Advanced Housing Modernisation

Robert Hastings
- Univ. Professor Emeritus
Donau Univ.-Krems AT
- AEU Ltd. Wallisellen CH

Energy Futures Available Today: Integrating Residential Energy Savings and Solar Initiatives

Advanced Housing Modernisation

Benefits & limitations of modernisation

Strategies with examples

Conclusions for homeowners

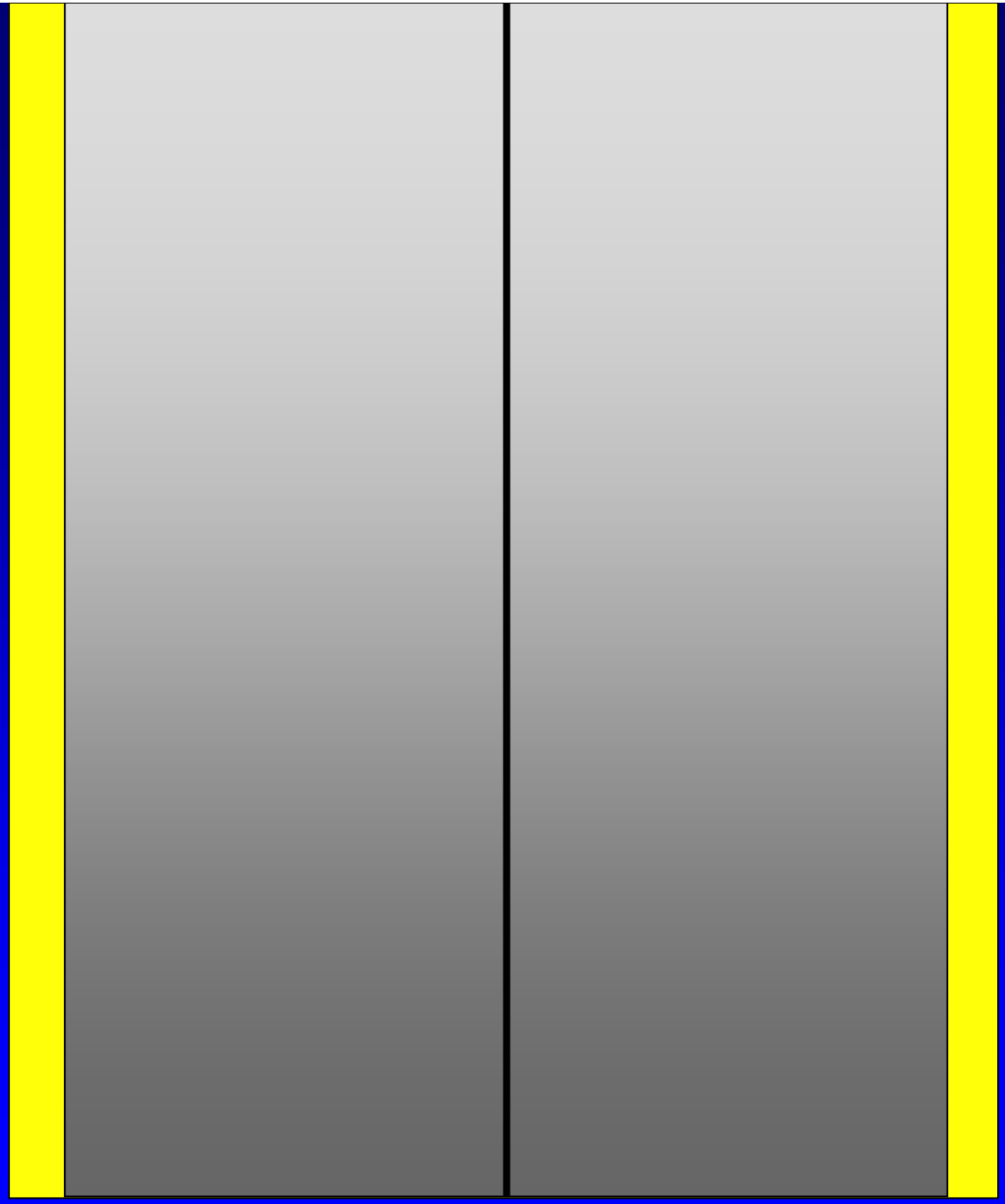
The Wonder of Modernisation

http://www.pbase.com/terry434/amish&page=1

The Wonder of Modernisation

01

02



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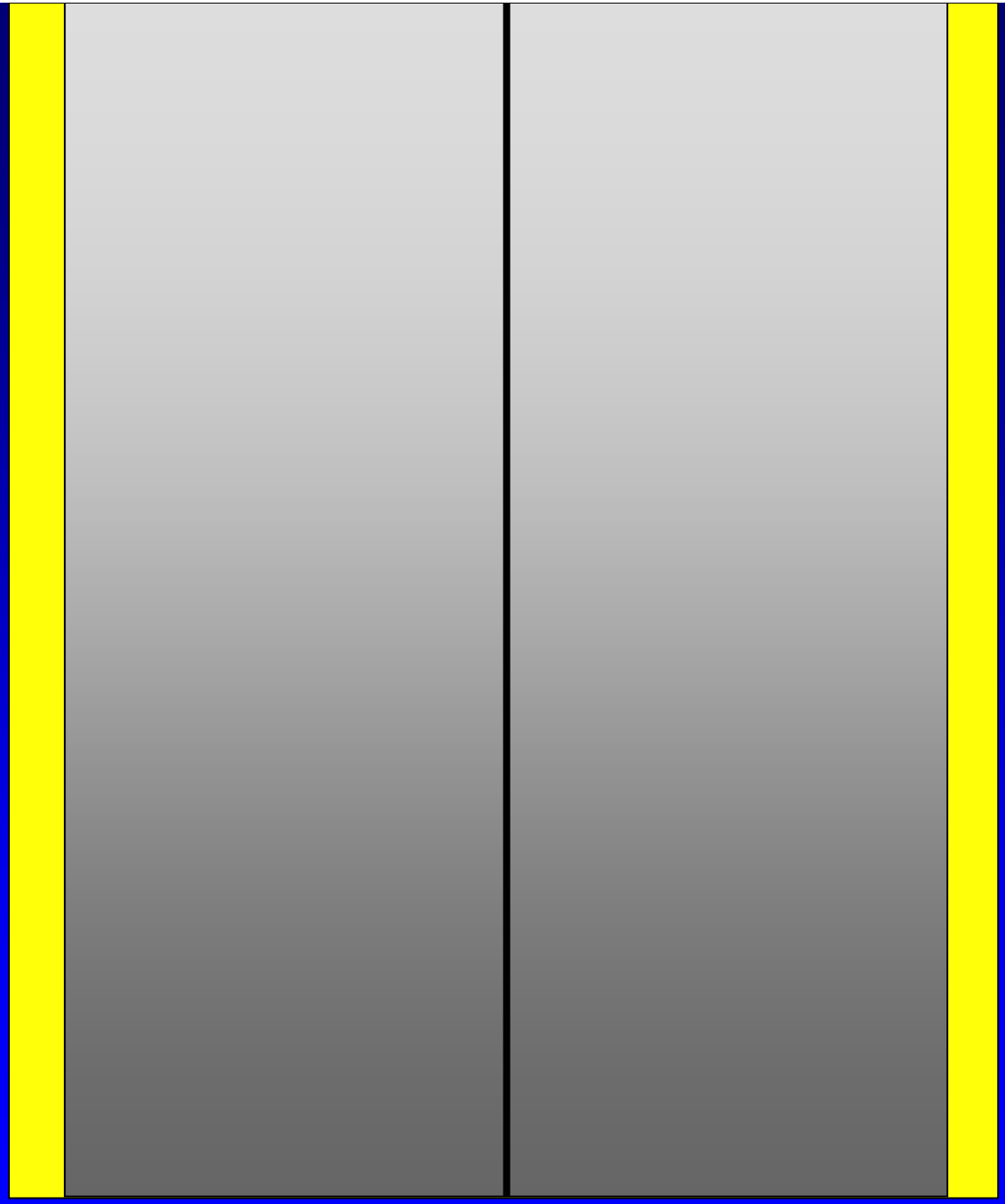

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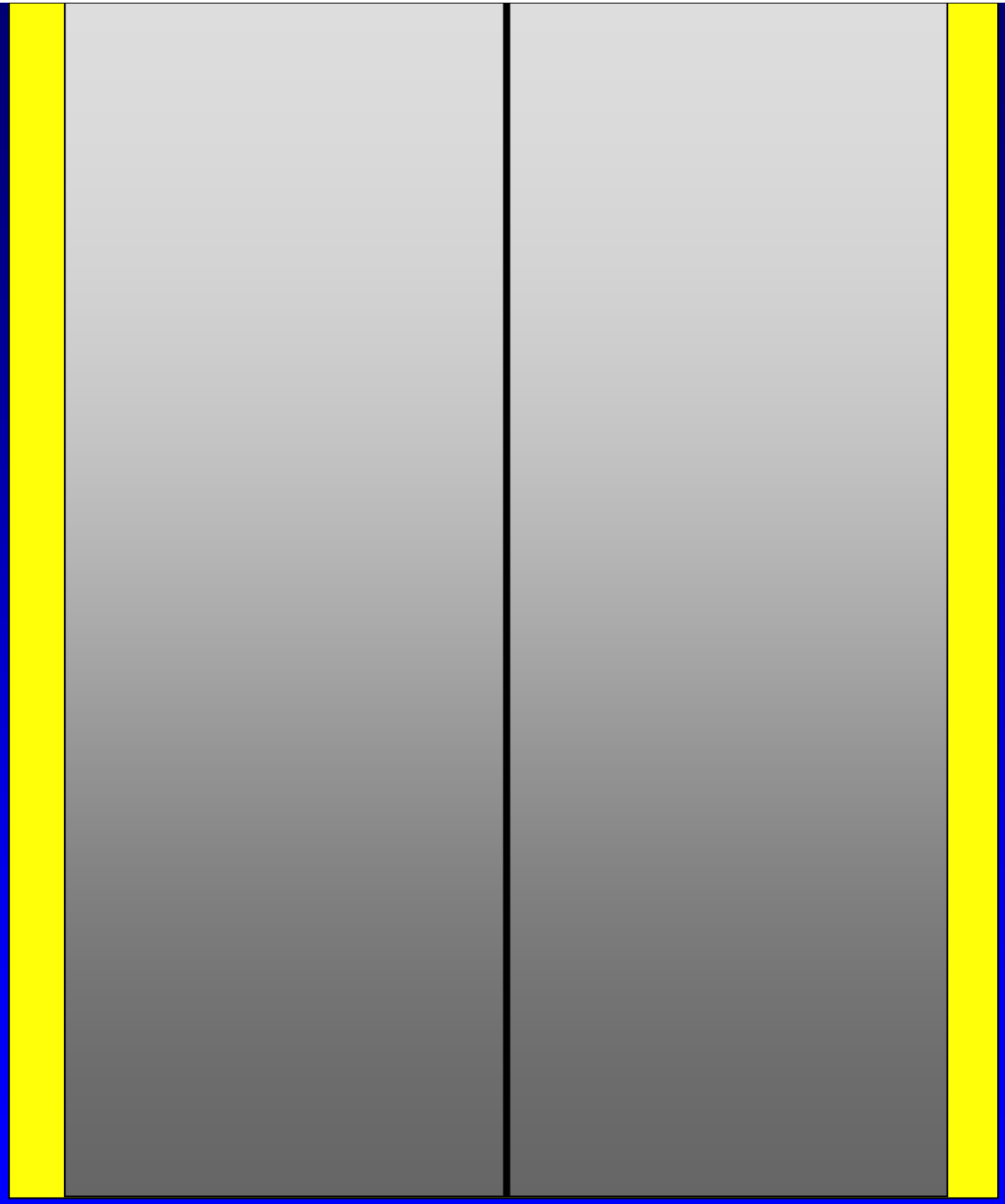

