Ljubljana (Slovenia)

21% energy saving

Total living expenses lower than before renovation

Nearly all users have chosen for energy saving measures

Project data

Location, address:	Šišenska 42-44
Region:	Ljubljana
Surroundings:	Central Slovenia
Climate:	Sub-Alpine
Heating degree days:	3300
Year of construction and renovation:	1960 (constructed); 2002 - 2004 (renovated)
Typology:	Apartment building
No of dwellings:	40 dwellings
Total floor area:	1860 m^2
Owner:	Various private owners, building management: Finance Operativa d.o.o.
Architect and Builder:	Builder: Pleskarstvo Marolt d.o.o.
Costs of energy saving measures:	€ 100.000
Renovation financed by:	Owners, state subsidy (10 % of investment)

Objectives and Results

The refurbishment of the building envelope was carried out to improve thermal characteristics of the building and to reduce the energy consumption by 21%. The measures on heating system are planned, too.

Figure 1: Apartment building on Šišenska 42-44 after renovation and IR thermography of refurbished state

Renovation concept

Key renovation features

- Insulation of facade
- High efficiency insulation glazing and frames

State-of-the-art

Before renovation	After renovation
Constructions [U-values: W/m^{2}K] • Non-insulated facades [1,3] • Windows (double glazing) [2,7] [1]	*Constructions [U-values: W/m^{2}K]* • Insulation of facades [0,35] • Installation of energy efficient windows with low emissivity double glazing (with six chambers PVC window frames, where [$U_{glazing}$ =1,1]

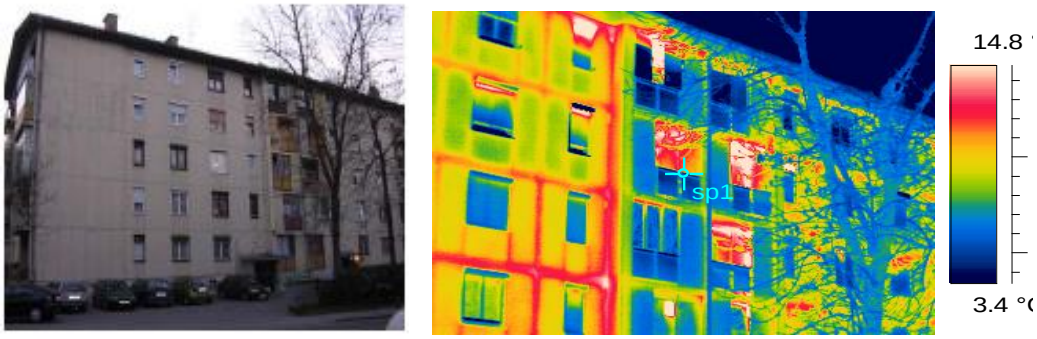

Figure 2: Before renovation and thermographic picture

Energy saving and monitoring

Energy consumption before renovation:
KWh/m^2: 312

Energy consumption after renovation:
KWh/m^2: 245
Percentage saving[2]: 21%

Additional information

- Two main problems of the building were identified:
  - as insufficient thermal protection and
  - dilapidated facade.
- The building was designed and built in the period when there was no regulation on thermal insulation and energy efficiency in buildings. The existing envelope structure consists of prefabricated concrete plates (total thickness 16 cm) with a core of concrete mixed with wooden chips (“betocel”) in thickness of 8 cm as a moderate thermal insulation. This resulted in U value of approx. 1,3 [W/m2K] for outer wall and the window technology normally applied in that time (double glazed cast windows) resulted in U values of approx. 2,7 [W/m2K] with normally high air leakage.
- An examination of energy efficiency of the building was carried out. The examination revealed that potential energy savings due to the building envelope improvements could be as high as 40%.
- The recommended measures were the following:
  - thermal insulation of the outer walls and
  - replacement of existing windows with energy efficient windows, according to the requirements for new buildings, set in the Regulation for thermal insulation and energy efficiency of buildings from 2002.

Lessons learned and conclusions

- Since the buildings the same architecture are located nearly, this example plays a role of demonstration project of refurbishment.
- Simple pay back of total investment ~14 years
- Simple pay back of incremental investment in energy efficiency ~3-4 years
- Energy use is still high; the main reason identified by energy advisors is the need for hydraulic balance and thermal regulation; state subsidies are available for both measures.

References

[1] Building management: Finance Operativa d.o.o.;
[2] Ministry of environment and Physical Planning

[1] Total U-value of glazing and the window frame
[2] Compared to the situation before renovation