Retrofitting 3 kindergartens in Rustavi City in order to achieve high energy efficiency standards and greenhouse emission reduction

Dr. K. Melikidze

SUSTAINABLE DEVELOPMENT AND POLICY (SDAP) CENTER
Overall and Specific Objectives of a EU Funded Project

❖ Project is built around the core idea (overall objective), which aims to enable local authorities of city of Rustavi to implement select SEAP measures.

❖ SO1 To develop and implement set of measures, materials and technologies to achieve high energy efficiency standards and reduction of greenhouse gas emissions in public buildings (kindergartens).

❖ SO2 To test run energy efficient equipment in 3 kindergartens in Rustavi to ensure consequent proper operation and maintenance.

❖ SO3 “To evaluate the impact of these measures on beneficiaries (from both technology and social points of view) to find possible bottlenecks, needs for further improvements in order to make them applicable to municipalities with similar climatic conditions throughout the post Soviet space.
Main Activities of the EU Project

❖ Carrying out feasibility study with comprehensive energy audits of 3 kindergartens (with the ENSI software tools);
❖ Developing kindergartens’ technical designs;
❖ Carrying out cost effective tenders (the best price-quality ratio) for local companies to implement the above rehabilitation works;
❖ Rehabilitating kindergartens;
❖ Assessing project results;
❖ Organizing and carrying out communication activities
Accomplished Project Activities

❖ The technical pre-design assessment of the kindergartens have been carried out by the technical experts team

❖ The comprehensive energy audits for the # 6 # 40 and # 41 kindergartens have been conducted, the EA reports were developed with identification of the EE measures and financial analysis

❖ The technical designs with consideration of energy efficiency technical solutions in the #6,# 40 & 41 kindergartens have been developed;

❖ Three tenders have been carried out;

❖ The rehabilitation works in the # 6 # 40 and # 41 kindergartens have been implemented;
SET of the EE Measures with the related Technologies Implemented in 3 kindergartens

- Installation of the heating system with the effective heating boilers and construction of the boiler room;
- Installation of the comprehensive ventilation system with the heat recovery;
- Installation of the HW system with the solar collectors;
- Installation of the new energy efficient widows with the low emission glazing and sealing tapes;
- Installation of the new electrical system with the electrical grounding and efficient lighting;
- Insulation of roof;
- Insulation of the exterior walls;
- Insulation of basement:
Results of the software modeling for # 6 and # 40 kindergartens

**EE Potential - Energy Audit**

<table>
<thead>
<tr>
<th>Kindergarten # 6 in Rustavi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heated area: 692 m²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EE measures</th>
<th>Investment [Euro/GEL]</th>
<th>Net savings[kWh/yr], [kvt sT/w], [Euro/yr], [GEL/yr]</th>
<th>Payback [year]</th>
<th>NPVQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Insulation of walls</td>
<td>25 082</td>
<td>67 067</td>
<td>2 275</td>
<td>11.0</td>
</tr>
<tr>
<td>2. Insulation of new windows</td>
<td>10 805</td>
<td>38 820</td>
<td>1047</td>
<td>10.3</td>
</tr>
<tr>
<td>3. Insulation of new lighting system with CFL bulbs</td>
<td>14 725</td>
<td>656 – 489</td>
<td>1211</td>
<td>12.2</td>
</tr>
<tr>
<td>4. Insulation of roof</td>
<td>16 697</td>
<td>26 910</td>
<td>1034</td>
<td>16.2</td>
</tr>
<tr>
<td>5. Installation of modern mechanical ventilation system with heat recovery</td>
<td>12 115</td>
<td>30 149</td>
<td>946</td>
<td>12.8</td>
</tr>
<tr>
<td>6. Installation of heating system in combination with the DHW with solar water collectors system</td>
<td>16 355</td>
<td>40 760</td>
<td>3171</td>
<td>12.8</td>
</tr>
<tr>
<td>7. Insulation of floor</td>
<td>7 417</td>
<td>5 341</td>
<td>1274</td>
<td>12.8</td>
</tr>
</tbody>
</table>

