Replication potential of the ClearSupport concept beyond the current PSF regions

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TOOLS FOR SUPPORTING SUSTAINABLE DEVELOPMENT POLICY
ClearSupport Conference
Gdansk July 8, 2009
General aspects:

Concept – when and where
Guidelines, tools and reports

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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<tbody>
<tr>
<td>Population</td>
<td>2 mio inhabitants</td>
</tr>
<tr>
<td>Area</td>
<td>20.000 km²</td>
</tr>
<tr>
<td>Number of residential buildings</td>
<td>463,029</td>
</tr>
<tr>
<td>Number of dwellings</td>
<td>777,772</td>
</tr>
<tr>
<td>Average number of dwellings per building</td>
<td>1.7</td>
</tr>
<tr>
<td>Total floor space of dwellings</td>
<td>58,031,187 m²</td>
</tr>
<tr>
<td>Average floor space of dwelling</td>
<td>71.3 m² 8,000 dw./year</td>
</tr>
<tr>
<td>Average size of private household (persons)</td>
<td>2.8</td>
</tr>
<tr>
<td>Share of dwellings in urban settlements</td>
<td>51.6%</td>
</tr>
<tr>
<td>Share of population in urban settlements</td>
<td>50.5%</td>
</tr>
<tr>
<td>Occupation of dwellings in urban settlements</td>
<td>89.5%</td>
</tr>
<tr>
<td>Occupation of dwellings in rural settlements</td>
<td>81.2%</td>
</tr>
</tbody>
</table>

*After privatisation in 90-ties 90% of flats are private*

Source: SURS, Census, 2002
1946-1980 apartment buildings

- 61% of all residential buildings are from 1946-1980 period,
- **1946-1953** rehabilitation of WW2 demolished buildings,
- **1954-1967** state-owned social housing built,

- **late 60-ties and 70-ties - flourishing period!**
  - 1967 national regulation for design of dwellings
  - 1973 Ljubljana - municipal rules for apartment buildings construction
  - 1971 New construction technologies introduced – “outinord” cast in place concrete buildings up to 3 cm insulation obligatory – first attempt!
Residential buildings in urban areas

Buildings per year of construction and architectural building type

Figure: Distribution of houses and buildings in urban settlements by their age (Source: SURS, Census, 2002).
Some buildings from the most frequent groups subject to refurbishment

- 50-ties, masonry, no TI, GF + 3 storeys
- Late 50-ties, masonry, no TI, high rise building
- Early 60-ties, masonry, no TI, self-standing building
- Late 70-ties, reinforced concrete, pre-cast large panels; low TI, thermal bridges, envelope elements, masonry, GF + 4 storeys
- Late 70-ties, cast in place reinforced concrete “self standing” blocks, low TI
- Late 70-ties, concrete high multi-story buildings with pre-cast large panel envelope elements
Upgrading quality standards...

Energy use for heating and DHW, electricity consumption

EPBD legislation 2007:
Reduction of heat demand by improved envelope and beyond, by mechanical ventilation heat recovery min. 0.8
Supported: RES for DHW and for space heating

Source: GI ZRMK, MP)

Specific energy use (kWh/m² year)

- Electricity
- Fuel conversion into heat
- Heat for DHW
- Energy demand for heating

- Passive house
- Low energy house
- Contemporary buildings / restoration, 2002
- Existing building stock 1980 - 2002
- Old buildings 1946-1980
Typical renovation case study

1960
40 flats, 95 residents, 1860 m²
Walls: prefabricated concrete plates mixed with wooden chips
U=1.3 W/m²K
Windows U=2.7

2005
(investment 100,000 EUR, 10% subsidy)
Wall: 0.35 W/m²K (67,100 EUR)
Windows: U glazing=1.1 W/m²K (31,300 EUR)
Savings: 125,000 kWh (21%)
7,000 EUR/year, PB 14y (total), PB incremental investment PB 3-4 years

Non-renovated apartment house Sisenska 42-44 in Ljubljana. IR thermography detected cold bridges in the envelope: (joints of concrete panels).

