



# Radomir 3 Bulgaria

**46% energy saving**

**Higher comfort in dwellings**

**Simple and replicable solutions**

### Project data

Location, address:	Radomir
Region:	Western Bulgaria
Surroundings:	Municipality, part of the greater municipality of Pernik
Climate:	Mild continental
Heating degree days:	2900 in the heating season (mid of October - mid of April)
Year of construction and renovation:	1980 (constructed); 1997 (renovated)
Typology:	Panel multi – dwelling building of eight storeys
No of dwellings:	23
Total floor area:	4,623 m <sup>2</sup>
Owner:	Owner occupied flats
Renovation design team:	Energoproekt
Realization team:	Exergia SA (Greece), Energoproekt (Bulgaria), ICEU (Germany)
Costs of energy saving measures:	Pay-back period for implemented energy saving measures: 12 years
Renovation financed by:	PHARE funded demonstration project



Refurbished building

### Objectives and results

The objectives of this pilot project were to show the possibilities to save energy in dwelling buildings through the implementation of different energy saving measures and to assess the viability of different technologies used at building refurbishment. In three typical dwelling buildings, erected with prefabricated concrete panels, were implemented different energy saving measures.

The implemented measures shown that with simple technologies can be reached significant energy savings – more than 46%. These measures are applicable for 30% of the dwellings in the country.

### Renovation concept

#### Key renovation features

- Thermal insulation of exterior walls with extruded polystyrene;
- Water proofing and thermal insulation of roof with Keramsit;
- Thermal insulation of basement ceiling;
- Repair and draught proofing of existing wooden windows;
- Installation of electrical heat accumulators;
- Installation of hot water electrical heaters.

### **State-of-the-art**

#### **Before renovation**

##### *Constructions [U-values: W/m<sup>2</sup>K]*

- Roof 0,9
- Non-insulated basement 2,9
- Non-insulated external concrete walls 2,95
- Double glazed wooden windows 2,9

##### *Installations*

- No boiler

#### **After renovation**

##### *Constructions [U-values: W/m<sup>2</sup>K]*

- Additional insulation of roof 0,5
- Insulation of basement ceiling 0,52
- Insulation of external concrete walls 0,52
- Repair and draught proofing of wooden windows 2,65

##### *Installations*

- Installation of electrical heat accumulators
- Installation of hot water electrical heaters

### **Energy saving and monitoring**

*Energy consumption before renovation:*  
KWh/m<sup>2</sup>: 166,2

*Energy consumption after renovation:*  
KWh/m<sup>2</sup>: 89,7  
Percentage saving: 46%

The energy consumption before the refurbishment is calculated after an energy audit, as 55% of the rooms were not heated. After the renovation, the energy consumption has been monitored for 2 years.



Building before refurbishment

### **Additional information**

- In order to compare the cost effectiveness of different types of heating in this building were installed electrical heat accumulators. The monitoring shown that the use of electricity for heating is too expensive.
- As the renovation did not affect the flats internally, the inhabitants did not have to move.
- The inhabitants were interviewed after the completion of the works. Most of them are satisfied by the results.
- The main result of the implemented energy saving measures is an increase of comfort of the dwellings: better temperature, less condensation, etc.

### **Lessons learned and conclusions**

- The choice of fuel for heating is of higher importance for the economic results of a refurbishment. The heating with electricity is too expensive, even with electrical heat accumulators that consume electricity at lower price (night tariff).
- The implemented insulations on external walls, roof and basement are cost effective.