



# Advanced Housing Modernisation

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# Advanced Housing Modernisation

Benefits & limitations of modernisation

Strategies with examples

Conclusions



A close-up photograph of a hand with light-colored nail polish holding a yellow pencil with a pink eraser tip. The pencil is positioned just above a white calculator, with the eraser tip hovering over the keypad. The background is a warm, out-of-focus brown color.

**Financing is usually the issue to affording superior, future oriented renovation.**

**An example of "creative financing":**



## Benefits & limitations of modernisation

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



## Two solutions:

### A) Demolition and new construction



## Consequences:

- + A new modern bldg. with low energy consumption
- Loss of buildings with character / personality
- Wasted embodied energy
- New buildings often sterile boxes!





Two solutions:

A) Demolition and new construction

**B) Advanced renovation**

+ Energy savings to 90%

+ Investment affordable

+ Comfort like new construction

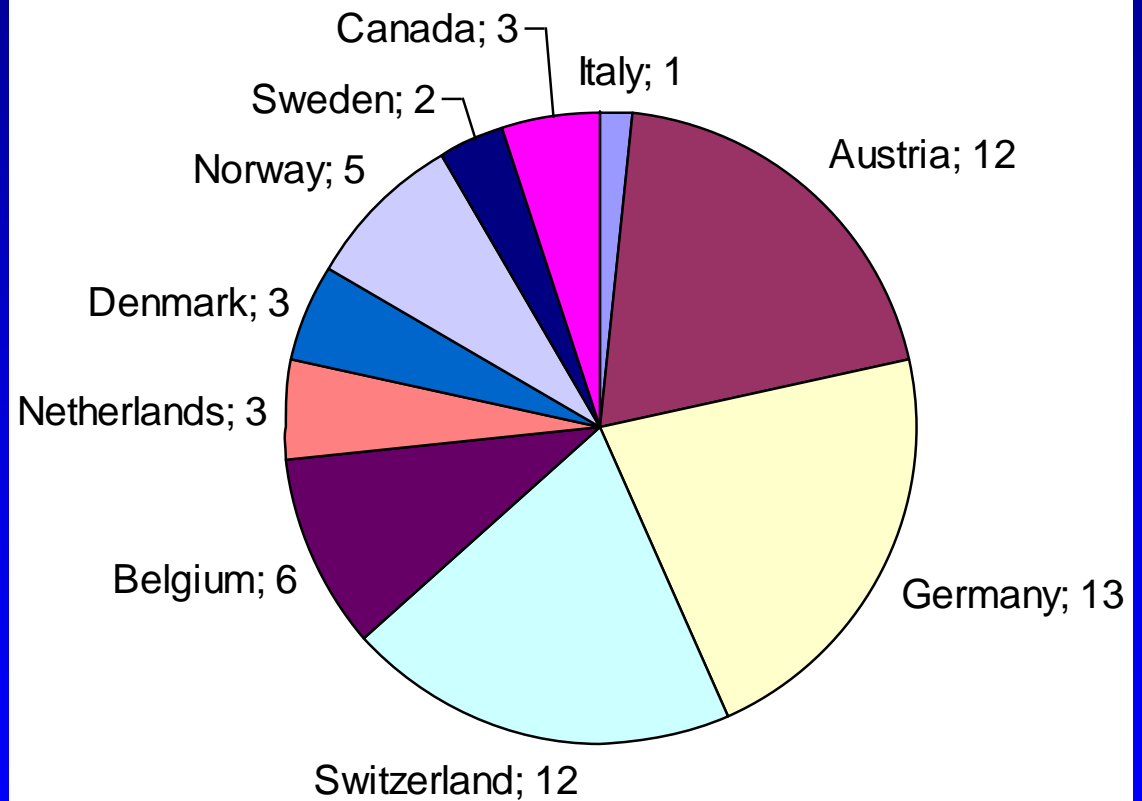
+ Richness and diversity  
of architecture preserved

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



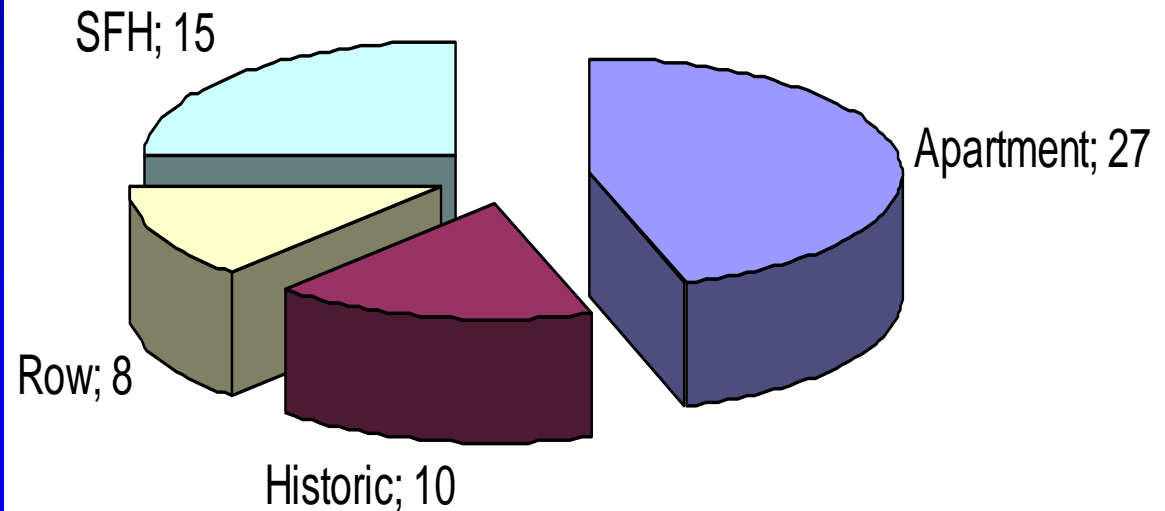
# In Subtask B ten countries documented 60 exemplary renovations