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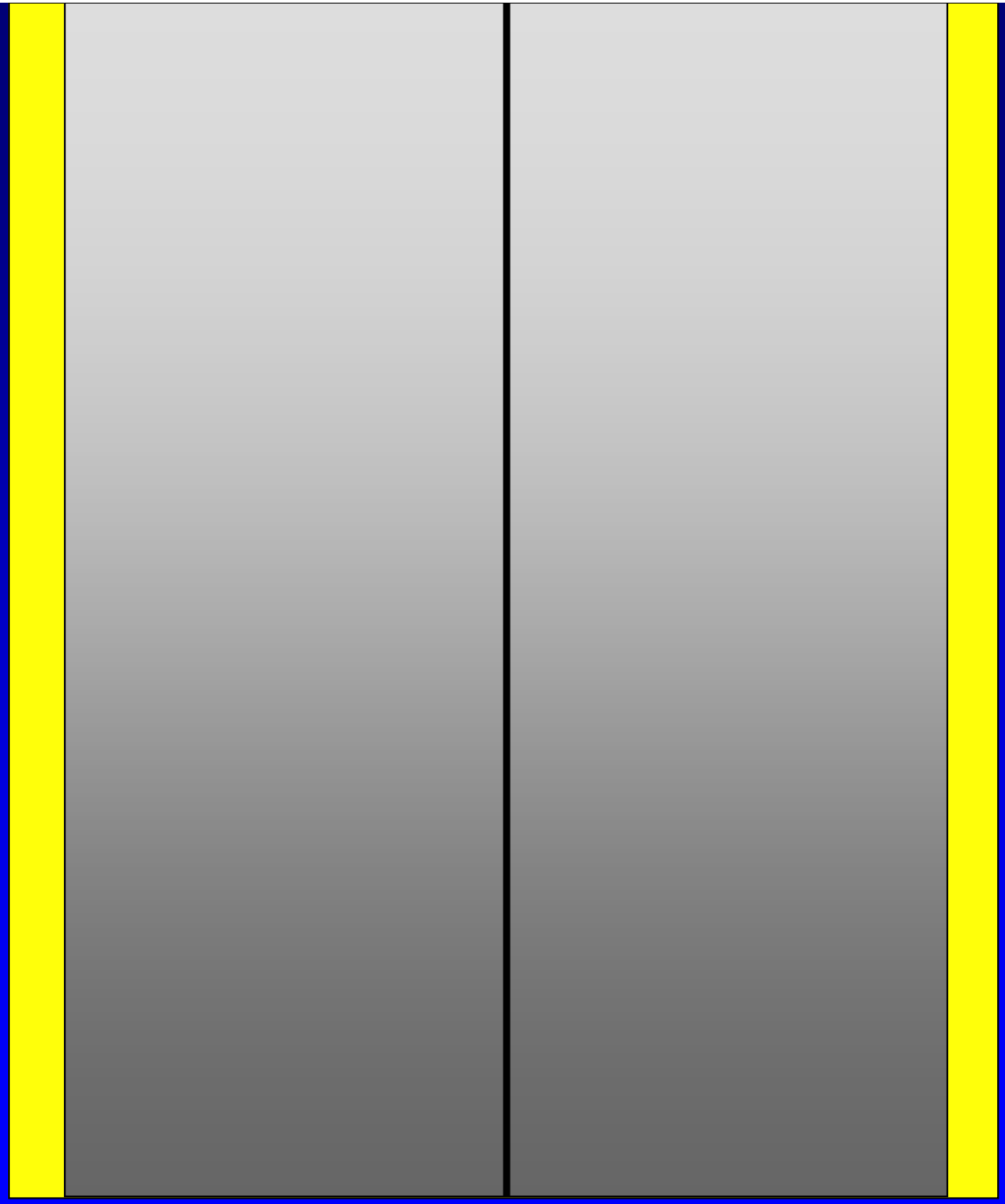


01

The wonder of modernization!

Benefits & limitations of modernisation

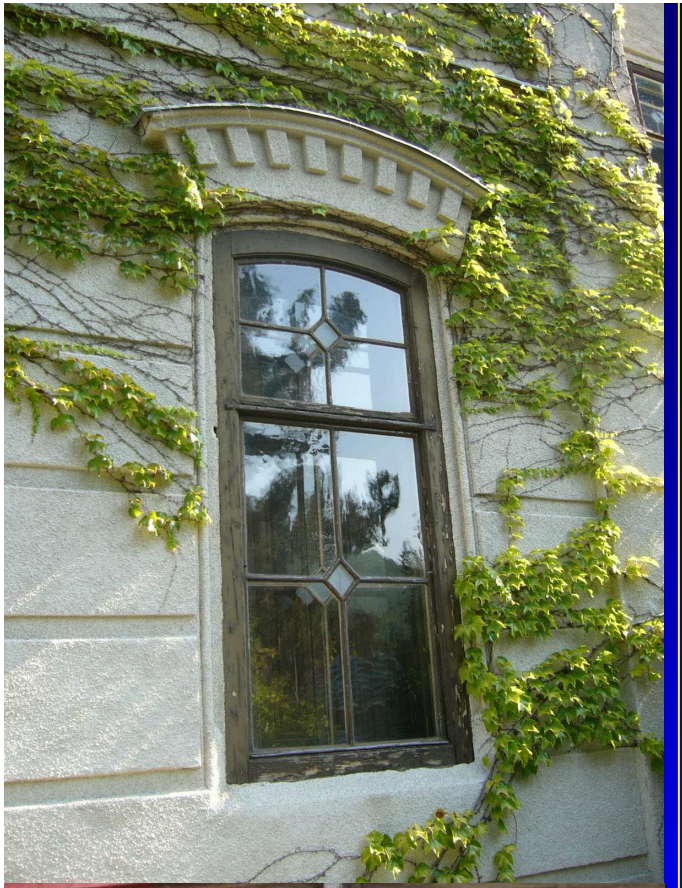
- Fix something broken
- Addition
- Comfort
- Improve value
- Energy saving

Consequences:

- Replacement fulfills modern needs and may use little energy
- Loss of buildings with character / personality
- Wasted embodied energy
- New building often a sterile box!

Two solutions:

A) Demolition and new construction



Two solutions:

A) Demolition and new construction

B) Advanced renovation

- Energy savings to 90%
- Investment affordable
- Comfort like new construction
- Richness and diversity of architecture preserved

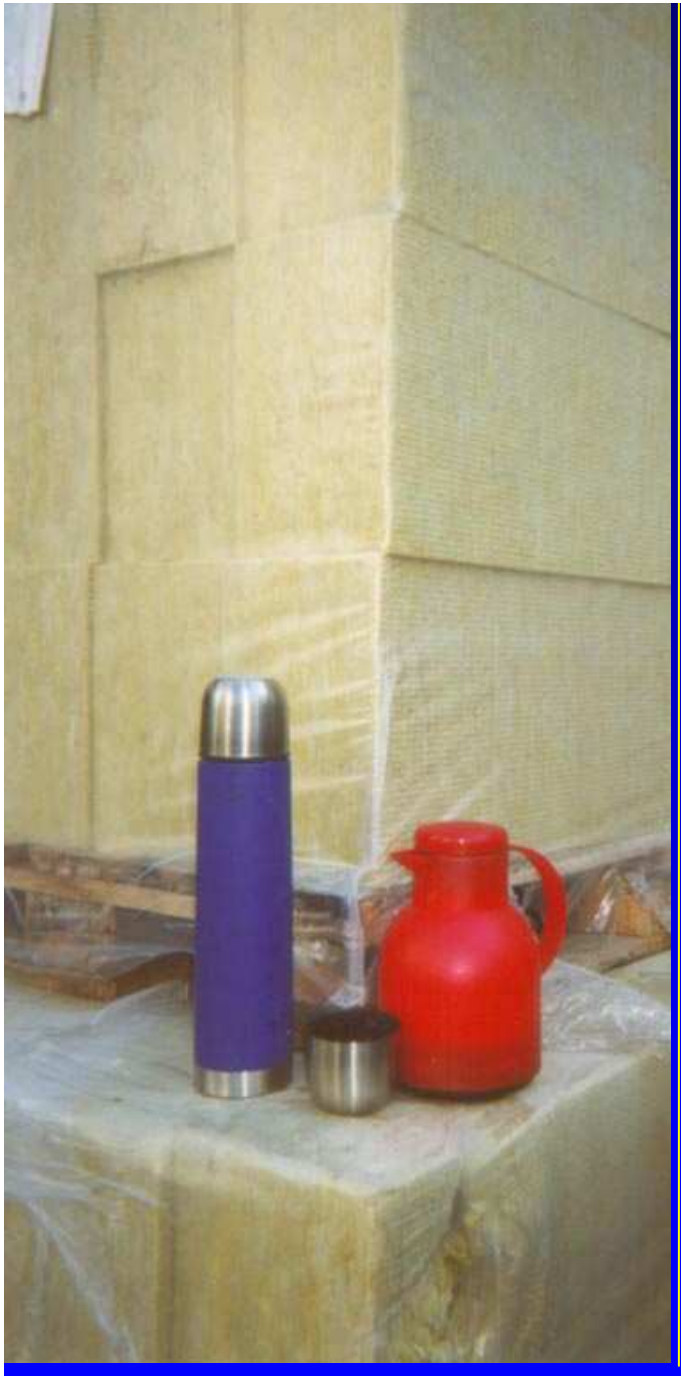
Renovation of a 19th century villa in Purkersdorf
Architekturbüro Reinberg GmbH, AT

