Cost-Effective Slovenian Pilot Building

Resource- and cost-effective integration of renewables in existing high-rise buildings
(NMP2-LA-2008-212206)

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Cost-Effective

- Cost Effective project
- Slovenian pilot
Main objectives

• High solar fraction also for high-rise buildings through façade integration
• Improve primary energy balance and reduce CO₂-Emissions of existing high-rise buildings
• Concepts for cost-effective integration of renewables in existing high-rise non residential buildings
Technical scope

• Development of new multifunctional facade components:
  • Transparent glazing integrated collector
  • Air-heating vacuum tube collector
  • Angle-selective transparent BIPV system
  • Natural ventilation with heat recovery
  • Combination of unglazed collector + heat pump
Activities

• State of the art
• Technical concepts
• Economical concepts
• Integrated techno-economical concepts
• Multifunctional components
• Pilot buildings
  • Spain (Cáceres)
  • Slovenia (Ljubljana)
Slovenian Pilot

- ZAG, Ljubljana
- 46°04', 14°31
- ~ 300 m altitude
- Extension 1982
- Offices, laboratories, service, conference rooms.
Slovenian Pilot

• Continental climate

• Orientation: 15°SW
Slovenian Pilot

- Cat. No. 2
- Offices
- 125 m²
- 368 m³
Concept

- Thermal insulation
- High performance windows
- Adjustable shading devices
- Heating/cooling: collectors
- Smart lighting
- BMS
Works

- Envelope
- Mechanical
- Electrical
- Collectors integration
  - Vacuum tube
  - Transparent glazing
- BMS
- Start up
Monitoring

• Measuring system
• Questionnaire

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<th>What</th>
<th>Why</th>
<th>How</th>
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<tr>
<td>Indoor temperature and humidity</td>
<td>To assess fulfillment of user requirements</td>
<td>Arduino local system</td>
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<tr>
<td>Door opening</td>
<td>To assess ventilation air exchange to / from monitored rooms</td>
<td>Door access control + open time estimation, ZAG IT service</td>
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<tr>
<td>Heat released by radiators</td>
<td>To assess heat supplied</td>
<td>(to be developed) (Agilent)</td>
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<tr>
<td>Cold supplied via ventilation system</td>
<td>To assess cold supplied</td>
<td>Air-flow measurements and temperature measurement (Agilent)</td>
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<td>Energy for compressor chillers</td>
<td>To assess premonitoring status</td>
<td>AC power measured (Agilent)</td>
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<td>Heat flow through walls</td>
<td>To assess transmission heat losses (w) / gains (k)</td>
<td>Surface temperature measurement, in nect. Heat flux sensor (Agilent)</td>
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<tr>
<td>Pressure difference</td>
<td>To assess ventilation heat losses (w) / gains (k)</td>
<td>Kachoroki (Agilent)</td>
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<td>Internal gains (electrical – lights)</td>
<td>To assess heat gains</td>
<td>(to be developed) (Agilent)</td>
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<td>Internal gains (human source)</td>
<td>To assess heat gains</td>
<td>Average presence estimation</td>
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<td>Comfort</td>
<td>Alternative assessment of the system</td>
<td>Questionnaire and interviews</td>
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<td>Weather</td>
<td>To assess external influences</td>
<td>Weather station (AMR)</td>
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<td>Irradiation</td>
<td>To assess primary energy supply</td>
<td>Pyranometers (AMR)</td>
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<td>Indoor lighting</td>
<td>/to be discussed/</td>
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<tr>
<td>External illumination</td>
<td>/to be discussed/</td>
<td></td>
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<tr>
<td>Heat flow from collectors to the system</td>
<td>To assess performance of the system</td>
<td>Mass flow and temperature difference</td>
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Conclusions

• Primary purposes
  – Demonstration
  – Measurements

• Secondary purposes
  – To learn about technical difficulties
  – To evaluate concept
  – To evaluate real costs

THANK YOU