Nearly zero energy building renovation, the EU-GUGLE project

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National Renewable Energy Centre of Spain - CENER

Conference on Sustainable Renovation Models
22nd April 2016, Aachen, Germany

The EU-GUGLE project

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

Call: FP7-2012-NMP-ENV-ENERGY-ICT-EeB. Smart Cities call. Demonstration of nearly Zero Energy Building Renovation for cities and districts

Project duration: April 2013 - March 2019 (72 months)

Demo sites: Aachen (Germany), Bratislava (Slovakia), Milan (Italy), Sestao (Spain), Tampere (Finland) and Vienna (Austria)

Follower Cities: Gaziantep (TK), Gothenburg (SWE), Plovdiv (BG)

Number of partners: 21 (10 different countries)

Budget: 26,389,085 EUR ; EC Contribution: 15,257,775 EUR
EU-GUGLE project: OBJECTIVE:

- To achieve 40 - 80 % primary energy savings per district, and to increase 25 % the share of renewable supplied in the buildings,
  - Sharing latest research results especially of retrofitting technologies and intelligent RES integration into buildings.
  - Taking the building-users and its public space as the connective environment to the project, with special attention to vulnerable groups and behavioral challenges.
  - Establishing adequate business environment favorable for Smart City demonstrations
EU GUGLE district AACHEN

<table>
<thead>
<tr>
<th>District</th>
<th>Aachen-North</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface affected</td>
<td>41,802 m²</td>
</tr>
<tr>
<td>Type of buildings</td>
<td>Residential buildings: recent (70s) and listed buildings (20s-30s)</td>
</tr>
<tr>
<td>Target</td>
<td>53 - 59 % primary energy savings</td>
</tr>
</tbody>
</table>

Technical measures
- Thermal insulation on facades, attic floor, roofs, cellar ceiling, windows, balconies
- Local heating network based on heat pumps using the thermal capacity of the sewer
- District heating

Non-technical measures
- Energy efficiency campaigns with tenants, advisory activities to affect consumer behaviour.
- Launching innovation vouchers for consultations

EU-GUGLE District BRATISLAVA

<table>
<thead>
<tr>
<th>District</th>
<th>Bratislava</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface affected</td>
<td>8,000 m2</td>
</tr>
<tr>
<td>Type of buildings</td>
<td>blocks of buildings, built after 1960</td>
</tr>
<tr>
<td>Target</td>
<td>From 60 % to 75 % primary energy savings</td>
</tr>
</tbody>
</table>

Technical measures:
- Insulation measures on facades, roofs, cellar ceiling, windows
- Solar thermal and PV. Gas boilers with micro CHP
- Heat recovery from the sewage
- Smart meters....

Non-technical measures
- Financing models adapted to privately owned apartments (no social housing)
- Raising awareness of tenants, to reduce energy consumption through user’s behaviour.
EU-GUGLE District MILAN

<table>
<thead>
<tr>
<th>District</th>
<th>Zona 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface affected</td>
<td>17,596 m²</td>
</tr>
<tr>
<td>Type of buildings</td>
<td>Three residential blocks and a public kindergarten</td>
</tr>
<tr>
<td>Target</td>
<td>From 66% to 80% primary energy savings</td>
</tr>
</tbody>
</table>

Technical measures:
- Prefabricated Facade with Built-in Mechanical Ventilation & Heat Recovery System
- External insulation without glue
- Advanced Solar Protection, Night Cooling Ventilation
- Heat recovery system (Exhaust air pump)
- Building Management Systems, Smart Meters
- Photovoltaic power plant

Non-technical measures
- Creation of an energy efficiency and deep renovation team inside the technical staff of the municipality
- Showcase information centre to give information and training
- Raising awareness campaign

EU-GUGLE District SESTAO

<table>
<thead>
<tr>
<th>District</th>
<th>Txabarri/El Sol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface affected</td>
<td>19,000 m²</td>
</tr>
<tr>
<td>Type of buildings</td>
<td>Social housing blocks, 222 dwellings</td>
</tr>
<tr>
<td>Target</td>
<td>From 66% to 80% primary energy savings</td>
</tr>
</tbody>
</table>

Technical measures:
- Insulation measures on facades, roofs, cellar ceiling, windows
- Sustainable building materials
- Installation of biomass boilers and Solar Collectors
- Adding heat recovery to the ventilation system

Non-technical measures
- Raising awareness campaign
- Promotion of the use of bicycles
EU-GUGLE District TAMPERE

<table>
<thead>
<tr>
<th>District</th>
<th>Tammela</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface affected</td>
<td>31.433 m²</td>
</tr>
<tr>
<td>Type of buildings</td>
<td>Apartment blocks mainly from the 70s, mainly owned by private households.</td>
</tr>
<tr>
<td>Target</td>
<td>Up to 57% primary energy savings</td>
</tr>
</tbody>
</table>

**Technical measures:**
- Insulation measures (walls, windows, balcony doors, roof)
- Renewing the thermostat valves and adjusting the heating network
- Renovation of the heating system
- Installation of solar collectors
- 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
- Remote monitoring of the properties

**Non Technical measures**
- Specialized events for the residents and the other parties on energy efficient and environmentally friendly renovating, building and living
- Promotion of the use of bicycles

EU-GUGLE District VIENNA

<table>
<thead>
<tr>
<th>District</th>
<th>Penzing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface affected</td>
<td>~67,500 m²</td>
</tr>
<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>
</tr>
<tr>
<td>Target</td>
<td>Up to 61% primary energy savings</td>
</tr>
</tbody>
</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
Current and Expected impacts of the project

