Advanced Housing Modernisation

Robert Hastings,
Sub B leader
AEU Ltd. Wallisellen CH

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Advanced Housing Modernisation

Benefits & limitations of modernisation

Strategies with examples

Conclusions
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
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
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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.
The projects and strategies were analyzed by housing types

Number of projects by building type

- Apartment: 27
- Historic: 10
- Row: 8
- SFH: 15
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 Manheim 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
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 \text{W/m}^2\text{K}
35 kW condensing gas boiler replaced 104 kW oil furnace

12 m² vacuum tube collectors cover most heating + dhw demand spring thru autumn

81% savings of primary energy space + water heating (367 ⇒ 70 kWh/m²)
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/m²a / 20 kWh/m²a

Ingrid Domenig-Meisinger
**Key to saving energy is insulating the envelope**

### Summary all projects

<table>
<thead>
<tr>
<th>Element</th>
<th>Improvement %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>830</td>
</tr>
<tr>
<td>Walls</td>
<td>670</td>
</tr>
<tr>
<td>Basement ceiling</td>
<td>500</td>
</tr>
<tr>
<td>Windows</td>
<td>300</td>
</tr>
</tbody>
</table>

- **U-Value (W/m²K)**
  - **U-Value before**:
    - Roof
    - Walls
    - Basement ceiling
    - Windows
  - **U-Value after**:
    - Roof
    - Walls
    - Basement ceiling
    - Windows

![Bar chart showing U-Value improvements for different elements](chart.png)
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 is 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 W_{e\text{lec}} x 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 m² 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/m²)

Hubert Fehr-Bigger
Architekt, Walenstadt CH
Majority (67%) of projects had solar thermal systems

![Solar Thermal Systems]

- Solar DHW: 34; 57%
- Solar Combi: 6; 10%
- No Solar: 20; 33%
3. Use PV to offset non-renewable energy use
Decisive factors:
Utility Feed-in tariff & duration

Example: Switzerland

As of 2010:

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

www.swissoolar.ch

www.swissgrid.ch
Renovation of an Apt. building in Staufen CH

110 m² PV roof
14.7 kWp

Architekturbüro Setz
www.setz-haus.ch
Also part of renovation 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/m²)
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.
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
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
Frequency of design and construction measures

- Insulation vacuum panels: 4
- Insulation interior: 7
- Insulation exterior: 53
- Windows added/enlarged: 20
- Sunspace addition: 4
- Balcony glassed in: 9
- Balcony new structure: 32
- Side addition: 15
- Roof addition: 15
- Floor plan redesign: 42
Housing renovating is constantly ongoing, when it is done it should be advanced.

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