Outer wall: thermal insulation of outer wall with 8 cm thick polystyrene layer.
Windows: installation of energy efficient windows with low-e double glazing (Ug=1.1 W/m²K with six-chambers PVC window frames, where the Uw=1.1 W/m²K.)
Facts: Ljubljana Housing Fund

- 3200 flats owned by Ljubljana Housing Fund – public fund of Municipality of Ljubljana (280,000 inhabitants)
- Mixed ownership: difficult decision-making
- Low income tenants – paying the operational costs may become a problem and additional burden for Ljubljana Housing Fund
- Aim: EI-refurbishment of existing buildings and new energy efficient construction
- Participation in EIE projects, FP5 demonstration projects, energy certification, passive house, LCC

Pipanova pot, Ljubljana, 20 new flats in low energy standard, design 2007
JSS MOL – Hermana Potocnika, Ljubljana
Passive House Refurbishment

1975/2004, EU FP5 Large High Rise
Reconversion Housing - University of Ljubljana, Faculty of Civil Engineering & Ljubljana Housing Fund JSS MOL;

- energy savings - 63%
- Insulation of facades
- insulation of roof
- Insulation of ground floor
- New balconies without thermal bridges
- Solar protection roller blinds + night insulation
- High efficiency insulation glazing and frames
- Management and control system: BMS, heating system management and control
New social housing
Polje II, Ljubljana

- Low energy buildings
- Controlled ventilation incl. humidity control
- Local d.h. system
- Solar collectors for DHW 50m2 /bld.
- 1 PV power plant 12 kW
- Design: ongoing in 2007
- Construction: 2009
Practical case: Before - Steletova 8, Ljubljana, 1.800 m², 60 flats

Before
- Wall 17 cm concrete + 5 cm TI
- Ceiling 8 cm TI
- Windows U=2,7 W/m²K
- Q_{NH} = 75-85 kWh/m²a

Planning passive standard renovation
- additional thermal insulation (15 cm)
- Windows PVC Uw=1,5W/m²K
- adjustment of heating system
- mechanical ventilation, 75% heat recovery
- target Q_{NH} 5 kWh/m²a
- Simplified calculation of energy demand; no scenarios, investment costs estimated, lowest prize tender for execution of works selected

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<thead>
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<th>Energy Demand</th>
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<tr>
<td>A</td>
<td>25-40</td>
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<tr>
<td>B</td>
<td>40-55</td>
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<tr>
<td>C</td>
<td>55-70</td>
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<tr>
<td>D</td>
<td>75-85</td>
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<td>&lt;25 kWh/m²a</td>
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<tr>
<td>C</td>
<td>55-75</td>
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<td>&lt;25 kWh/m²a</td>
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After renovation (2006/2007)

After renovation: Facade East

After renovation: Facade West

System of mechanical ventilation with heat recovery – single compact units in chosen rooms in each apartment

Benefits

• Thermal comfort?
• Energy (cost) savings?
• Users’ habits...
Was the renovation success or failure?

Energy savings are below expectations (costs reduction only 20%)

Reasons

• energy calculation – over estimated savings?
• Users’ behaviour – cause bigger losses than expected

Doubts about mechanical ventilation with heat recovery

Future practice?

Questions

Would detailed energy simulation and LCC-based selection of renovation scenario give a different recommendation to decision-makers?

What is the influence of energy calculation quality and users behavior to LCC of renovation scenarios?
Current position of LCC in Slovenia

Growing interest for LCC due to:

- **EPBD & Recast EPBD** – LCC thinking is more and more integrated in min. requirements, cost effectiveness of recommended measures in EPC; required in regulation for feasibility studies of AES;

- **Green public procurement** (“the economically most viable offer based on more comprehensive criteria” can be selected – impact of these criteria (incl. LCC) is up to 60%)

- **PPP** – many projects already started...