Strategies:

1. Insulate & tighten envelope
2. Use solar heat to reduce non-renewable energy use
3. Use PV to offset non-renewable energy use
4. Use passive solar to save energy, improve living quality

1. Insulate & tighten envelope

3-L-Haus Freyastraße
42 - 52 Manheim DE



Insulation is basis of rational renovation

Least cost:

- reduces heating bills
- eliminates cause of mould
- improves comfort

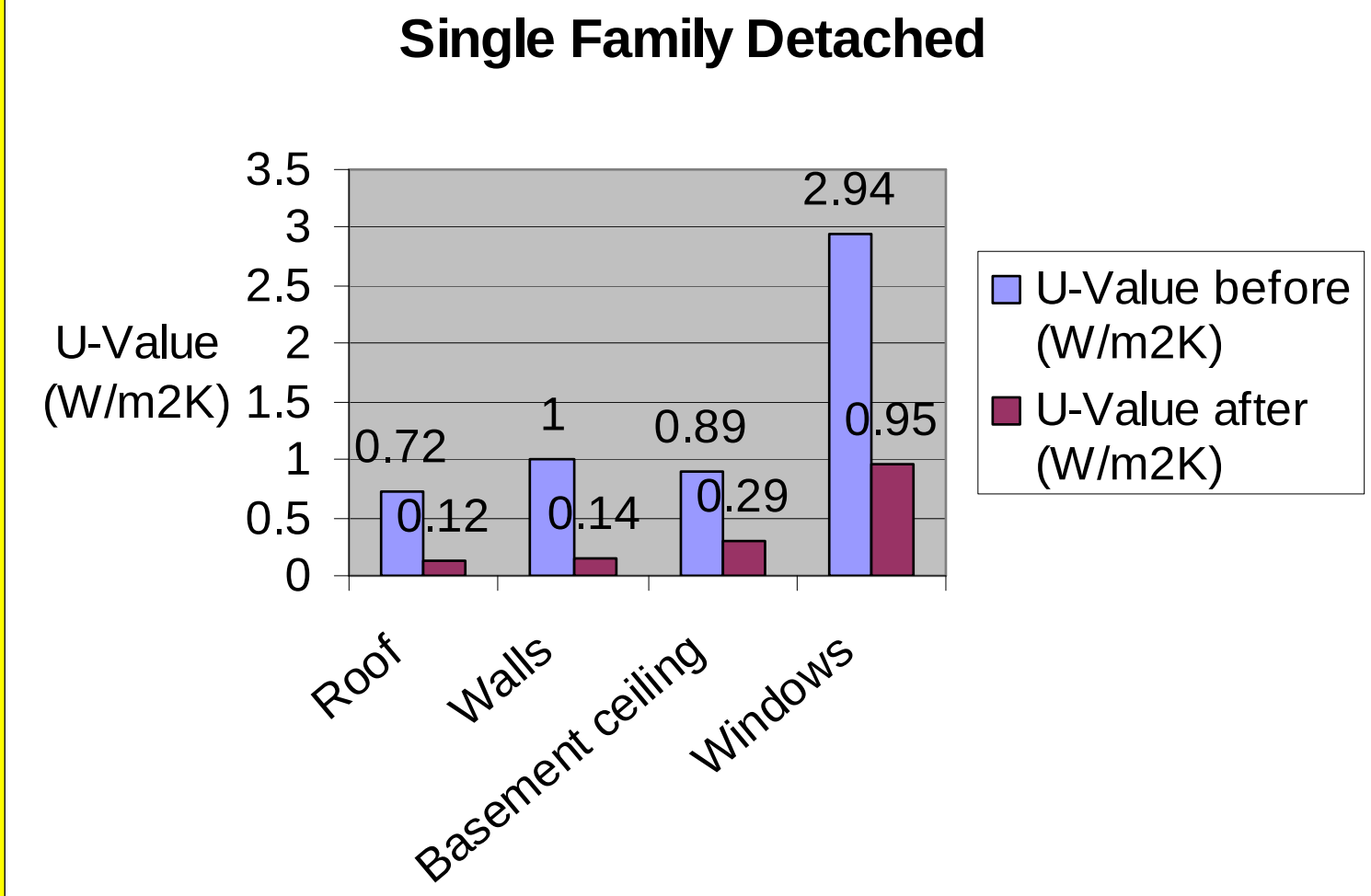
But, requires attention to details:

- Anchoring thick insulation
- Trimming windows and doors
- Optimization of thickness

Historic buildings a challenge:

- exterior insulation often forbidden
- interior insulation $\Rightarrow$ thermal bridges.

Key to saving energy is insulating the envelope



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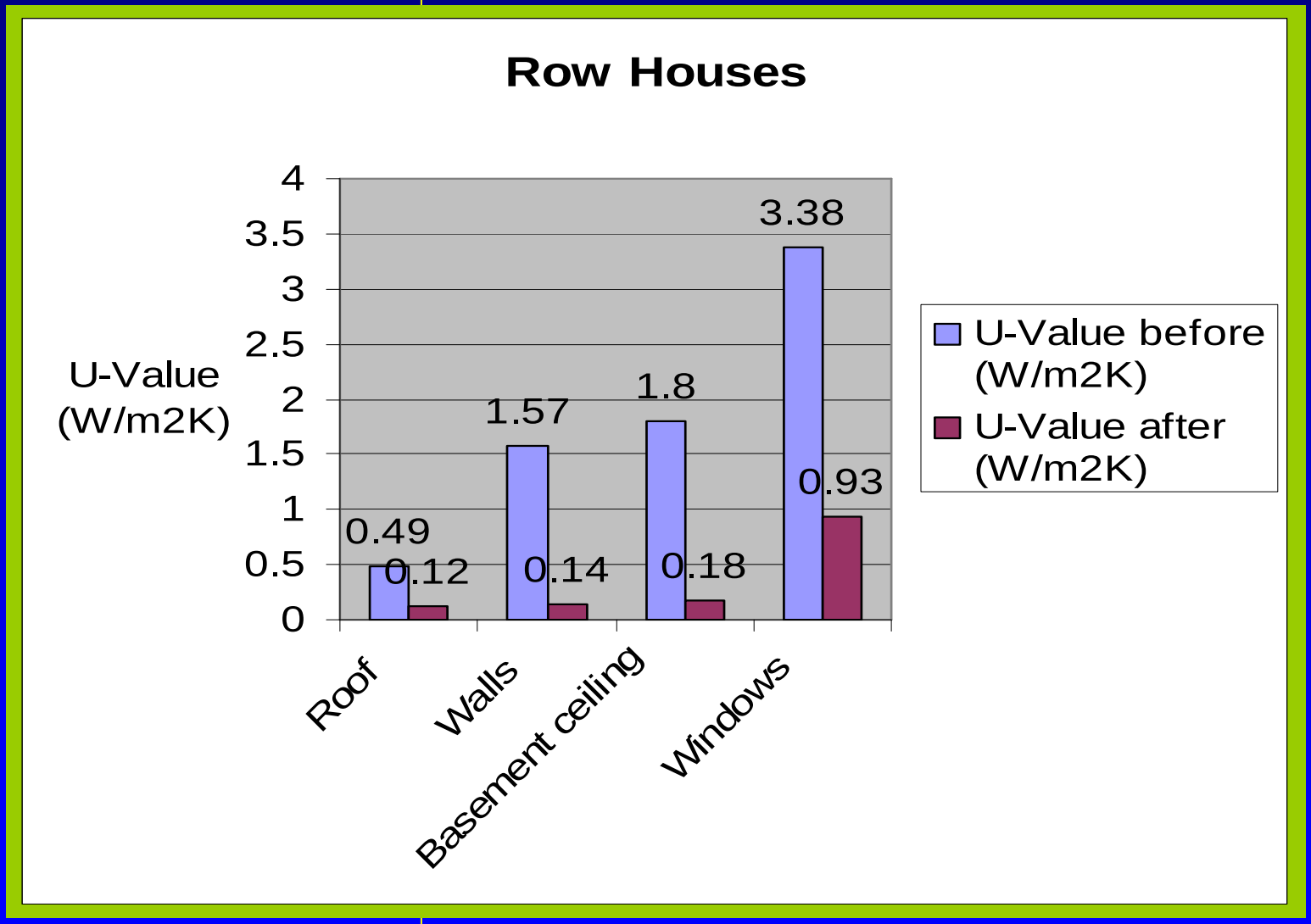

