



**Ljubljana
(Slovenia)**

45 % energy saving

Total living expenses lower than before renovation

All users have chosen for energy saving measures

Project data

Location, address:	Prvomajska 7
Region:	Ljubljana
Surroundings:	Central Slovenia
Climate:	Sub-Alpine
Heating degree days:	3300
Year of construction and renovation:	1923 (constructed); 2005 (renovated)
Typology:	Apartment building
No of dwellings:	4 dwellings
Total floor area:	368 m ²
Owner:	Various private owners
Architect and Builder:	Facade: Stilgrad d.o.o.; Windows: AJM d.o.o.; Roof: Zadruga Novaki z.o.o.
Costs of energy saving measures:	€ 32.500
Renovation financed by:	The owner; subsidies (up to 10%)



Figure 1: Apartment building Prvomajska 7

Objectives and Results

Thorough renovations of the building envelope and of the heating system were carried out to improve thermal characteristics of the building and to reduce the energy consumption by 45%.

Renovation concept

Key renovation features

- Insulation of roof
- Energy efficient windows
- Individual thermostats valves
- Insulation of floor towards the basement
- Installation modern boiler

State-of-the-art

Before renovation

Constructions [U-values: W/m^2K]

- Non-insulated roof [1,0]
- Non-insulated facade [1,4]
- Timber windows (double glazing) [2,7]¹

Installations:

- Local boilers

After renovation

Constructions [U-values: W/m^2K]

- Insulation of roof [0,21]
- Insulation of facade [0,32]
- Windows were replaced with energy efficient AL-PVC windows with low-e argon glazing [1,3]

Installations:

- Installation of a new modern boiler in the basement
- Installation of thermostat valves

Energy saving and monitoring

Energy consumption before renovation:
KWh/m²: 122

Energy consumption after renovation:
KWh/m²: 67
Percentage savings²: 45%

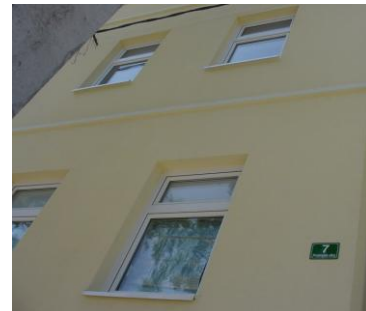


Figure 2: Energy efficient windows



Figure 3: Apartment building Prvomajska 7 before and between renovation

Additional information

- The main reasons for the renovation were insufficient maintenance state, bad quality window frames, the intention of the housing association to implement energy saving measures and a need to improve the aesthetical view of façades.
- Three main problems of the building were identified:
 - as insufficient thermal protection,
 - many local boilers and
 - dilapidated facade.
- The building was designed and built in the period when there was no regulation and no requirements regarding the thermal insulation and energy efficiency in buildings. The building codes related to brick structures resulted in U values of approx. 1,4 [W/m^2K] for outer wall. An examination of potential energy savings of the building was carried out.

Lessons learned and conclusions

- The benefit for the occupants is manifested through lower heating costs and higher level of thermal comfort. The integration of these measures contributed also to improvement of aesthetic value of the building.

References

[1] Building management: Marjan Rojko

¹ Total U-value of glazing and the window frame

² Compared to the situation before renovation