EU-GUGLE

A Sustainable Renovation Pilot Project for Smarter Cities

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EU-GUGLE is co-financed by the European Commission under the 7th Framework Programme for Research and Technological Innovation, and is co-ordinated by CENER, Spain’s National Centre for Renewable Energies.
The EU-GUGLE Project

European cities serving as Green Urban Gate towards Leadership in sustainable Energy

Demonstrating the feasibility of nearly-zero energy building renovation models in view of triggering large-scale, Europe-wide replication in smart cities and communities by 2020:

• 6 years (started in April 2013)
• 6 Pilot cities: AACHEN, BRATISLAVA, MILANO, SESTAO, TAMPERE, and VIENNA
• 3 associated cities: GOTHENBURG, GAZIANTEP, PLOVDIV
• 200,000 m² gross floor area is being renovated
• Target: up to 82% primary energy savings

www.eu-gugle.eu
The EU-GUGLE Project

- Combines the latest research results relevant to smart renovations at a district level
- Demonstrates the technical, socio-economic and financial feasibilities of sustainable renovation solutions for groups of buildings in European districts
- Integrates results into clear, comprehensive and transposable ‘smart renovation models’
- Triggers large-scale, Europe-wide replication in other smart cities and communities by 2020
**AACHEN**

<table>
<thead>
<tr>
<th>District</th>
<th>Aachen-North</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Affected</td>
<td>~41,800 m²</td>
</tr>
<tr>
<td>Type of Buildings</td>
<td>Recent (70s) and historical buildings (20s-30s)</td>
</tr>
<tr>
<td>Target</td>
<td>Up to 65% primary energy savings</td>
</tr>
<tr>
<td></td>
<td>Heating 25.6 GWh/a, Electricity 2.5 GWh/a</td>
</tr>
</tbody>
</table>

**Technical measures:**
- Additional insulation on facades, roofs and cellar ceilings
- Insulating windows
- Ventilation with heat-recovery
- Heat recovery from the sewage network and integrated heat pumps in a low-exergy heating network
- District heating
- Technical control systems for heating, electricity and lighting
- Solar energy and efficient gas boilers
- Lighting with presence detectors
- Smart meters

**Non-technical measures**
- Consumer behaviour studies and instruments to suit consumer behaviour
- Energy-efficiency rental fee and other agreements with tenants
- Communication measures and advisory activities to reduce energy consumption through consumer behaviour
Case Study - Aachen
Case Study - Aachen

Buildings from the 70s
Using heat from the sewage network with 2 heat pumps
Heat recovery from the ventilation system

<table>
<thead>
<tr>
<th>AREA</th>
<th>WIESENTAL: A_RES_BEST 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U-VALUE (W/m²K)</td>
</tr>
<tr>
<td><strong>MEASURES</strong></td>
<td><strong>REFERENCE</strong></td>
</tr>
<tr>
<td>FACADE/WALL</td>
<td>0,24</td>
</tr>
<tr>
<td>ROOF**</td>
<td>0,24</td>
</tr>
<tr>
<td>GROUND FLOOR</td>
<td>0,35</td>
</tr>
<tr>
<td>GLAZING</td>
<td>1,3</td>
</tr>
</tbody>
</table>

Before

![Before image](image1.jpg)

After

![After image](image2.jpg)
Case Study - Aachen

- Replacing balconies to avoid thermal bridges
- Installing partly triple-glazed windows
- Insulating the façade
- Insulating the attic floor and the basement ceiling
- Installing a central heating using heat pumps (heat from sewage network and ventilation)
- Installing partly LED-lighting
# Case Study - Aachen

- Listed buildings from 1923
- Thermal renovation completed: 14,376 m² (99 flats)
- Heating system changing from decentralized boilers to centralized district heating to be installed in 2016

<table>
<thead>
<tr>
<th>AREA</th>
<th>JOSEPH-VON-GÖRRESSTR. 1-15: A_RES_BEST 2</th>
<th>METHODS/</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U-VALUE (w/m²K)</td>
<td>REALIZED</td>
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</tr>
<tr>
<td>FACADE/WALL</td>
<td>0,24</td>
<td>0,84 (back)</td>
<td>4/0 cm thermal insulation 032 WLG</td>
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<tr>
<td></td>
<td></td>
<td>0,858 (front)</td>
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<tr>
<td>ROOF**</td>
<td>0,24</td>
<td>0,141</td>
<td>20 cm thermal insulation 032 WLG</td>
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<td>GROUND FLOOR</td>
<td>0,35</td>
<td>0,22</td>
<td>10 cm thermal insulation 035 WLG</td>
</tr>
<tr>
<td>GLAZING</td>
<td>1,3</td>
<td>1,3</td>
<td>triple glazing</td>
</tr>
</tbody>
</table>

**Before**

**After**
Case Study - Aachen

Heat Recovery from the Sewage System

- Sewage channel dimensions: 3.2 m x 2.55 m
- Average annual water temperature: 15°C
- Sewage water heat capacity: 380 kW
- Heat pumps: Two with 235 kW capacity
Case Study - Aachen

- Communication with tenants
  - Celebration of the completion of a section of construction as a ‘thank you’ to tenants living in renovated spaces and information ‘tenants2tenants’ for the new construction sections.
  - 2 special events in 25.08.2014 and 25.04.2015
  - Presentation of the energy advisory boards in Aachen
  - Visit and explanation of the new heating system by heat pumps
TAMPERE