Number of projects by country



# The projects and strategies were analyzed by housing types

## Number of projects by building type







## Strategies:

1. Insulate & tighten envelope to reduce energy demand
2. Use solar heat to replace 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 Mannheim DE





## Insulation is basis of rational renovation

### Least cost:

- reduces heating bills
- eliminates a 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.



# Gentle renovation in Modena IT



Calderaro, Valerio



# Strategies:

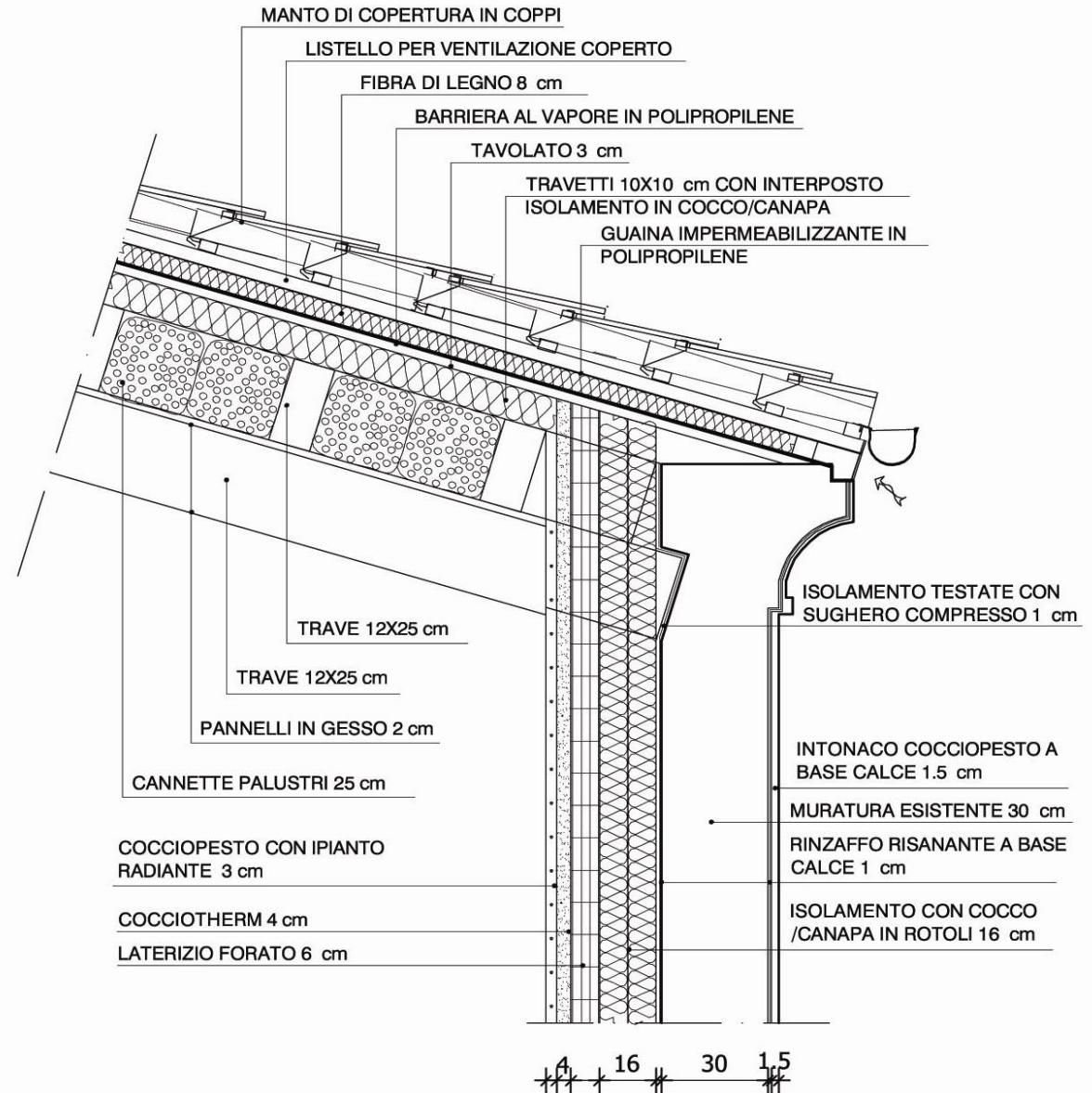
New interior cavity wall  
coconut + cork panels  
(400 + 600 mm)