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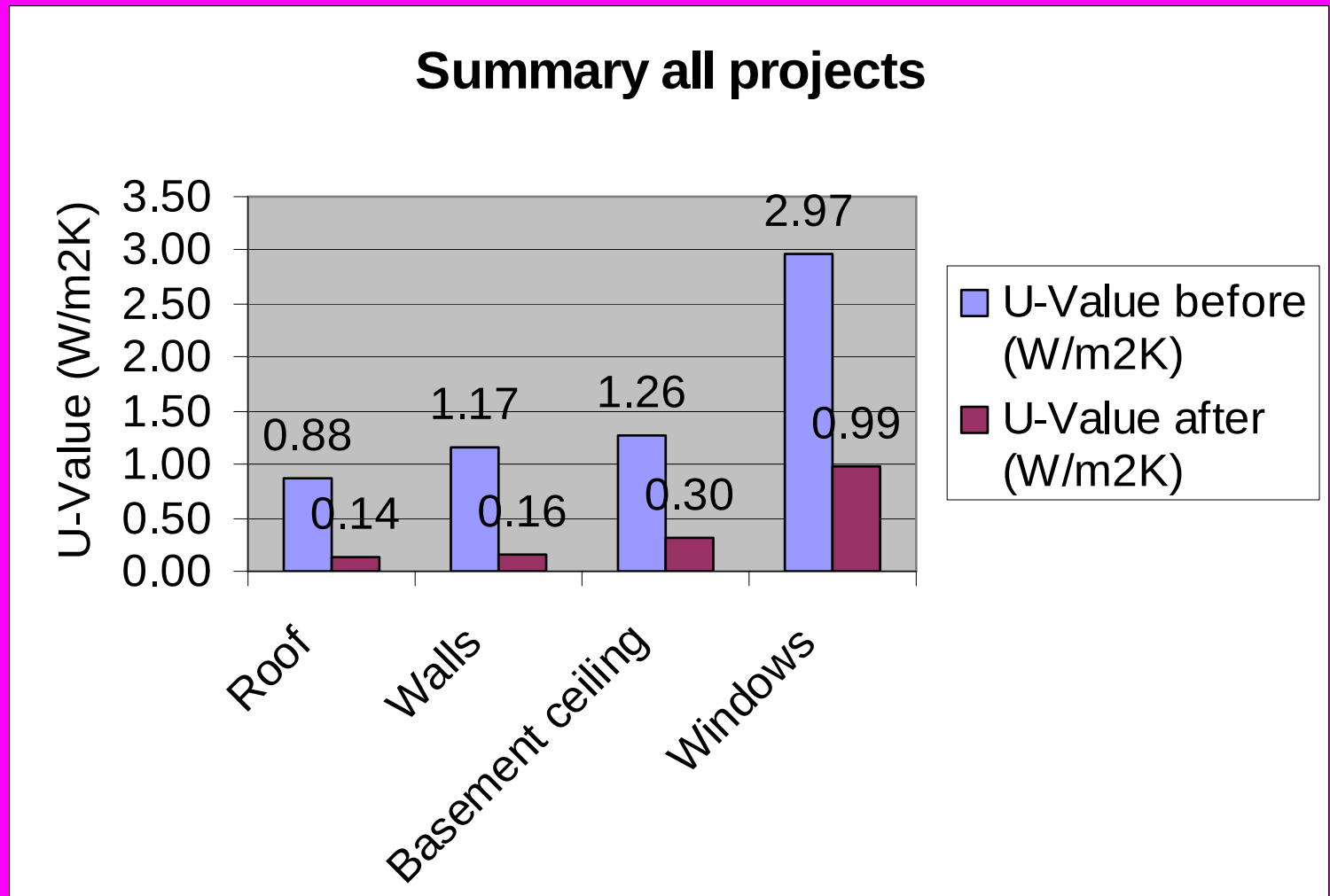


Gentle renovation

in Modena IT

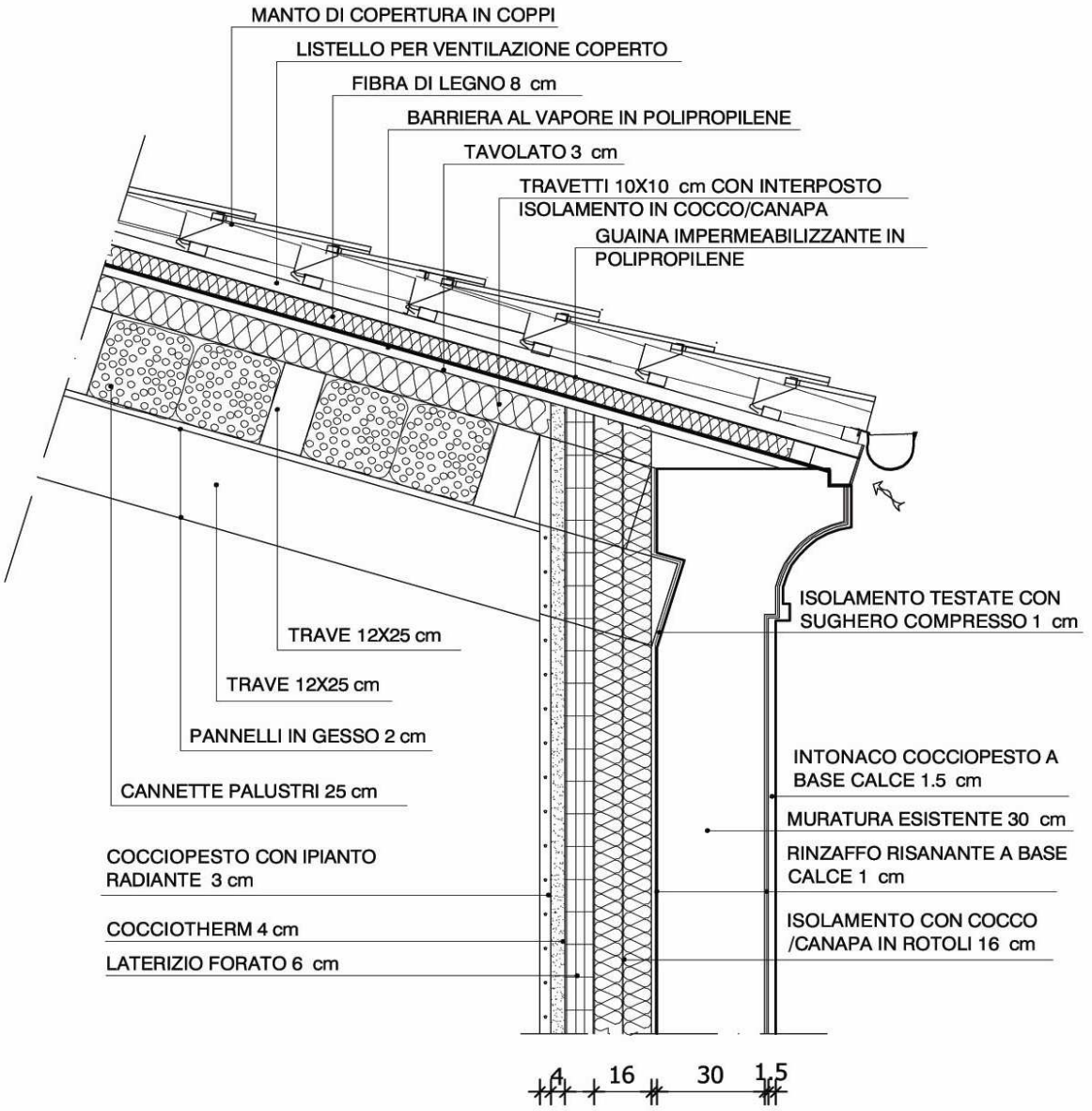
Calderaro, Valerio

Strategies:

New interior cavity wall coconut + cork panels (400 + 600 mm)
U 1.75 ⇒ 0.25

New inner windows
U 4.6 ⇒ 1.5 W/m²K

PARTICOLARE DELL'ATTACCO DELLA COPERTURA LATO NORD-EST



35 kW condensing gas boiler replaced
104 kW oil furnace

12 m^2 vacuum tube collectors cover most heating + dhw demand spring thru autumn

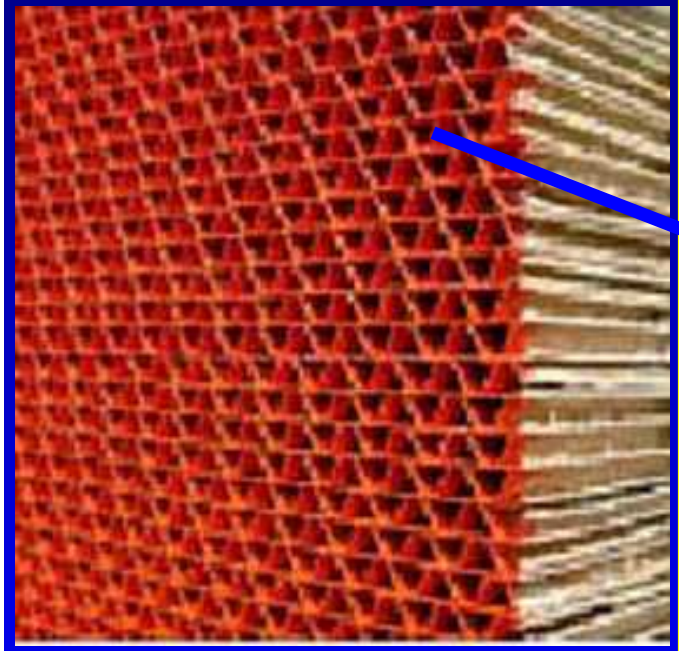
81% savings of primary energy
space+water heating
(367 $\Rightarrow$ 70 kWh/m^2)

