IEA ECBCS Annex 50
Prefab Retrofit of Buildings

Vorgefertigte Fassaden- und Dachelemente in der Sanierung

Austria, Czech Rep, France, Netherlands, Portugal, Sweden, Switzerland

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Operating Agent

Mark Zimmermann, Empa Building Science & Technology, May 19, 2011
Building renewal with prefabricated elements

80 % energy savings + added values (room extension, attic apartment)
Traditional Renovation

- hardly future oriented
- too many technical compromises
- to many craftsman involved
- poor coordination on site
- low quality level
- inefficient construction processes
Prefab Building Renovation

- Whole building concept
- no technical compromises
- few companies involved
- well coordinated modules
- quality assurance
- rapid construction processes
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Renovation project Magnusstrasse Zurich, arch. K. Viridén
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Soltag project by Velux, Copenhagen Denmark
Overview of Tasks

Renovation concept

Building Typology

Building Simulation

Renovation Process

Demonstration

Retrofit-Advisor

F4.10 ~1,905,000 modules

F4.1X ~271,000 modules

3-D Geomatics

Module Development

Building Typology

Building Simulation

Renovation Process

Demonstration

Retrofit-Advisor
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Modular approach

Large size modules developed by Austrian team
Modular approach

Large size, steel frame modules developed by French team
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Thermal bridge optimisation

Large size, steel frame modules developed by French team
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Modular approach

Small size modules developed by Swiss team
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Modular approach

Roof modules developed by Swiss team
Modular approach

Small size metal cassettes developed by Portuguese team
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Thermal bridge optimisation

Small size modules developed by Portuguese team
Challenge of Pre-Fabrication

Prefabrication of large elements has to ensure that the elements will fit to the existing building.
Laser Scanning – Design Support

Planarity of façades

Horizontal sections
Annex Demonstration Buildings

- Demonstration projects in Austria and Switzerland completed, new demonstration projects ongoing in Sweden and Switzerland
- 8 demonstration buildings completed, 5 more ongoing

Energy consumption (heating)

Source: gapsolution

<table>
<thead>
<tr>
<th>Diegweg Haus Nr.</th>
<th>3-19</th>
<th>4, 6, 8</th>
<th>12, 14</th>
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</thead>
<tbody>
<tr>
<td>before retrofit</td>
<td>142</td>
<td>184</td>
<td>225</td>
</tr>
<tr>
<td>after retrofit</td>
<td>13.6</td>
<td>9.6</td>
<td>9.6</td>
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</table>
Austrian demonstration buildings

Renovation of 3 apartment buildings (1959) completed 2008, GAP-Solution / AEE INTEC
Austrian demonstration buildings
Renovation of 2 apartment buildings (1970) completed 2009,
GAP-Solution / AEE INTEC
Austrian demonstration buildings
Renovation of row houses buildings (1952) completed 2009,
GAP-Solution / AEE INTEC
Swiss demonstration buildings
Renovation of apartment building (1952) completed 2009, Miloni Architects
Swiss demonstration buildings

Renovation of apartment building (1952) completed 2009, Beat Kaempfen Architects
Swiss demonstration buildings
Renovation of apartment building (1952) completed 2009,
Beat Kaempfen Architects
Swedish demonstration studies

Renovation of residential area under negotiation, Christer Nordstroem Architects
The Retrofit Advisor allows a simple evaluation of retrofit options for apartment buildings. Based on few input-data, the actual value of the property, its value after renovation and the estimated cost for refurbishment may be evaluated. It is an ideal tool to evaluate financially retrofit scenarios.

Please, choose the building type that fits best to your own building.
ECBCS Retrofit Advisor

- Actual state
- Repair only
- Low energy renovations
- Demolition reconstruction
Description of reference building

Building type 1:
Simple, detached suburban apartment building, constructed about 1930
Simple to average standard, relatively small apartments, normally 3 stories, raised ground floor, massive wall construction, artificial stone reveals, overhanging balconies, roof space not or little used as living space, simple staircase without elevator.

Information about your own building

Default values of the selected building type will be used for missing information. The more information you can give, the more precise the evaluation will be.

Building data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Heated floor area</td>
<td>540 m²</td>
</tr>
<tr>
<td>Unheated floor area</td>
<td>186 m²</td>
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<tr>
<td>Room height (in apartments)</td>
<td>2.45 m</td>
</tr>
<tr>
<td>Floors (ground floor and above)</td>
<td>4.0</td>
</tr>
<tr>
<td>Elevator</td>
<td>yes/no</td>
</tr>
<tr>
<td>Plot size</td>
<td>650 m²</td>
</tr>
</tbody>
</table>

Market value

€

- 1'000'000,-
- 800'000,-
- 600'000,-
- 400'000,-
- 200'000,-
- 0,-

* Indicative, no official label
Retrofit Advisor

<table>
<thead>
<tr>
<th>Actual State</th>
<th>Standard renovation</th>
<th>Minergy</th>
<th>Minergie-P</th>
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<tbody>
<tr>
<td>Retrofit</td>
<td>SIA standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrofits</td>
<td>New balconies</td>
<td>Steep roof attic</td>
<td>Flat roof attic</td>
</tr>
</tbody>
</table>

1.2 Renovation of building envelope according to Minergie-standard:
- Compact façade insulation: 200mm, window replacement $U=1.1$ W/m²K, insulation of roof space and basement (ceiling), installation of a mechanical ventilation system with heat recovery, renovation of interior.

<table>
<thead>
<tr>
<th>Energy Label*</th>
<th>Actual-state</th>
<th>Repair</th>
<th>Retrofit</th>
<th>Reconstruction</th>
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<tr>
<td>efficient</td>
<td>A</td>
<td>C</td>
<td>A</td>
<td>A 49% A 39%</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>D</td>
<td></td>
<td>D 172%</td>
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<tr>
<td>less efficient</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global warming potential</td>
<td>E</td>
<td>D</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Heating energy demand</td>
<td>E</td>
<td>D</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Renewable energies</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>35%</td>
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</tbody>
</table>

* Indicative, no official label