$U\ 1.75 \Rightarrow 0.25$

New inner windows

$U\ 4.6 \Rightarrow 1.5\ W/m^2K$

## PARTICOLARE DELL'ATTACCO DELLA COPERTURA LATO NORD-EST



35 kW condensing gas boiler replaced  
104 kW oil furnace

12 m<sup>2</sup> vacuum tube collectors cover most heating + dhw demand spring thru autumn

**81% savings of primary energy**  
space+water heating  
(367 ⇒ 70 kWh/m<sup>2</sup>)



Calderaro, Valerio



# Solar Facade Renovation of 50 flats in Linz AT

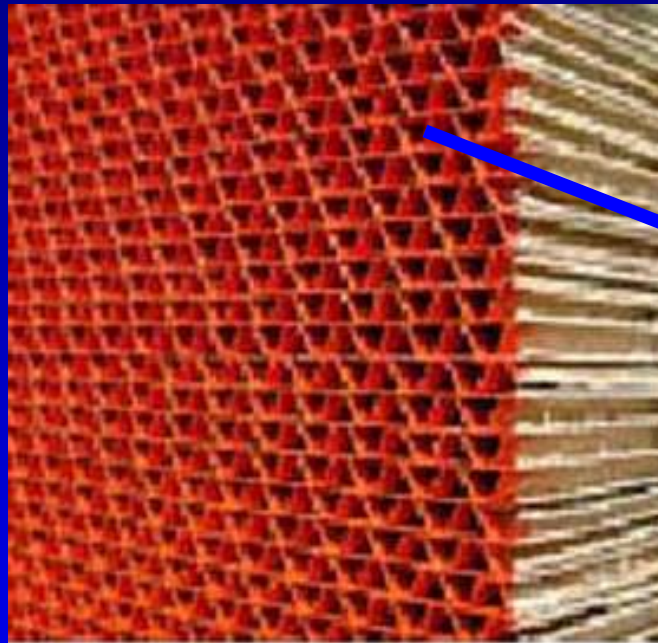


Ingrid Domenig-Meisinger

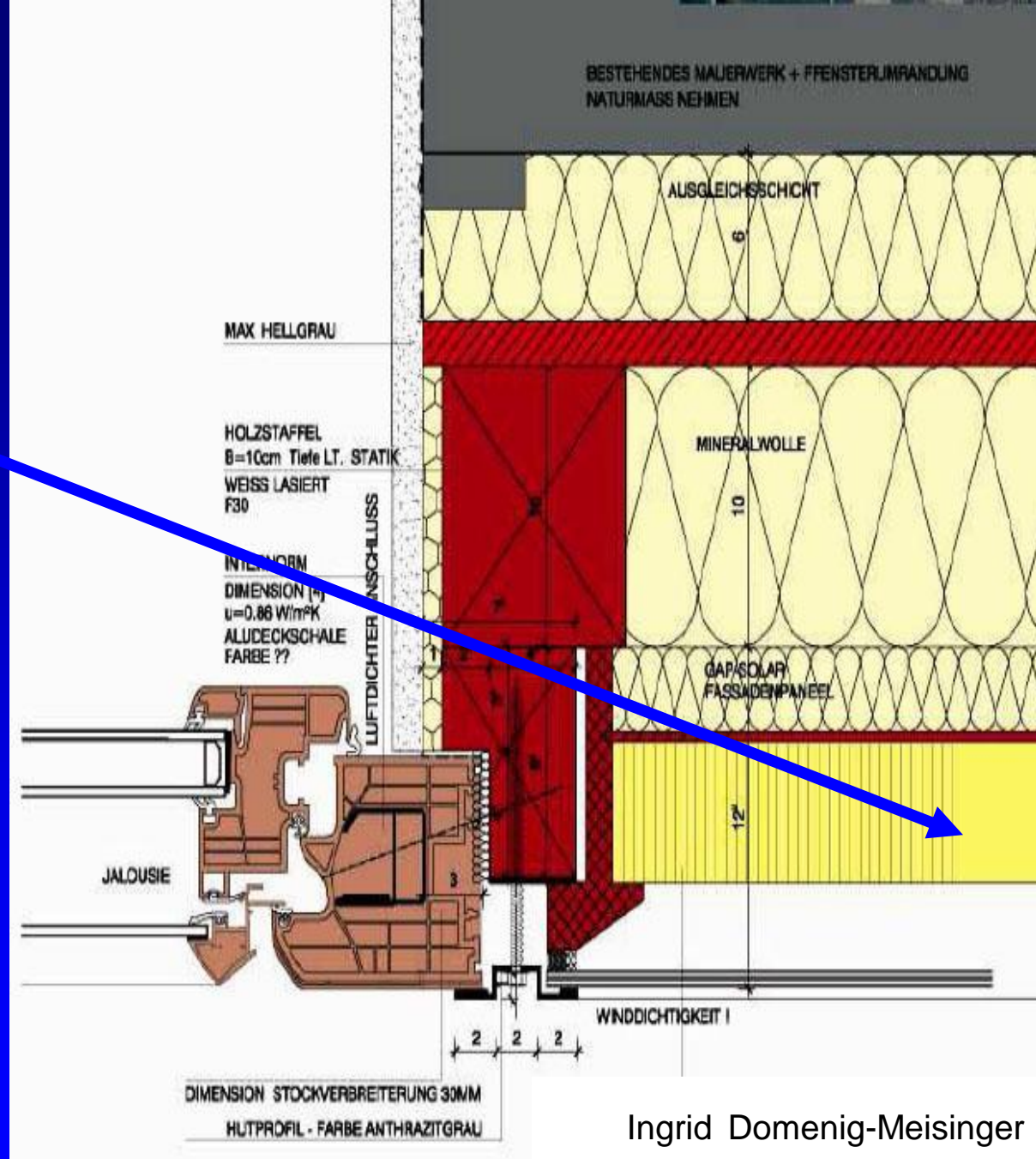


# Prefabricated solar façade

$$U_{\text{dynamic}} \approx 0 \text{ W/m}^2\text{K}$$



**88 % savings in heating costs!**  
150 kWh/m<sup>2</sup>a / 20 kWh/m<sup>2</sup>a