<table>
<thead>
<tr>
<th>District</th>
<th>Tammela</th>
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<tbody>
<tr>
<td>Surface affected</td>
<td>~32,500m²</td>
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<tr>
<td>Type of buildings</td>
<td>Apartment blocks mainly from the 70s largely owned by private households.</td>
</tr>
<tr>
<td>Target</td>
<td>Up to 50% primary energy savings</td>
</tr>
</tbody>
</table>

**Technical Measures:**
- Insulation measures (walls, windows, balcony doors and roof)
- Renewing the thermostat radiator valves and adjusting the heating network
- Centralizing and renovating the heating system
- Solar panels
- Adding heat recovery to the ventilation system
- Air-source heat pump
- Metering for water consumption in every apartment
- Renovation of the drainpipe system
- Energy-efficient lighting
- Connection to new biofuel-based CHP municipal district heating network
- Remote property monitoring

**Non Technical Measures**
- Specialized events for the residents and the other parties on energy-efficient and environmentally friendly renovations, buildings and lifestyle
- Bicycle use promotion
Case Study - Tammela

- City of Tampere - Tammela sets an example for urban city development, the ecological district is used as an innovation platform
- PPPP - Tammela model pilot process is based on an alliance working method
Case Study - Tammela

Existing housing stock in Tammela

299 000 m²

New housing in Tammela (goal)

120 000 m²

= 419 000 m²

Demos
1) 30 000 m² retrofit
2) 20 000 m² low energy new buildings

Specific consumption goal
133 kWh/m²/a
Case Study - Tammela

Before

After
Case Study - Tammela

- Two dominant household types:
  - Young couples with limited funds
  - Seniors with pensions and resist investing
- Homeowners make key decisions at all stages of the project
- First step: Motivating the housing companies
- Workshops on decision-making and financing are key elements
Case Study - Tammela

- All buildings are centralizing their heating systems and
- Connecting to the municipal district heating network
- On-site and centralized real-time monitoring in all buildings
## VIENNA

<table>
<thead>
<tr>
<th>District</th>
<th>Penzing</th>
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<tbody>
<tr>
<td>Surface affected</td>
<td>~67,500 m²</td>
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<tr>
<td>Type of buildings</td>
<td>residential buildings and social housing from the 50s to 80s, owned by the City of Vienna, housing associations and flat owners</td>
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<tr>
<td>Target</td>
<td>Up to 61% primary energy savings</td>
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</table>

### Technical measures
- High insulation and decentralised ventilation
- Thermodynamic optimisation via simulation and monitoring
- Multi-Active Façade combined with PV
- Building Integrated PV (BIPV)
- Replacement of decentralised fossil heating systems by centralised renewable heating plants allowing contracting

### Non-Technical measures
- Socio-economic evaluation
- Participatory action research
- Symbiotic integration of green power marketing
Case Study - Penzing 1

- Challenge is the cap of €1.50/m² additional monthly rent over 10 years
- Consideration of energy poverty
- Participatory actions to involve the tenants together with a social forum (Wohnpartner)
Case Study - Penzing 2

- Redensification - additional attic apartments (26) on top with:
  - Natural gas boiler (central heating system) (135 kW)
  - Low-temperature underfloor heating system (40°C) with individual controls
- Mixed model of tenants and new flat owners
Case Study - Penzing 2

- Minimization of heat losses, insulated envelope with U-Value=0.19 W/(m²K)
- New window installation U-Value=1.2 - 1.3 W/(m²K)
- Insulation of the cellar U-Value=0.19 W/(m²K)
Case Study - Penzing 2

- Nogging piece with roof insulation ($U = 0.17 \text{ W/}(\text{m}^2\text{K})$)
- Energy-efficient elevators
- Communication flow/quality assurance debates during weekly meetings
Case Study - Penzing 2
Case Study - Penzing 2

- Step-by-step realisation of the energy efficiency measures were completed in August 2014
- Distribution and intermediation among all involved parties
- Few building users complained about particular delays and disturbances; most were satisfied as their requested structural damage was repaired
Case Study - Penzing 2

<table>
<thead>
<tr>
<th>Effizienzklassen</th>
<th>Klassengrenzen</th>
<th>Bestand</th>
<th>Sanierung</th>
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<tbody>
<tr>
<td>niedriger Heizwärmebedarf</td>
<td>kWh/m²a</td>
<td>kWh/m²a</td>
<td>kWh/m²a</td>
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<tr>
<td>A++</td>
<td>HWPₚₑₑₓₘₓ ≤ 10 kWh/m²a</td>
<td></td>
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<tr>
<td>A+</td>
<td>HWPₚₑₑₓₘₓ ≤ 15 kWh/m²a</td>
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<tr>
<td>A</td>
<td>HWPₚₑₑₓₘₓ ≤ 25 kWh/m²a</td>
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<td></td>
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<tr>
<td>B</td>
<td>HWPₚₑₑₓₘₓ ≤ 50 kWh/m²a</td>
<td>26,45</td>
<td></td>
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</tbody>
</table>
Contact

For more information please contact:
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www.eu-gugle.eu