IEA ECBCS Annex 50
Prefab Retrofit of Buildings

**IEA ECBCS Annex 50**
Prefabricated Systems for Low Energy Renovation of Residential Buildings

**Approaches to the problem of the occupied building site**

Ecosan '07
Weiz, Austria, October 10-12, 2007

Mark Zimmermann, Empa

**Energy needs of different building standards**

<table>
<thead>
<tr>
<th>Building Standard</th>
<th>Heating</th>
<th>Hot Water</th>
<th>Electricity</th>
<th>Construction</th>
<th>Renewal</th>
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<td>SIA380/1</td>
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<td>Minergie</td>
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<td>Passivhaus</td>
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Susustainable benchmark
**Heat Energy Demand and Heated Floor Area of Dwellings in Zurich**

- **New buildings**

**Traditional Renovation**
- hardly future oriented
- too many technical compromises
- too 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

Renovation project Magnusstrasse Zurich, arch. K. Viridén
### Energy consumption before and after renovation

<table>
<thead>
<tr>
<th></th>
<th>Old building</th>
<th>New building</th>
<th>Renovation Magnusstr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>600</td>
<td>230</td>
<td>68 MJ/m²</td>
</tr>
<tr>
<td>Hot water</td>
<td>130</td>
<td>125</td>
<td>9 MJ/m²</td>
</tr>
<tr>
<td>Electricity</td>
<td>120</td>
<td>100</td>
<td>55 MJ/m²</td>
</tr>
<tr>
<td>Total (final energy)</td>
<td>850</td>
<td>455</td>
<td>132 MJ/m²</td>
</tr>
</tbody>
</table>

Vacuum Insulation Panels VIP
before

renovated

Renovated building: Minergy-Standard, ca. 75 % energy savings
For heating and hot water
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Soltag project by Velux, Copenhagen Denmark

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Prefab Retrofit of Buildings

European project within IEA building R&D program

Coordination
Zimd/Schwehr
BFE

Swiss
National
project

IEA ECBCS
Annex 50
Prefab Retrofit

CCEM

Institutes
CTI - Industry

Switzerland

BFE

Portugal

Netherlands

Sweden

France

Germany

Czech Rep.

Austria

Austria

Germany

Czech Rep.

France

Sweden

Netherlands

Portugal
Agreed general project outline

- Project addressing researchers, design teams, building industry and building owners
- Focus on typical European apartment blocks
- Intended energy consumption: 30-50 kWh/(m²·year) for heating, cooling and hot water
- Building envelope renewal applying to a large extent prefabrication technologies
- Sloped and flat roof solution, cladding systems and compact façades
- Some demonstration buildings monitored and evaluated
Building type evaluation

### Function
- Wohnungsgroesse: -
- Wohngrundriss: +
- Balkon: +
- Küchengroesse: -
- Wohnungszugang: +++
- Wohnunggebung: +

### Economy
- Familienwohnungen: ++
- Altenwohnungen: +++
- Studentisches Wohnen: +

### Ecology
- Funktion: -
- Ökonomie: ++
- Ökologie: +++
- Gestaltung: -

### Sanierungstraeger

### Struktur

#### Renovation concepts
- T3 Radiator heating renovation
- T7 Control system
- T4 Floor heating
- T6 Integrated solar hot water/PV system
- T5 Room extension
- T2 Apartment room air systems
- T1 Central air system
- R3 Attic steep roof space module
- R1 Insulated steep roof elements
- R9 Attic flat roof space module
- R8 Attic flat roof space module
- R0 Attic insulation
- F4 Prefabricated facade module
- F5 Room extension
- F2 Ventilated facade insulation
- F1 Compact facade insulation

### Traditional measures

#### Prefab Retrofit of Buildings

Produced by Empa
3D Measurement Techniques by University of applied sciences Northwestern Switzerland, Institute for Geomatics

CAD Model (Details)
Wildenstein Castle (Bubendorf, Canton BL)

3D Measurement Techniques are a key technology for prefabrication

Photogrammetry using GPS-guided Model or Laser Scanning
### Vision of Retrofit Advisor

**Existing Situation**

**Retrofit Design Options**

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### Products

- **Building upgrade concept** documenting typical solutions for prefabricated roofs with integrated HVAC components and for façades
- **Guidelines** for system evaluation, design, construction process and quality assurance
- **Retrofit advisory tool** to support the decision process of investors
- Set of evaluated and **optimized building products and components** that ensure highest standard of energy efficiency
- Retrofitted and documented **demonstration buildings**
- **Synthesis report** for a broad audience, demonstrating the potential of prefabricated retrofit
## Time Schedule

<table>
<thead>
<tr>
<th>Subtask</th>
<th>Prep. Phase</th>
<th>Working phase</th>
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<tbody>
<tr>
<td></td>
<td>2006</td>
<td>2007</td>
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<tr>
<td><strong>Work package A:</strong> Typology + concepts</td>
<td></td>
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<tr>
<td><strong>Work package B:</strong> Renovation modules for façades, roofs, HVAC</td>
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<tr>
<td><strong>Work package E:</strong> Monitoring, dissemination</td>
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