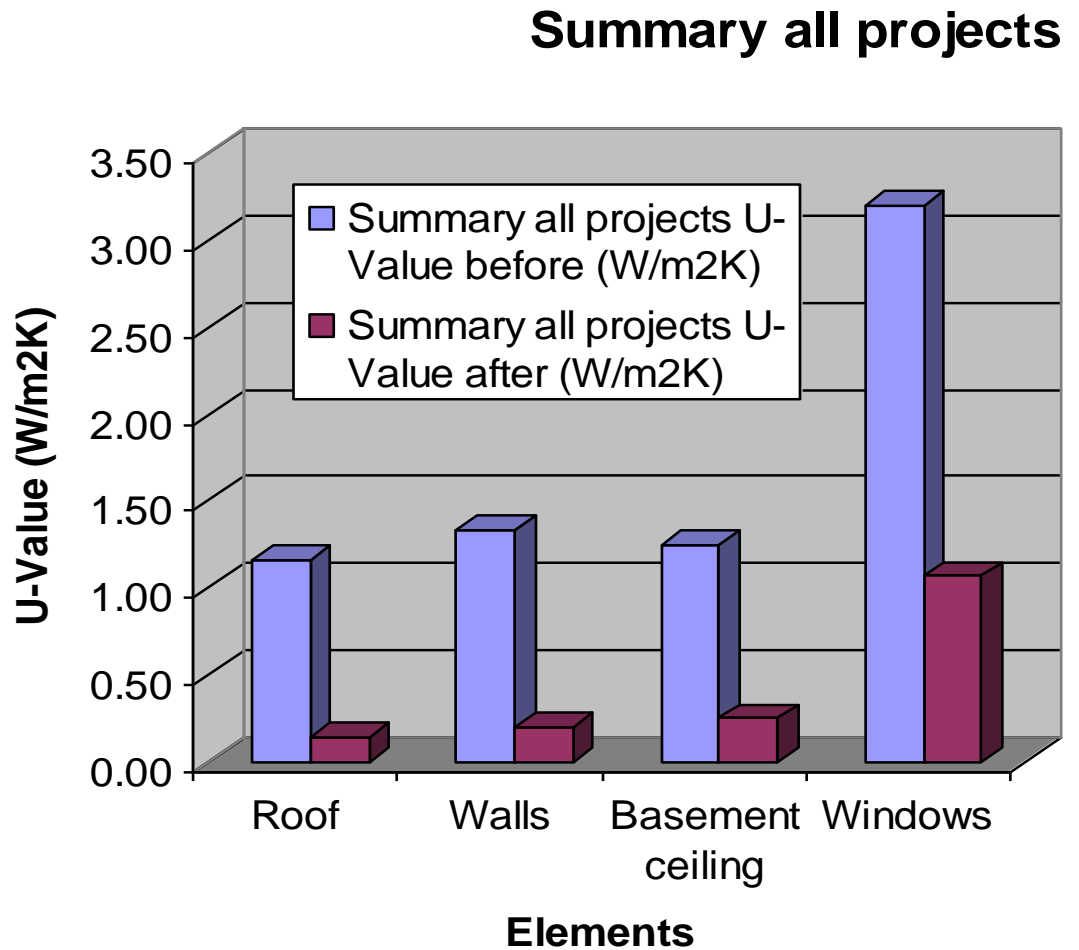
Ingrid Domenig-Meisinger





# Key to saving energy is insulating the envelope

Element	Improvement %
Roof	830
Walls	670
Basement ceiling	500
Windows	300





## 2. Use solar heat to reduce non-renewable energy use

Hubert Fehr-Bigger  
Architekt, Walenstadt CH





## Marginal costs

At certain point  
energy delivered from solar  
competitive with  
energy saved from conservation

i.e. costs of:

- Last increment of insulation
- 3x verses 2x glazing
- 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 =  $800 \text{ W}_{\text{elec}} \times 15 \text{ min}$ )
- 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<sup>2</sup> 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