**Profitable EE measures summary:**

Total profitable measures: 94 181

---

**Kindergarten # 6 in Rustavi**

Heated area: 692 m²

- Insulation of walls
- Insulation of new windows
- Insulation of new lighting system with CFL bulbs
- Insulation of roof
- Installation of modern mechanical ventilation system with heat recovery
- Installation of heating system in combination with the DHW with solar water collectors system
- Insulation of floor

Total profitable measures: 94 181

---

**Actual, Baseline, After Measures**

Annual Energy use

- Cooling
- Various
- Lighting
- Fans and pumps
- DHW
- Ventilation
- Heating

---

**Profitable EE measures summary:**

Total profitable measures: 94 181

---

**NPVQ:**

- 94 181
- 18 085
- 7 425
- 18 625

---

**Keywords:**

- Results of the software modeling
- Kindergarten # 6
- # 6
- Georgia
- EE measures
- Profitable EE measures
- Insulation of walls
- Insulation of new windows
- Insulation of new lighting system with CFL bulbs
- Insulation of roof
- Modern mechanical ventilation system with heat recovery
- Heating system in combination with the DHW with solar water collectors system
- Insulation of floor
- Net savings
- Payback
- NPVQ

---

**Logo:**

- European Union for Georgia
- Sustainable Development and Policy Center
- Demonstration Projects Eastern Partnership
- Covenant of Mayors
Carbon Dioxide Emissions Reduction in # 6 and # 40 kindergartens

<table>
<thead>
<tr>
<th>Energy carrier</th>
<th>District Heating</th>
<th>Electricity</th>
<th>Gas</th>
<th>Oil</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present situation – baseline (kWh/m²a)</td>
<td>na</td>
<td>66.3</td>
<td>317.3</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>After EE and renovation measures (kWh/m²a)</td>
<td>na</td>
<td>28.5</td>
<td>83.4</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Savings (kWh/m²a)</td>
<td>na</td>
<td>37.8</td>
<td>234.0</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Savings (kWh/a)</td>
<td>na</td>
<td>26 156</td>
<td>161 929</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>CO₂ emission coefficients (kg/kWh)</td>
<td>na</td>
<td>0,104</td>
<td>0,202</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>CO₂ emission reductions (kg/m²a)</td>
<td>na</td>
<td>3.93</td>
<td>47.24</td>
<td>8</td>
<td>na</td>
</tr>
<tr>
<td>CO₂ emission reductions (t/year)</td>
<td>35.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy carrier</th>
<th>District Heating</th>
<th>Electricity</th>
<th>Gas</th>
<th>Oil</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present situation – baseline (kWh/m²a)</td>
<td>na</td>
<td>44.9</td>
<td>303.1</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>After EE and renovation measures (kWh/m²a)</td>
<td>na</td>
<td>21.7</td>
<td>93.2</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Savings (kWh/m²a)</td>
<td>na</td>
<td>23.2</td>
<td>209.9</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Savings (kWh/a)</td>
<td>na</td>
<td>57 169</td>
<td>51 856</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>CO₂ emission coefficients (kg/kWh)</td>
<td>na</td>
<td>0,104</td>
<td>0,202</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>CO₂ emission reductions (kg/m²a)</td>
<td>na</td>
<td>2.4128</td>
<td>42.4</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>CO₂ emission reductions (t/year)</td>
<td>110.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Development of the EE Technical Designs: Details of Insulation of Buildings based on the EU ETCS guidelines
Refurbishment of the #6 kindergarten: Demolishing the wooden balconies and partial construction of the walls with blocks
Refurbishment of the # 6 kindergarten: Insulation of Windows
Refurbishment of Façade: # 6 Kindergarten
Before and After
Refurbishment of the # 40 kindergarten: Installation of Ventilation System, Lighting and Solar Collectors
Refurbishment of the # 41 kindergarten: Installation of the New Windows, Heating, Ventilation and Lighting
Insulation of walls with the plinth area in the # 40 kindergarten
Refurbishment of the Façade: # 40 kindergarten
Before and After
Thermal imaging with a FLIR50 of the Façade: #40 Kindergarten
Thank you