- **Limited experiences with LCC** at a building level (building concept alternatives were traditionally not analysed as a part of investment programme – but the savings are promising)

- Public sector is in focus of national EEAP (ESD):
  - Priority - renovation of social housing including demonstration projects
  - Our aim to demonstrate the dimensions of LCC based planning of renovation scenarios
Energy calculation and Level 2 LCC at system level
Steletova, Ljubljana – in progress

VAR0-before renovation
VAR1-after renovation with ventilation & heat recovery
VAR2-after renovation, inadequate user habits – open windows

108 kWh/m²a before (calc. PHPP)
27 kWh/m²a as planned (PHPP)
36 kWh/m²a actual (PHPP)
LCC calculation assumptions

SCENARIOS:
- VAR1: existing situation + only maintenance (theoretical)
- VAR2: existing situation; replaced windows and facade (no energy improvement)
- VAR3: VAR2 + mechanical ventilation with heat recovery
- VAR4: renovation (windows and wall TI) no mech. ventilation
- VAR5: renovation (windows and wall TI) + mech. ventilation
- VAR6: renovation (windows and wall TI) + mech. ventilation + bad users’ habits (uncotrolled ventilation)
- VAR7: as usual: windows replaced in 10 years, no TI of walls (investment, operational costs, maintenance, replacement, repair cost

<table>
<thead>
<tr>
<th>Price heating [€/kWh]</th>
<th>Q (kWh)</th>
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<td>0.03175</td>
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Increase of energy price
- 6.0%

Interest rate
- 2.5%

Inflation
- 2.5%
Preliminary LCC results
Preliminary LCC results

To do:
Consider actual investment instead of pre-calculated one

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<thead>
<tr>
<th>VARIANTA</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<tbody>
<tr>
<td>Cas preklo:</td>
<td>/</td>
<td>6</td>
<td>27</td>
<td>29</td>
<td>/</td>
</tr>
<tr>
<td>Prihajanje z 30 leti:</td>
<td>218.535 €</td>
<td>260.795 €</td>
<td>64.055 €</td>
<td>7.654 €</td>
<td>258.075 €</td>
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ClearSupport “targets”:
(current activities by ZRMK)

Montenegro
Kosovo
FYR Macedonia
Bulgaria

…..
Bulgaria - facts:

Post-WW2 period: migration from villages to cities

-> social problems; construction of panel-type concrete multi-storey buildings

Period 1960 – 1995:
18,900 panel dwelling buildings with 707,441 dwellings (>25% of the population)

Beginning of 1990s: privatisation;
97% of the housing stock now private-owned
National Programme for Refurbishment of Dwelling Buildings in Bulgaria:

20% of the costs of the refurbishment of 684,676 dwellings in big residential buildings erected with reinforced concrete panels to be subsidized by the state.

Important:

Refurbishment should include the implementation of energy saving measures.

-> need for guidance, expert support, definition of appropriate measures, trusted calculation procedures
FYR Macedonia - facts:

Post-WW2 period:
intensive urban development;
>85% of the present housing stock built.

1950s, early 1960s (25-30%):
in need of comprehensive reconstruction.

Later periods:
in a relatively good condition (construction – seismic characteristics!), but inadequate thermal characteristics

Present state:
99% privatised (almost 700,000 dwellings)
83% occupied
Approx. 60% of the building stock: 1- or 2-storey single or double-family houses

The tendency:

to live in a new apartment (-> surplus created!) in a town
<- negligence of maintenance of older buildings

Outcome:

unnecessary condensation and overpopulation of existing urban areas.

Problems:

- incapacitation of the possibility to grow financial resources for maintenance and refurbishment (effect of privatisation);
- uncontrolled and unskilled DIY constructional interventions by homeowners.
Thank you for your attention!

Sources:
JSS MOL, E-NET.si, IMOS
EIE LCC DATA
EIE EI-Education
M Mirtic, diploma 2009
S Trpevski, COST C16, 2007