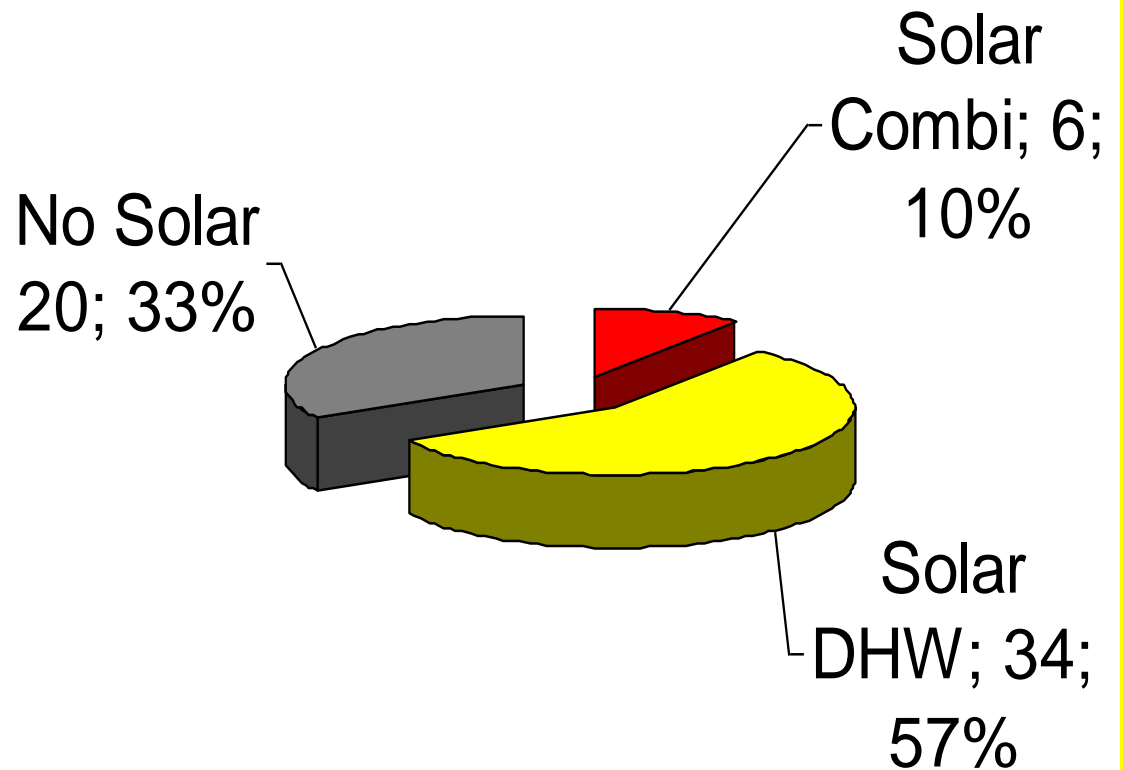
**Annual primary energy cut 80% !**  
(230 to 47 kWh/m<sup>2</sup>)

**Hubert Fehr-Bigger**  
Architekt, Walenstadt CH



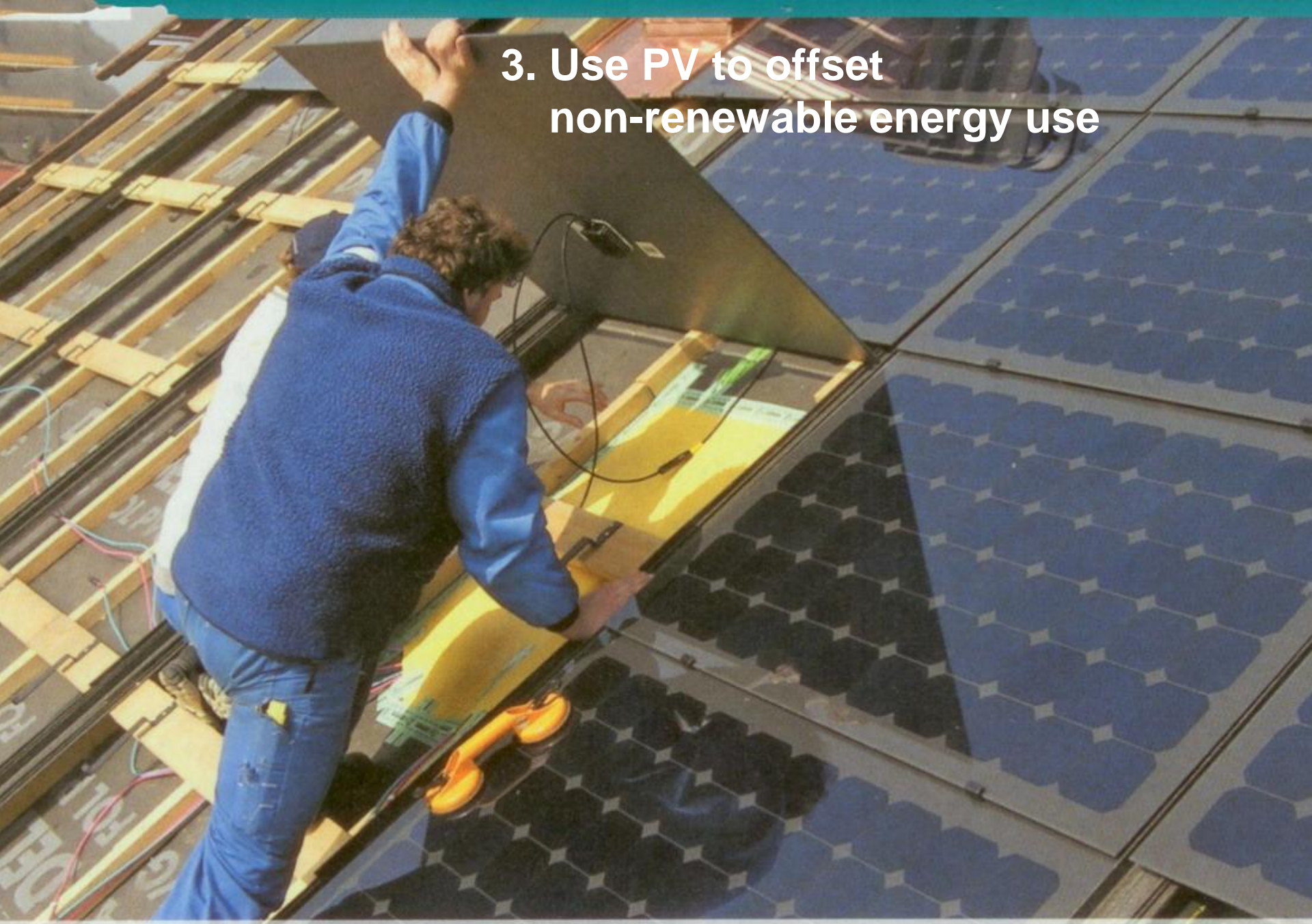
# Majority (67%) of projects had solar thermal systems