Key figures. Investment and Environmental Impacts

<table>
<thead>
<tr>
<th>EU GUGLE project</th>
<th>2016 (until today)</th>
<th>At the end of the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investments (€)</td>
<td>27,054.846</td>
<td>81,021.443</td>
</tr>
<tr>
<td>Area retrofitted (m²)</td>
<td>48.758</td>
<td>186.318</td>
</tr>
<tr>
<td>Energy savings (kWh/y)</td>
<td>5,327.082</td>
<td>15,226.492</td>
</tr>
<tr>
<td>CO2 emissions (T CO2/y)</td>
<td>2.052</td>
<td>5.188</td>
</tr>
</tbody>
</table>
Demonstration of cost effective highly energy efficient solutions and technologies

- Industrialized Facade with Built-in Mechanical Ventilation & Heat Recovery System.
- 100% RES supply for heating pilot (biomass boiler and Solar Thermal)
- RES integration (PV and Solar thermal)
- High efficient heat recovery in ventilation systems
- Heat recovery system in the sewage network

Best practices data base for the construction sector based on innovation and competitiveness

- Bio-based deep refurbishment
- Building retrofitting based on ETCIS
- Advanced Solar Protection, Night Cooling Ventilation
- Energy refurbishment of listed buildings
- High performance. Cost-effectiveness approach
- Low disruption to the tenants and building owners
- Industrialized solutions
Reduce the gap between theoretical energy use and real energy use after refurbishment

- Dynamic energy simulations before and after the retrofitting
- ICT based energy management systems. Smart meters
- Building users’ empowerment

<table>
<thead>
<tr>
<th>SUPPLY SYSTEM</th>
<th>ENERGY NEEDS (kWh/y)</th>
<th>ENERGY USE (kWh/y)</th>
<th>DELIVERED ENERGY (kWh/y)</th>
<th>PRIMARY ENERGY (kWh/y)</th>
<th>CO2 EMISSIONS (t CO2/y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEATING: DISTRICTHEATING (i)</td>
<td>322.673</td>
<td>322.673</td>
<td>322.673</td>
<td>225.871</td>
<td>67.4</td>
</tr>
<tr>
<td>COOLING</td>
<td></td>
<td>3.290</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DOMESTIC HOT WATER</td>
<td>DISTRICTHEATING (i)</td>
<td>85.917</td>
<td>85.917</td>
<td>80.142</td>
<td>18.0</td>
</tr>
<tr>
<td>LIGHTING</td>
<td></td>
<td></td>
<td>36.177</td>
<td>61.501</td>
<td>8.1</td>
</tr>
<tr>
<td>RES ON-SITE (THERMAL)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RES ON-SITE (ELECTRICITY)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>411.880</td>
<td>444.767</td>
<td>347.514</td>
<td>93.5</td>
</tr>
</tbody>
</table>

Providing the construction sector with specific abilities

- High efficient nZEB buildings
- Air tightness, thermal bridges,
- High efficient HVAC systems and RES installation
- Bio-based materials
- Industrialised solutions
Common monitoring data structure and sharing of monitoring results

- Aligned with the new Smart Cities Information System (SCIS)
- Gathering monitoring data across Smart Cities, CONCERTO and EE-buildings-projects ("Technical Monitoring Database")
- making technologies comparable

Citizens engagement

- Information / Discussion meetings citizens and building owners
- Dialog with tenants and other stakeholders. How do we get everybody on board?
- Citizen empowerment and training
- Information available in other languages to reach cultural diversity.
Going beyond EU-GUGLE

- 6 pioneer cities is not enough to change the world!
- Our role is to **INSPIRE** others and **SHARE** our experiences (good and bad) to foster EU wide deployment of smart energy solutions
- EU-GUGLE launched two initiatives:
  - **Collaboration with other projects**
    - My Smart City District community
  - **Knowledge sharing with other cities**
    - The Replication Cluster

Joining forces with other projects

- A Community of 8 smart cities projects, bringing together 25 pilot cities
- One portal to find them all: www.mysmartcitydistrict.eu
- One LinkedIn group to interact with them all: « My Smart City District Community »
- One Twitter account to stay in touch: @MySmartCityD
Joining forces with other projects

My Smart City District community

JOINT EVENTS

• June 2015: EU wide open doors events in pilot cities
• June 2016: 5 lunch webinars on financing, scalability of solutions, stakeholder involvement, etc.

=> Visit eu-gugle.eu and mysmartcitydistrict.eu soon!

The Replication Cluster

• A joint initiative of the SINFONIA & EU-GUGLE projects
  - 8 pioneer cities: Innsbruck, Bolzano, Bratislava, Vienna, Aachen, Tampere, Milan, Sestao
  - 7 early adopter cities: Gothenburg, Plovdiv, Gaziantep, Rosenheim, Seville, La Rochelle, Pafos

• A community of like-minded cities interested in designing and implementing their own district-scale refurbishment strategies.
• A framework to exchange ideas and engage in knowledge sharing activities (study visits, workshops, networking)
The Replication Cluster today

8 pilot cities
7 early adopters
29 Replication cities

Does your city want to join the family?

JOIN THE REPLICATION CLUSTER!

Visit www.eu-gugle.eu or talk to us at the break
On behalf of the EU-GUGLE team,

Thank you for your attention!

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