Calderaro, Valerio

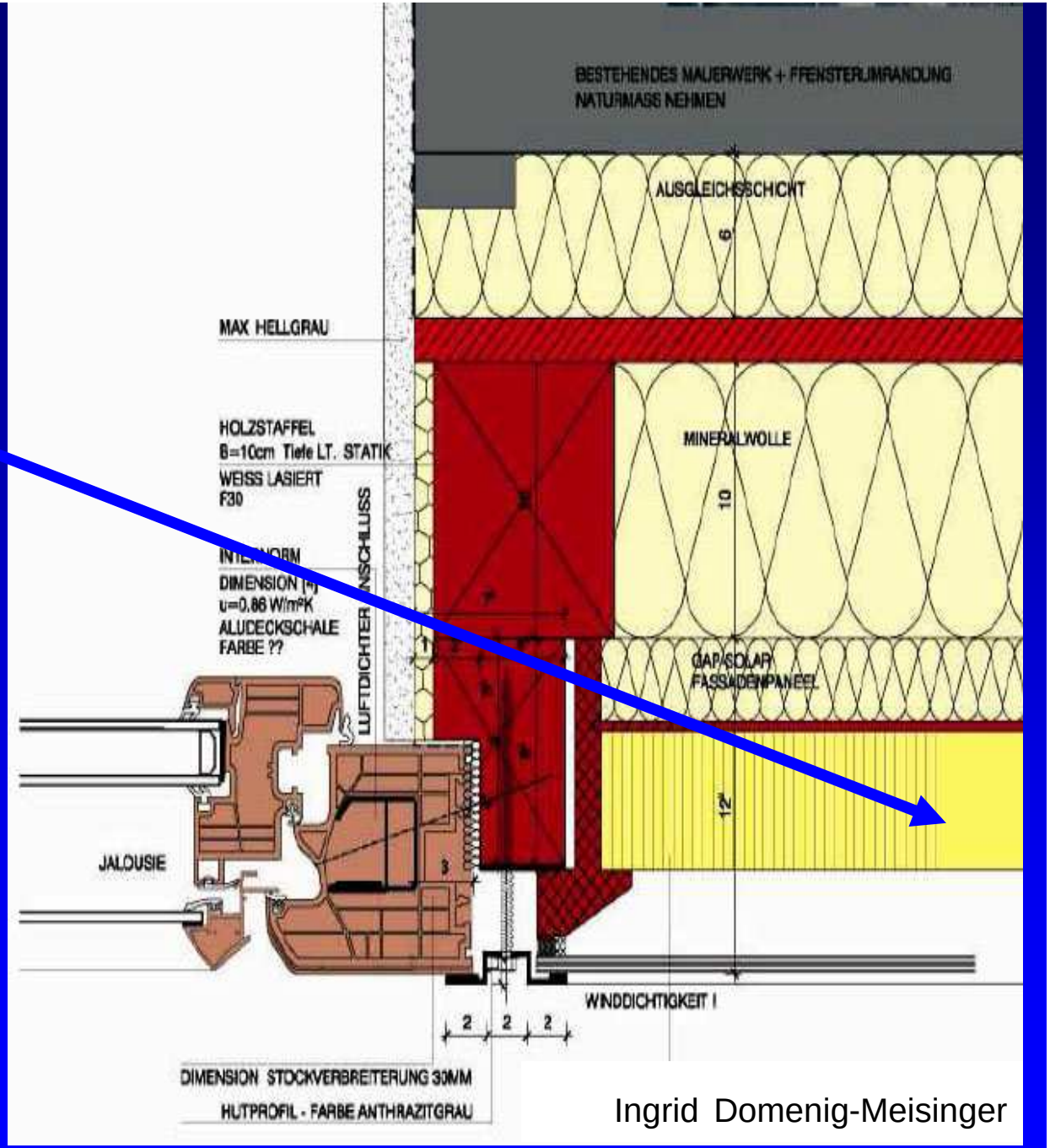
Solar Facade Renovation of 50 flats in Linz AT

Ingrid Domenig-Meisinger

Prefabricated
solar façade
$U_{dynamic} \approx 0\ W/m^2K$



88 % savings in heating costs!
150 kWh/m²a / 20 kWh/m²a



Ingrid Domenig-Meisinger


2. Use solar heat to reduce
non-renewable energy use
Hubert Fehr-Bigger
Architekt, Walenstadt CH

Marginal costs

At certain point
energy <u>delivered</u> from solar
competitive with
energy <u>saved</u> from conservation

i.e. costs of:

- Last increment of insulation
- 3x verses 2x glazing / frames
- High effic. ventilation heat recovery

Key is well matched systems

Conservation measures drastically shortens heating season

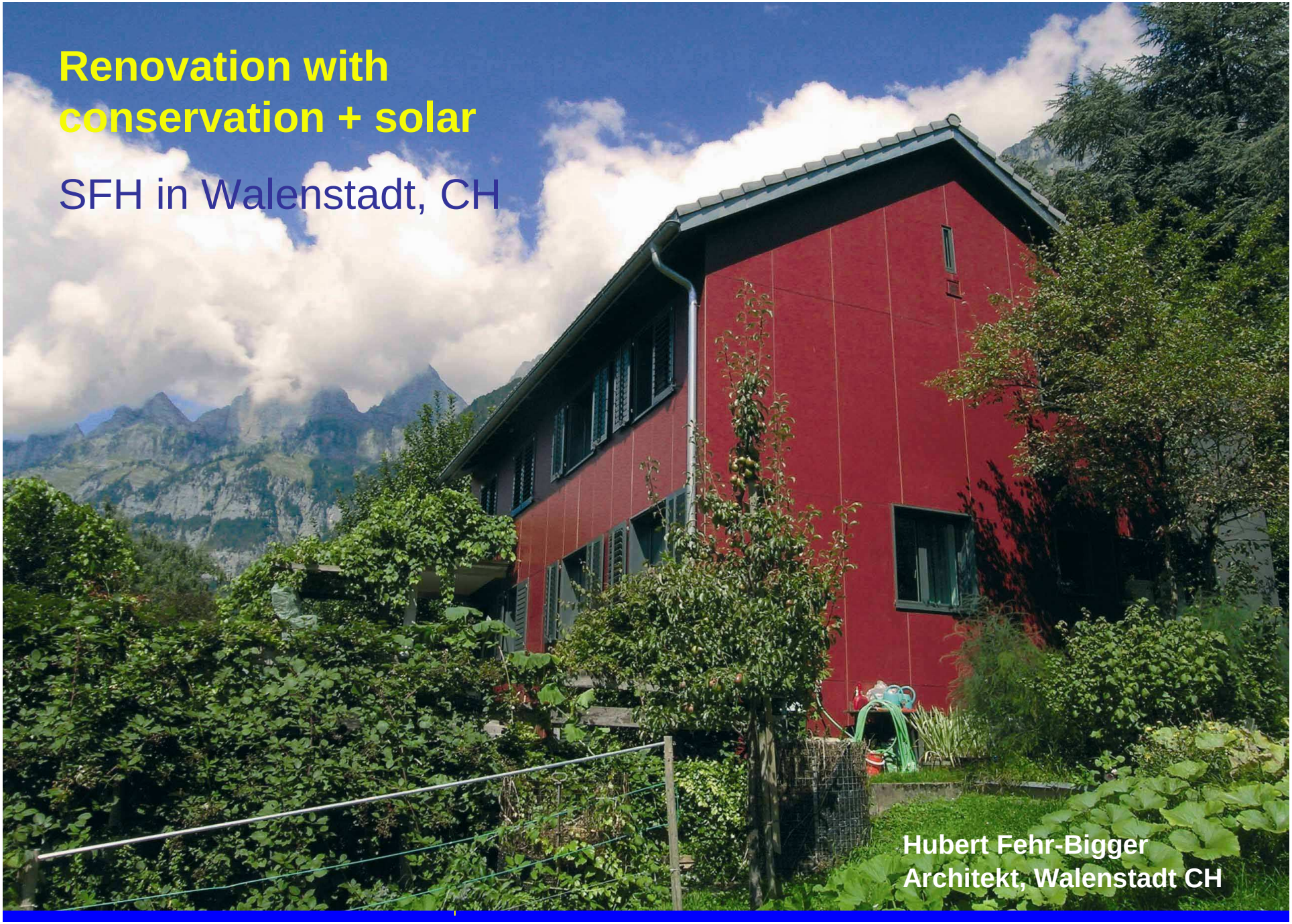
Solar system can cover
- heating spring to fall
- hot water demand all summer

Example: solar + pellet oven:
- Solar reduces oven tact frequency (each firing = 800 W_{elec} x 15 min)
- Higher oven efficiency

Saves energy, extends component life

Renovation with conservation + solar

SFH in Walenstadt, CH



Hubert Fehr-Bigger
Architekt, Walenstadt CH

Strategies:

13 m^2 drain-back solar
800 L tank.

Roof, wall and
basement insulated:
220, 200 and 80 mm

PH Windows

3 kW wood pellet stove

Ventilation sys. with
80% heat recovery

Hubert Fehr-Bigger
Architekt, Walenstadt CH

Solar covers:

- Much of space heating demand spring and fall
- All dhw heating in summer

1½ T wood pellets per year instead of 3,500 litres heating oil

Annual primary energy cut 80% !
(230 to 47 kWh/m^2)

Hubert Fehr-Bigger
Architekt, Walenstadt CH

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Renovation incl. solar air collectors