## Solar Thermal Systems





### 3. Use PV to offset non-renewable energy use



## Decisive factors:

Utility Feed-in tariff &  
duration

## Example: Switzerland

As of 2010:

Systems  $\leq 10$  kW:

buy-back rate for 25 years

- bldg. attached: €0.41

- bldg. integrated: €0.50

[www.swissolar.ch](http://www.swissolar.ch)

[www.swissgrid.ch](http://www.swissgrid.ch)



# Renovation of an Apt. building in Staufen CH

110 m<sup>2</sup> PV roof  
14.7 kWp

Architekturbüro Setz  
[www.setz-haus.ch](http://www.setz-haus.ch)



**Also part of  
renovaton package:**

Insulation of  
Attic /walls /cellar  
140 / 200 / 100 mm

Ventilation with  
85% heat recovery

Heat pump replaced  
oil furnace

**Primary energy for  
heating + water  
cut 65% !**

**(154 to 54 kWh/m<sup>2</sup>)**

Architekturbüro Setz  
[www.setz-haus.ch](http://www.setz-haus.ch)



## Motivation of building owner: Guido Erni

PV + renovation investment for future retirement income.

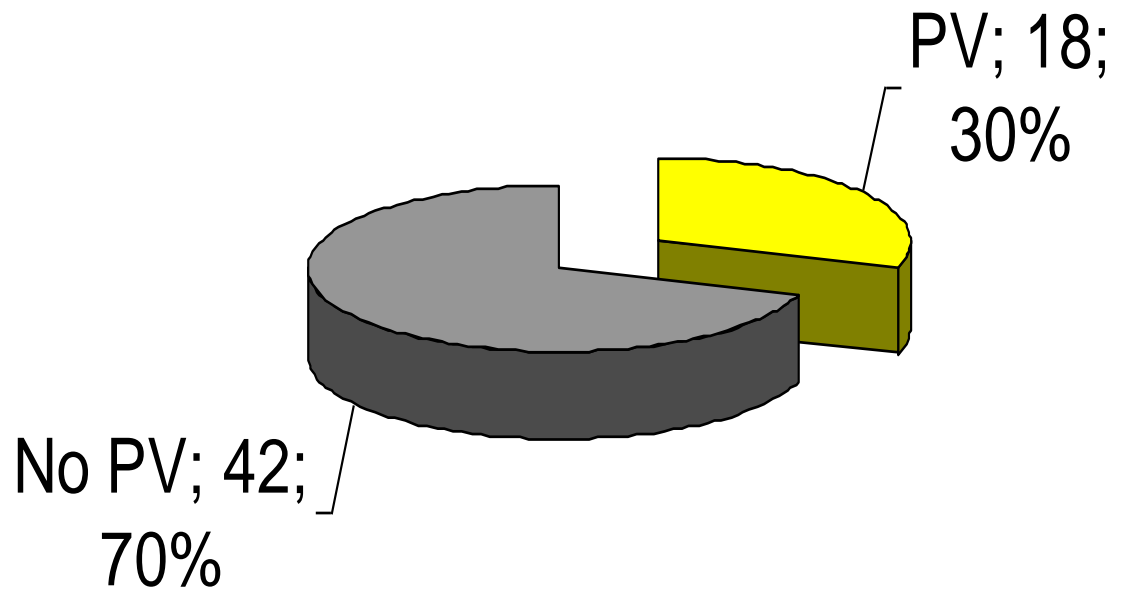
"Irresponsible not to install PV on this optimal surface!"

