



## Radomir 1 Bulgaria

**46% energy saving**

**Healthier and warmer dwellings**

**The occupants highly appreciate the implemented energy saving measures**

### 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 seven storeys
No of dwellings:	21
Total floor area:	4,557 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: 6 years
Renovation financed by:	PHARE funded demonstration project



Work in progress

### 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 external walls with extruded polystyrene;
- Water proofing and thermal insulation of roof with Keramsit;
- Repair and draught proofing of wooden windows;
- Thermal insulation of basement ceiling;
- Installation of new boiler for space heating;
- Improvement of heating system;
- Installation of hot water electrical heaters.

### State-of-the-art

#### Before renovation

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

- Roof 0,9
- Non-insulated basement 2.9
- Non-insulated external concrete walls 2,95
- Double glazed wooden windows 2,9

##### Installations

- No boiler
- No control of the heating system
- No control of radiators

#### After renovation

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

- 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 new efficient boiler for central heating
- Presetting heat radiation; optimum adjustment of the heating curve with weather-dependent flow temperature regulation
- Fixing of thermostatic valves on radiators;
- Fixing of timer-controls on radiators;
- Fixing of heat meters on radiators

### Energy saving and monitoring

Energy consumption before renovation:  
KWh/m<sup>2</sup>: 197,8

Energy consumption after renovation:  
KWh/m<sup>2</sup>: 106,7  
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.



New boiler

### Additional information

- The improved buildings were chosen as the measures applied could be widely replicated. This was due to factors such as building fabric, heating infrastructure, ownership and supporting institutional configuration.
- An energy audit was done before the refurbishment. This audit is the basis for assessment of a great number of dwelling buildings erected with reinforced concrete panels.
- 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, more aesthetical windows, etc.

### Lessons learned and conclusions

- The implemented energy saving measures are cost effective. Their pay back period is 6 years.
- The applied measures can be widely replicated with guarantee results. This is due to factors such as: type of building, choice of insulating materials, heating infrastructure
- The target group for future introduction of energy efficiency measures in the multi-dwelling houses with individual heating in Bulgaria are the households, occupying these dwellings.