Vacation hut in Werfen AT

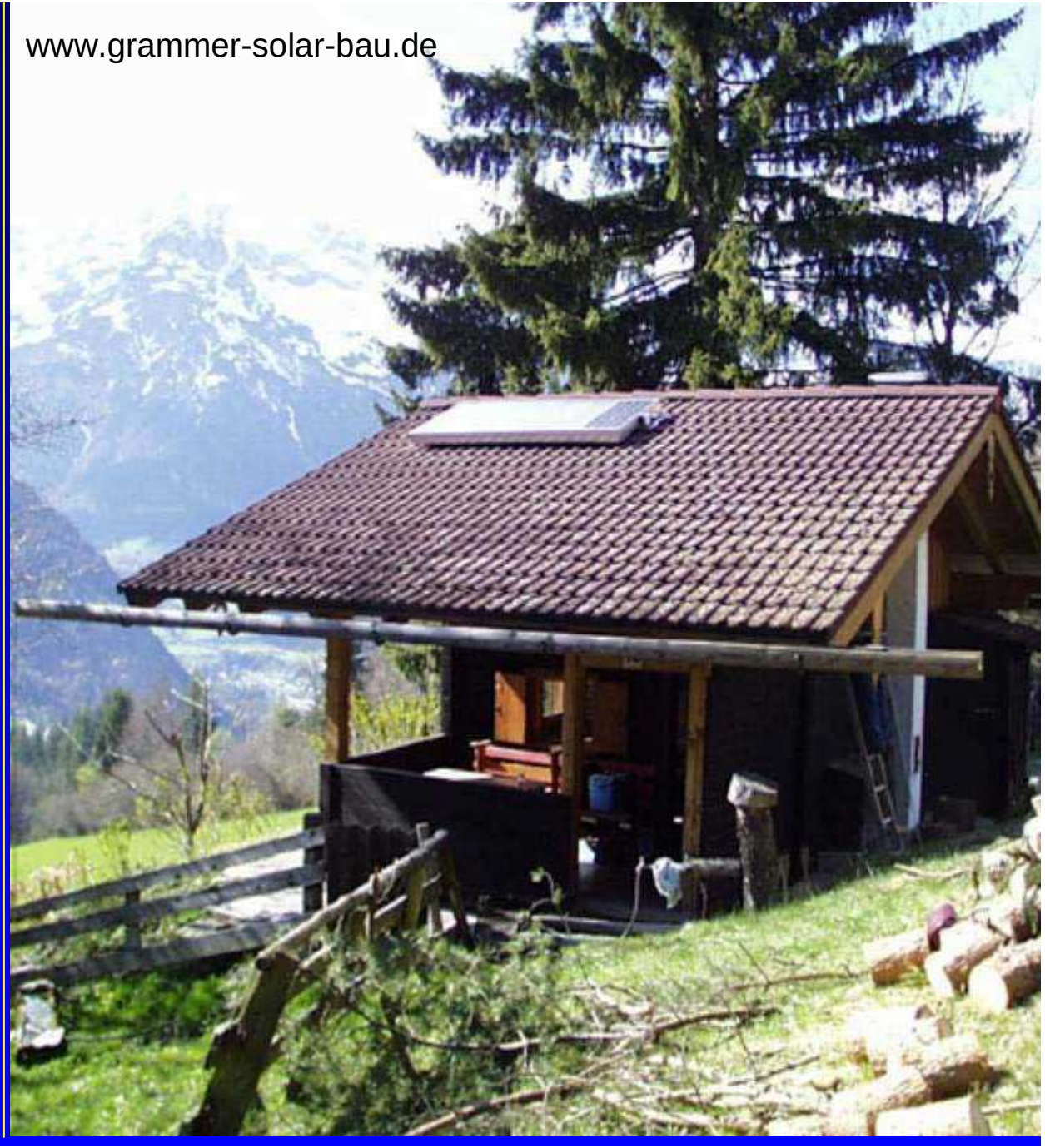
In operation since 1999

Hot air: 120 m³/h

Nominal heating capacity: 1.5 kWp

www.grammer-solar-bau.de

www.grammer-solar-bau.de



Advantages

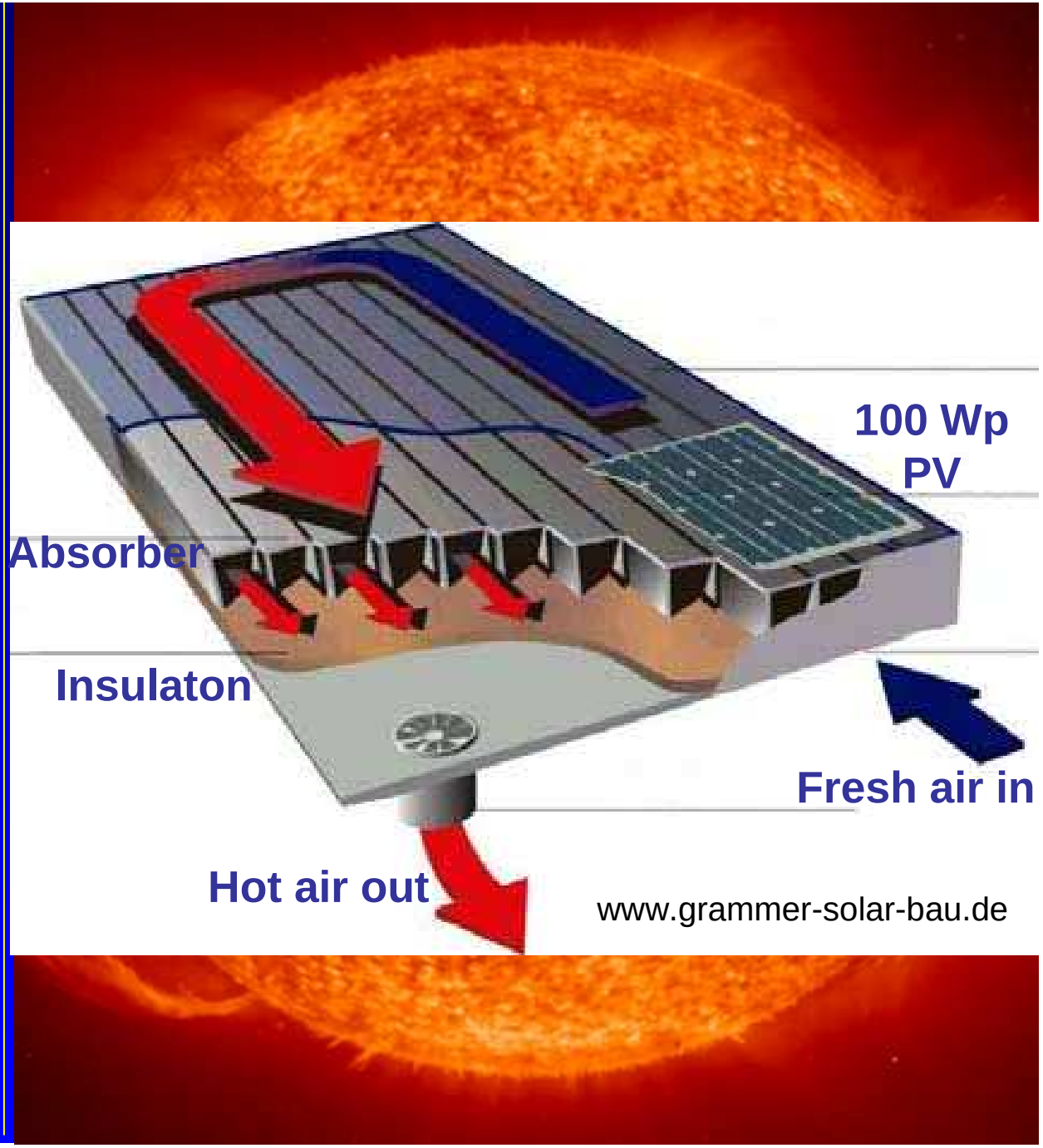
Eliminates base heat load (electric)

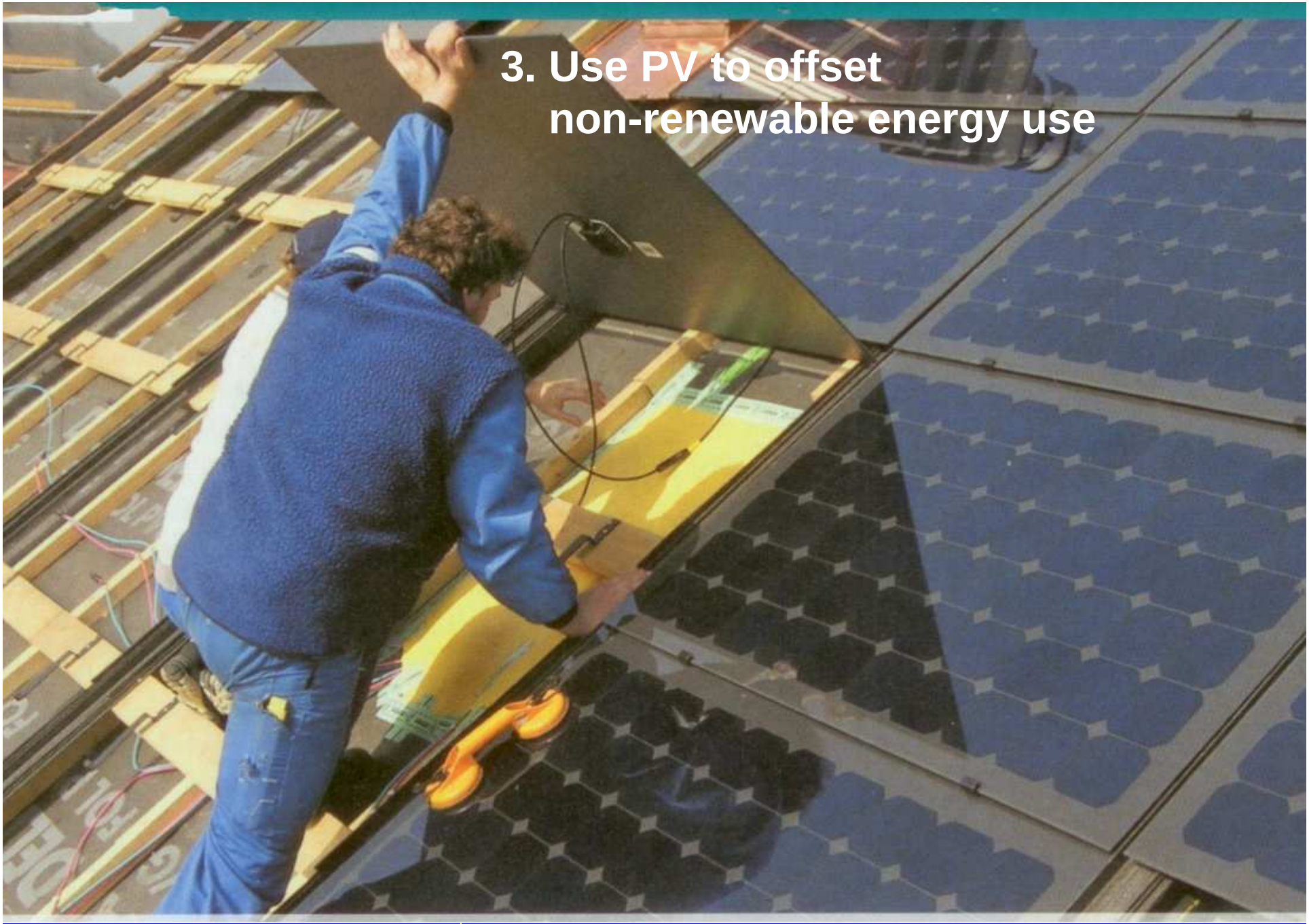
No musty odour & dampness during absence

Keeping house tempered allows rapid heating up

Runs even when power failure

Freeze protection




3. Use PV to offset
non-renewable energy use

Decisive factors:

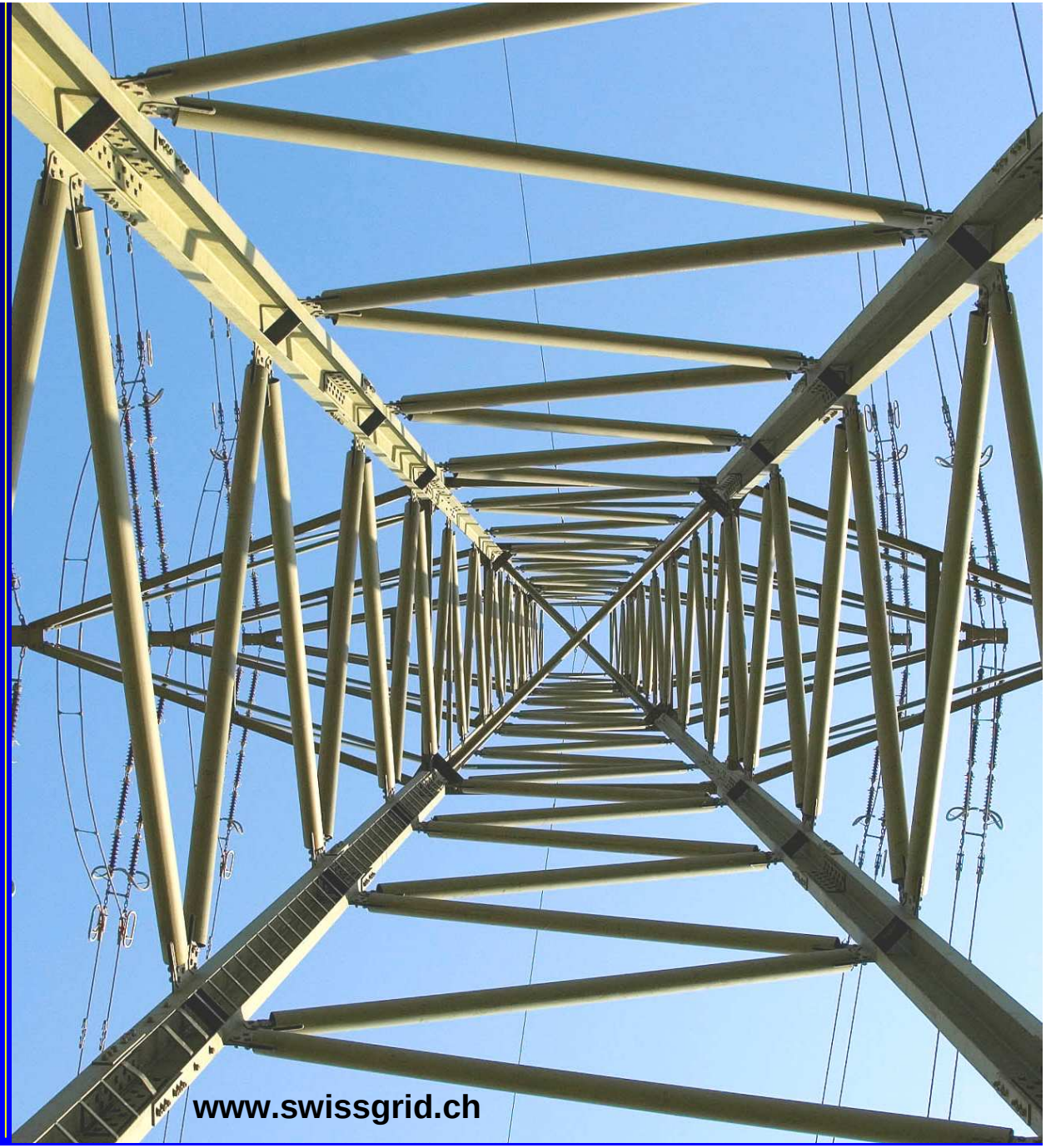
Utility Feed-in tarif & duration

Example: Switzerland

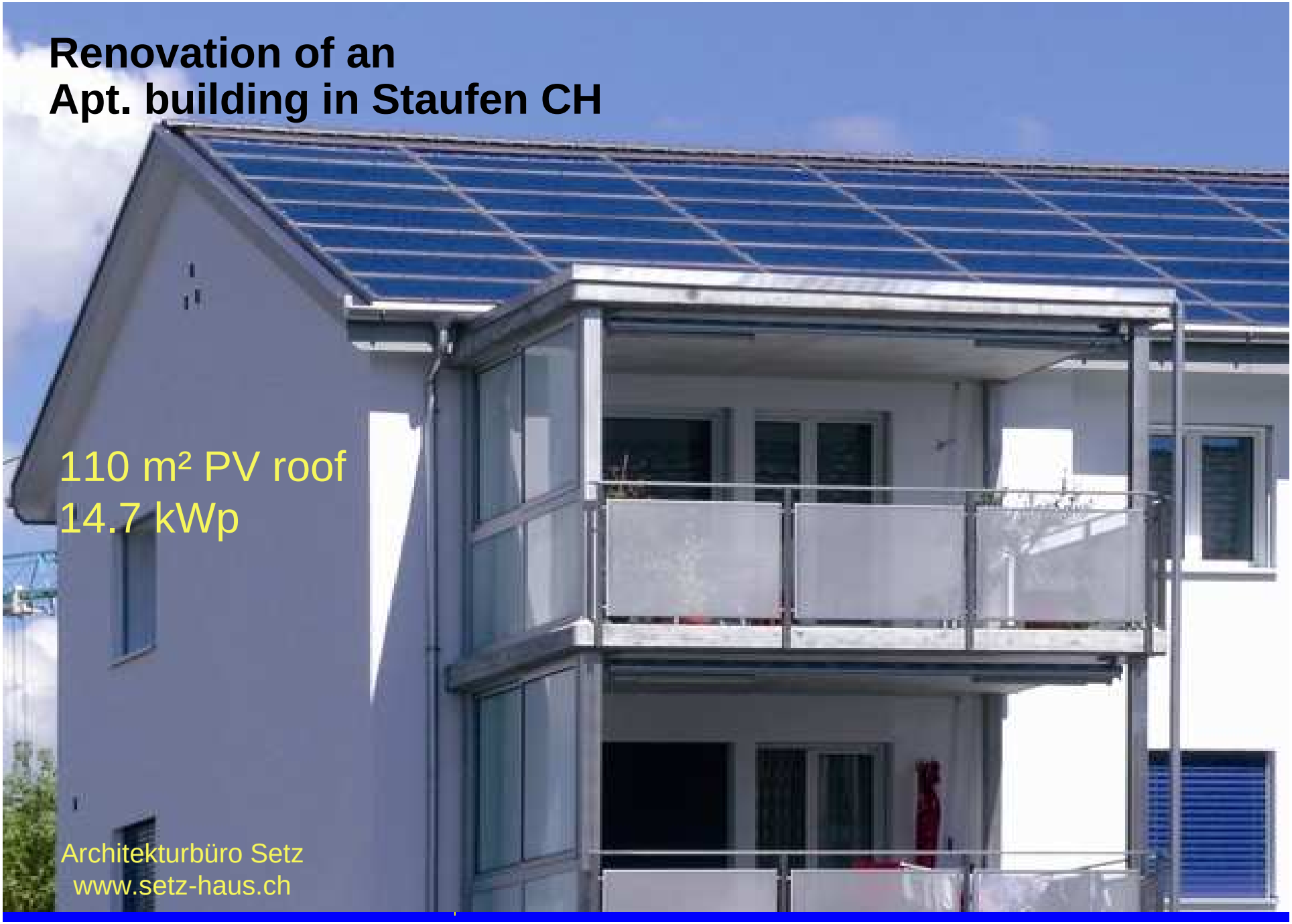
As of 2010:

Systems ≤10 kW:
buy-back rate fkr 25 years
- bldg. attached: €0.41
- bldg. integrated: €0.50

www.swissoolar.ch



Renovation of an Apt. building in Staufen CH



Also part of renovaton package:

Insulation (mm):
- attic floor: 140
- Façade 200
- cellar ceiling 100

Ventilation with 85% heat recovery

heat pump replaced oil furnace

Primary energy for heating + water cut 65% !

(154 to 54 kWh/m²)

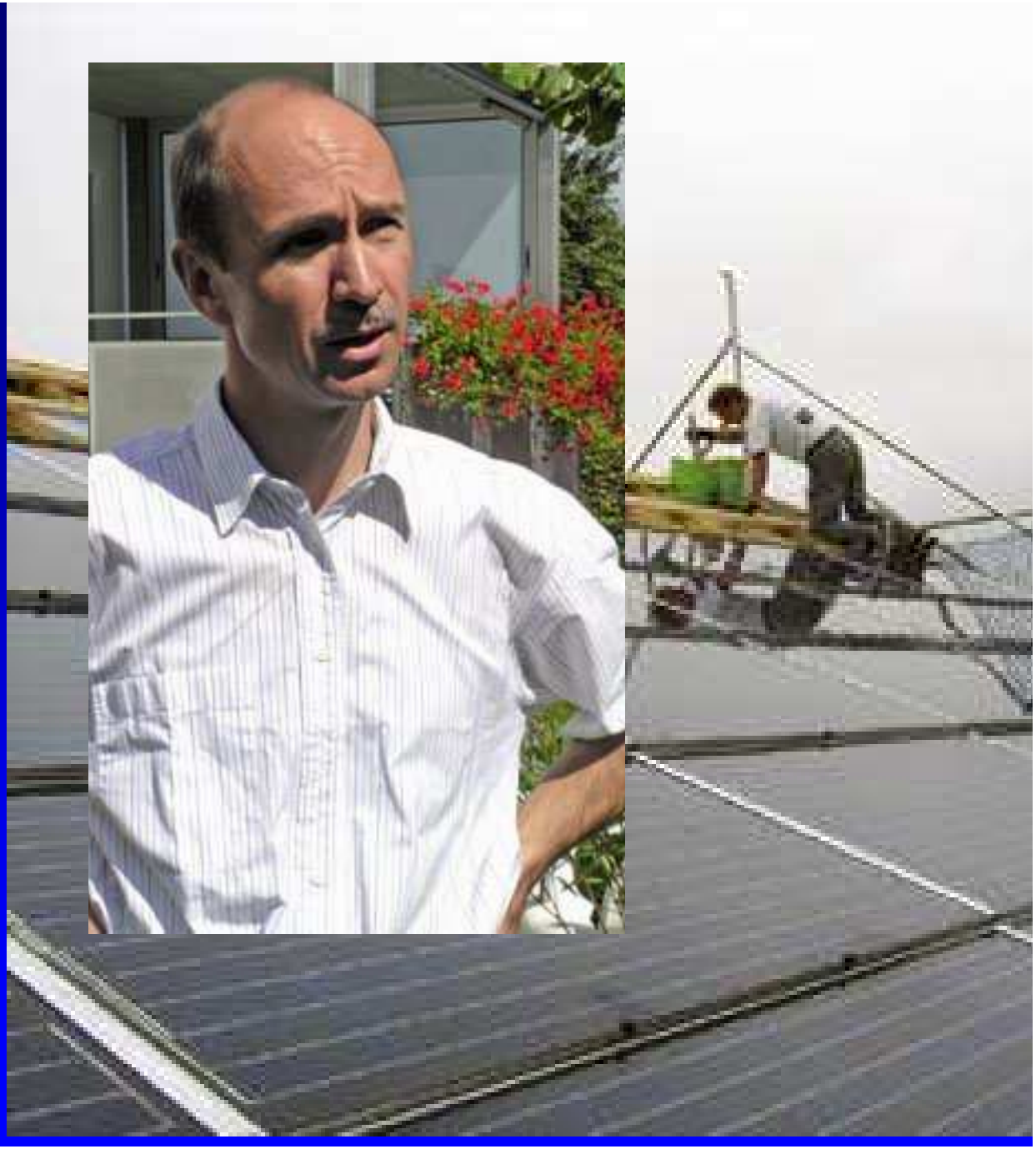
Architekturbüro Setz
www.setz-haus.ch

Motivation of building owner: Guido Erni

PV + renovation investment for future retirement income.