PV output:  
~ 14.3 MWh/a



**A few (30%) projects had photo-voltaic systems**

## Projects with PV-Systems



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



# Goals

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

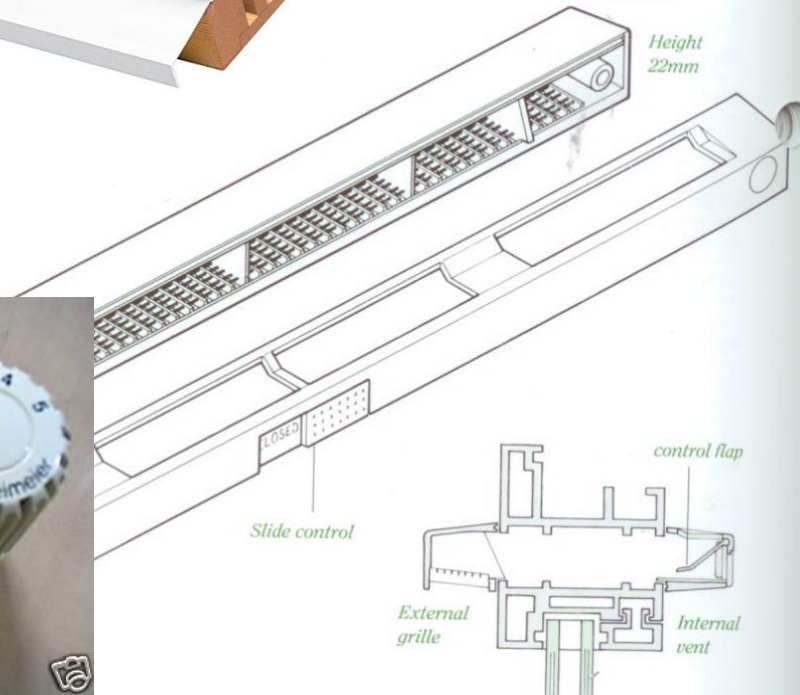




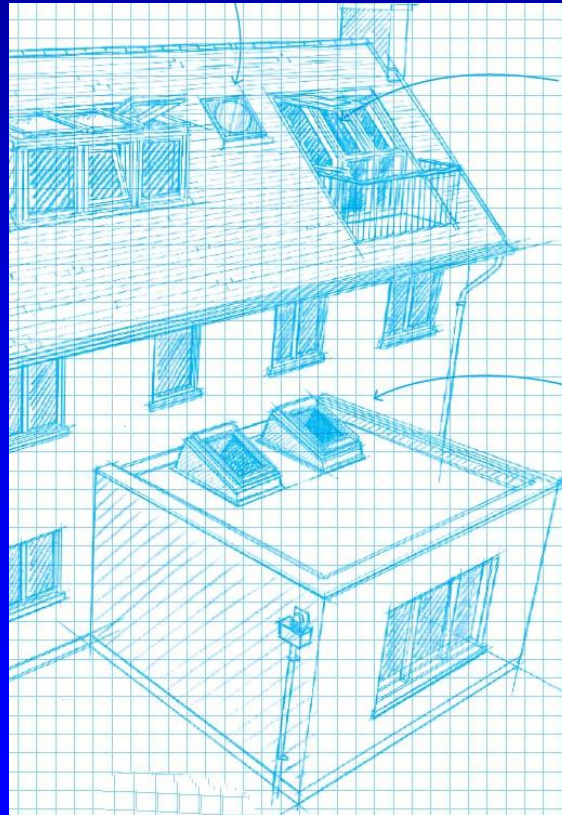
# 1. Net heat gain

Useful solar > heat loss

- PH quality windows
- Mass
- 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](http://www.rollimarchini.ch)**



