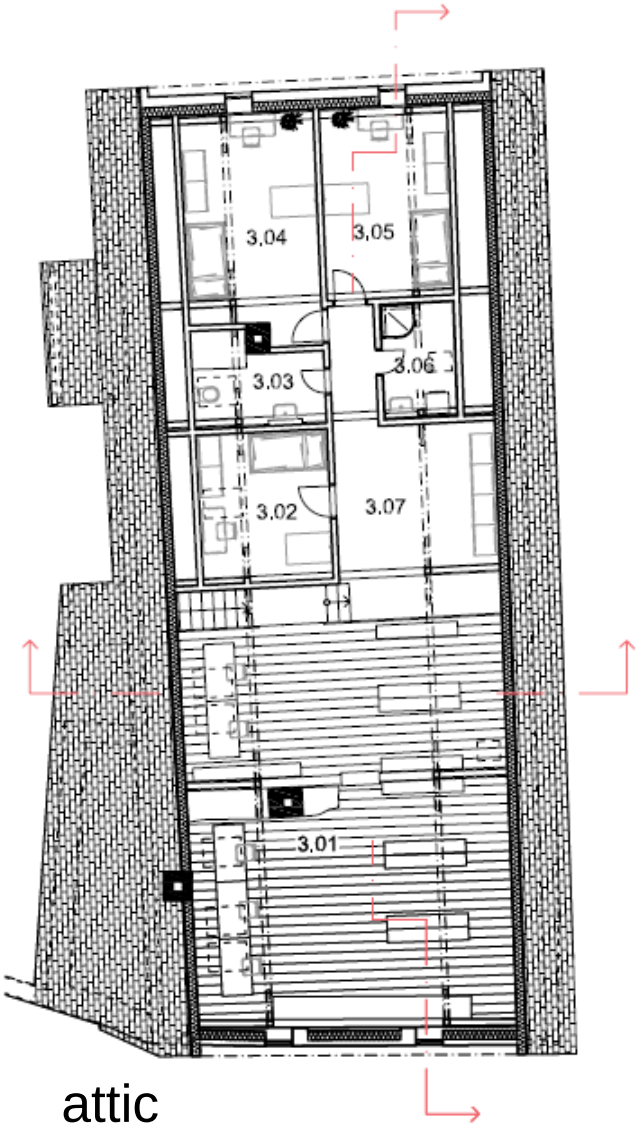


1st floor

Plans of reconstruction – ground plans

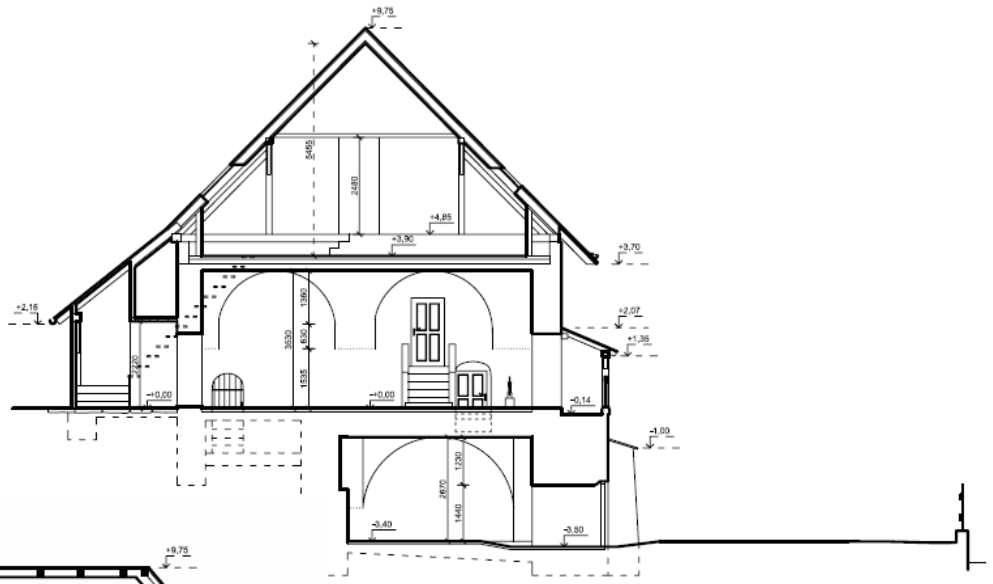


2nd floor

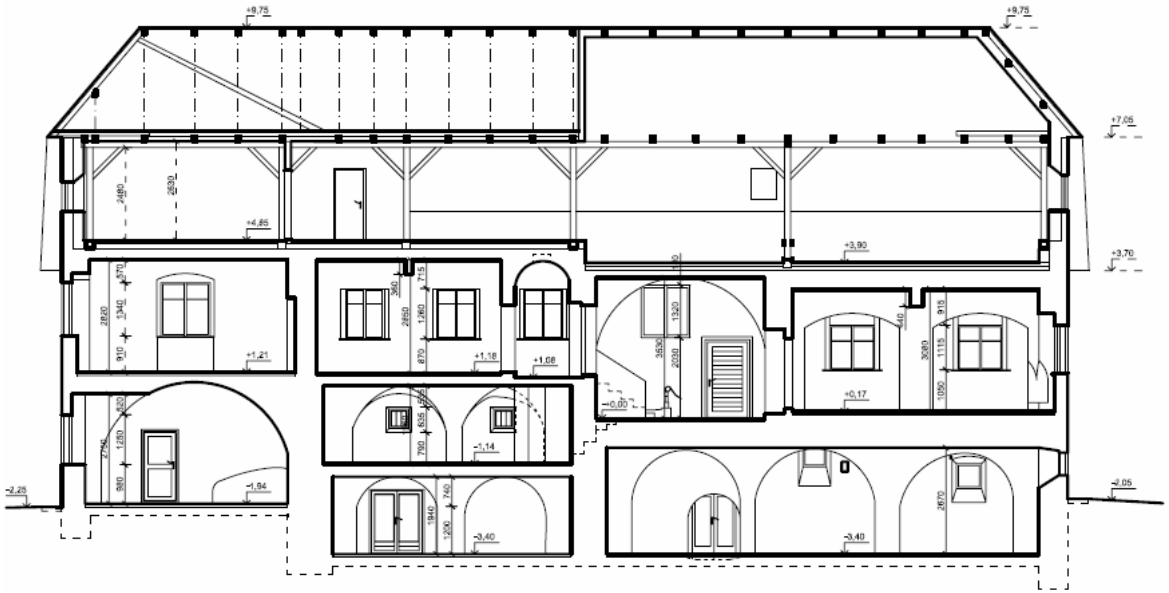


attic

Plans of reconstruction – sections



Cross section



Longitudinal section

Perspective of the court

Thank you for your attention