"It would be irresponsible not to install PV on this optimal surface!"

In 2006 PV output = 14.3 MWh



4. Use passive solar to reduce energy and improve living quality

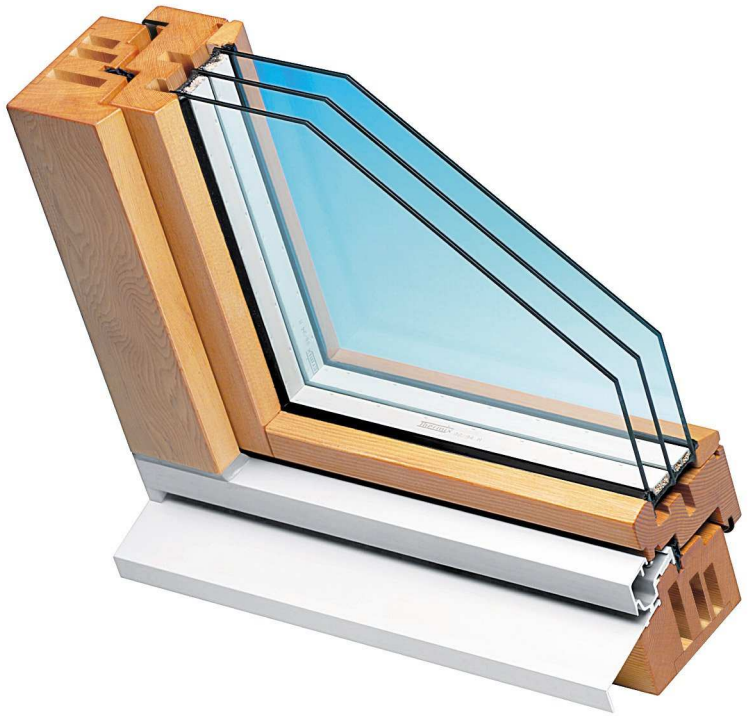
Goals

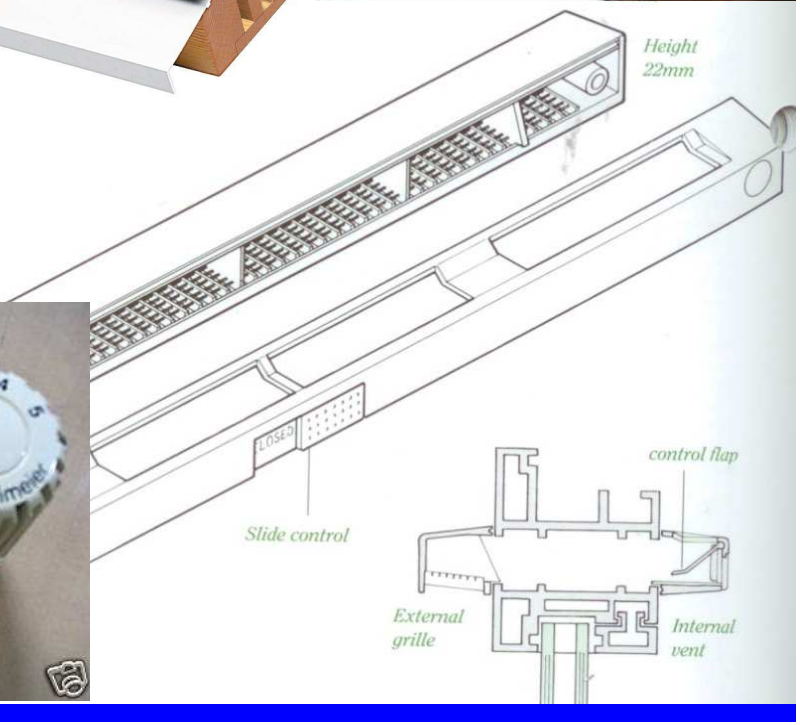
1. Net heat gain
2. Daylighting
3. Summer comfort

1. Net heat gain

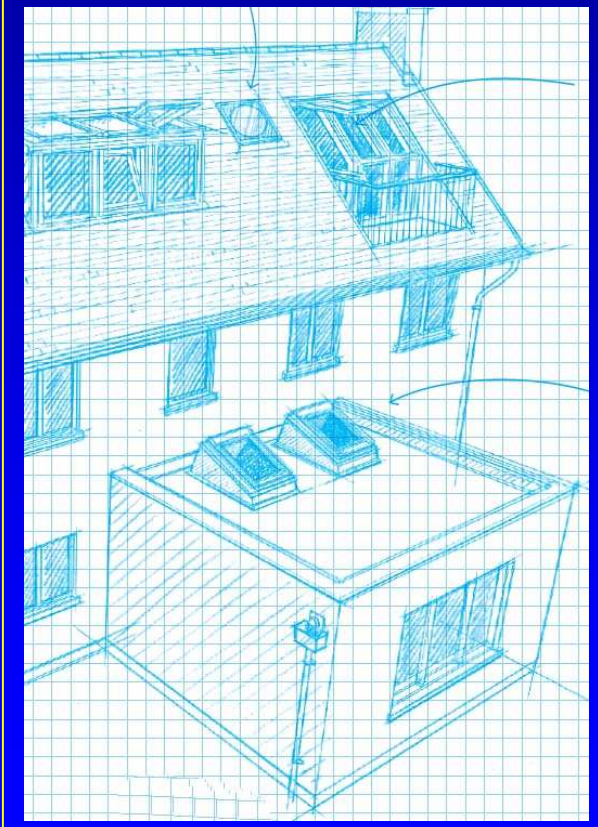
Useful solar > heat loss

- PH quality windows
- Mass
- Planned nat. ventilaton
- Room temperature regulation





2. Daylighting by opening the Envelope!



3. Summer comfort

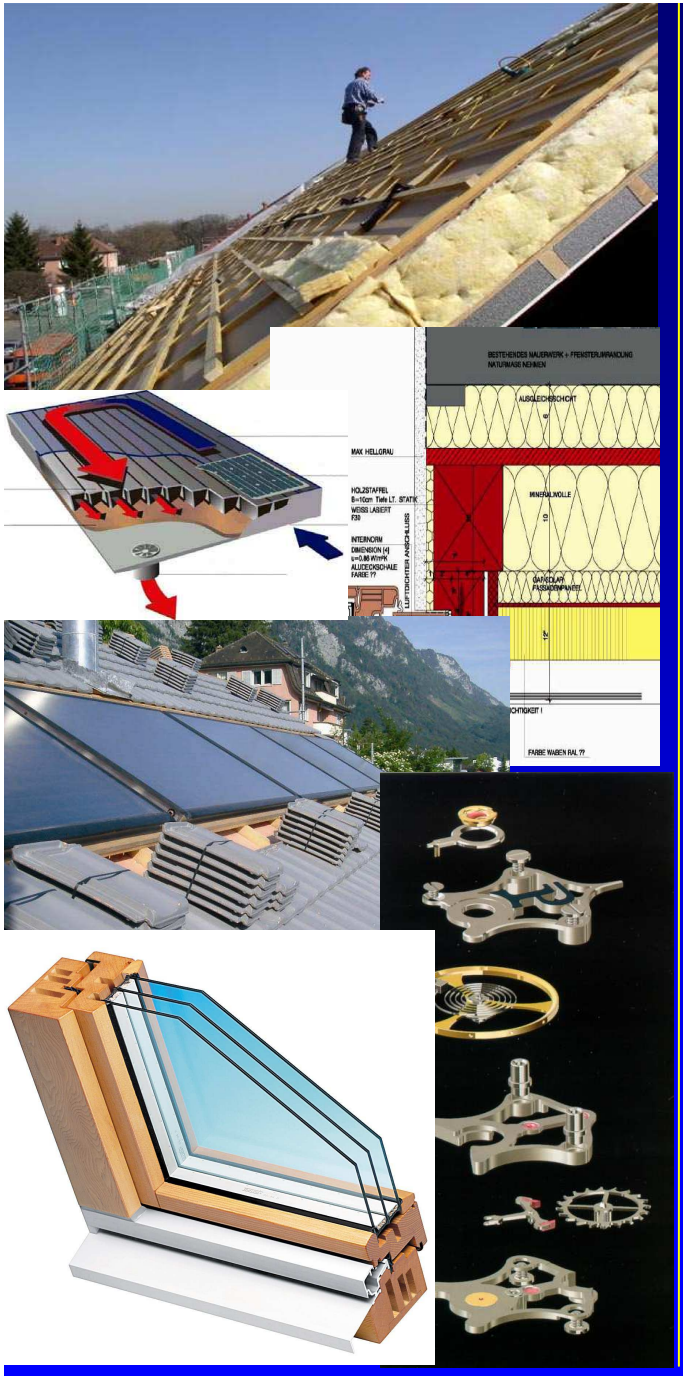
Renovation maximizing passive solar gains

60% heating savings

Apartment Building in Ostermundigen, CH

Architects: Office Rollimarchini

www.rollimarchini.ch



Conclusions

Renovating housing can:

- provide superior comfort
- preserve places to live with special character
- dramatically cut energy consumption

Key is "symbiosis" between:

- conservation measures and
- well matched solar strategies

Housing renovating
is constantly ongoing,
and when it is done
it should be advanced.

Exemplary projects from
AT, CH, DE, GR, IT, NL
demonstrate up to
90% energy savings!

**Base decisions on the future,
not the past!**

Robert Hastings
Univ. Professor Emeritus

Department for Building & Environment
Donau-University Krems AT

Architecture, Energy & Environment Ltd.
Wallisellen, CH