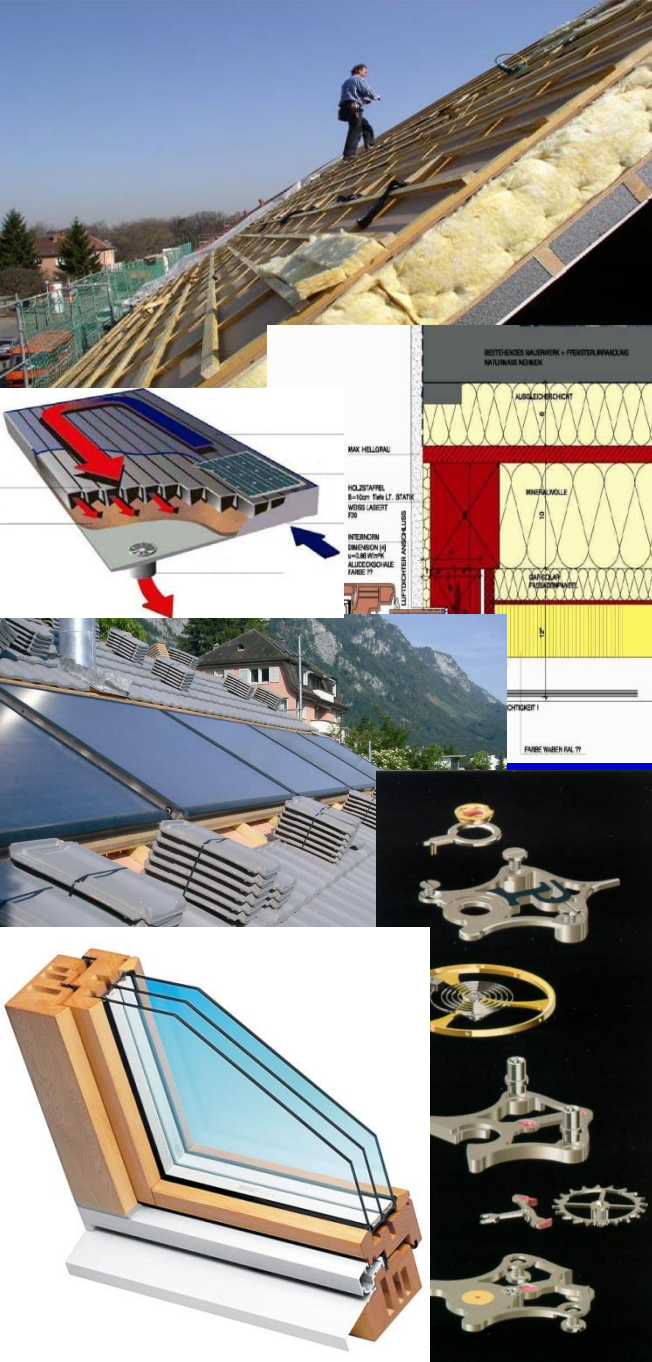
# Conclusions

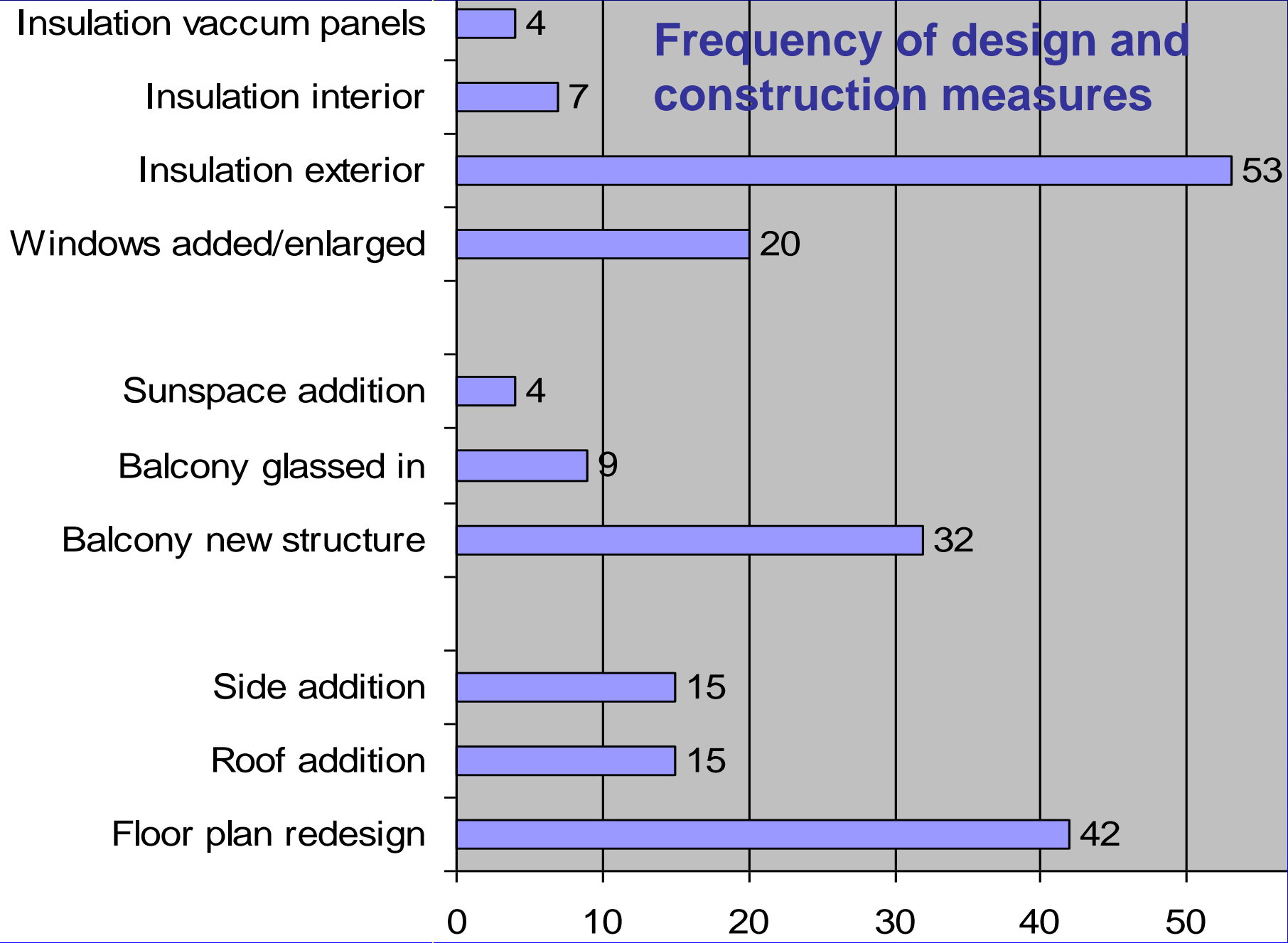
Renovating housing can:

- 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,  
when it is done  
it should be advanced.

Exemplary projects from  
ten countries demonstrate  
up to 90% energy savings!

