ASPECTS OF BUILDINGS REHABILITATION IN ROMANIA

Dr. ing. Ioan Silviu DOBOSI, Vice-president AIIR/REHVA
Prof. dr. ing. Adrian RETEZAN, President - AIIR Banat Branch
INTRODUCTION

- The energy required for heating and cooling buildings from the Member States of European Union is around 40% from the final energetic consumption and the resulting emissions in this sector rises at approximately 36%.

- The energy consumption per inhabitant in Romania is 50% higher than the European Union average. This thing can be explained through the higher energy intensity from the industry as well as through the excessive energy losses from buildings. For many years buildings with low thermal protection were built, and in general with low quality thermo protective materials. The thermal resistance of windows and doors is three, respectively five times lower than in Western Europe that leads to huge heating losses.

- The necessary consumption for heating/cooling building can be reduced by improving heating and air-conditioning system and through a better thermal insulation of walls and windows. Through the thermal refurbishment of buildings the energy consumption can diminish with 40% to 70%.
The necessity of investing in energetic refurbishment of buildings:

- Nowadays, blocks of flats usually register a specific annual energy consumption for heating with values between 180 kWh/mpy and 240 kWh/mpy. Building complexes designed between 1950-1990 have registered the highest energy losses through exterior walls, windows and terraces. These energy losses determine high apartment heating costs during the winter season. Also, the block of flats designed between 1950-1990 often present elements of construction of deteriorated facades as well as components - exterior walls and windows- energetically inefficient.
To this date there are several laws in force:

- Law no. 199/2000 regarding the **Efficient use of energy** (rep. M.O. 734/8.10.2002);


- Law no. 372/13 December 2005 regarding the **Energy performance of buildings.**

As a result, a legal frame was created for the thermal refurbishment and renewal of the existing buildings and their installations from urban and rural areas (residential, health care, for the educational system, public, for industry, etc).

The OG 29/2000 enforces the mandatory drawing up of the **Energy certificate for buildings**, an official document that certifies the performance at a certain moment (thermal insulation level, performance of the heating installation, domestic hot water preparation, specific energy consumption from fossil fuels, etc). This document will represent a legal instrument for the evaluation of buildings in case of sale, lease, mortgage, etc.
Government Ordinance No. 18/4 March 2009: with a direct effect over the reduction of conventional fuel used for the preparation of the thermal agent for heating, the reduction of greenhouse gases, the reduction of expenses with house heating during winter and ventilation during torrid days, as well as the improvement of the urban aspect of counties.

The specific objective pursued by this norm is the reduction of the specific annual cost for heating in the block of flats, thermal insulated at values under 100 kWh/mpy useful area.
The opportunity of investing in the energy refurbishment of buildings:

For the buildings sector, according to the first National Action Plan regarding the Energy Efficiency 2008 – 2012, transmitted by our country to the European Commission, according to the provisions of Directive 2006/32/CE, it is forecasted that by applying the measures of thermal refurbishment of block of flats included in the Multiannual National Plan forseen by the Government Urgence Order no. 18/2009, to achieve energy savings of approximately 25% in regard to the existing situation, respectively the realization of energy saving for the period 2008 – 2010 of approximately 36,000 MWh/year (approx. 3,0 thousand tep).
Objectives included in the Romanian Government Programme for 2009 – 2012

- Implementing new investment programmes and continuing the existent programmes in the public interest infrastructure in order to attain in an accelerated rhythm the housing conditions according to the European requirements in order to increase the life quality;
- Increase the energy performance of apartment buildings and public buildings;
- Increase of financial resources from the state budget for implementing national developing programmes of infrastructure for the local interest.
Technical solutions

- Indicating technical solutions is made during the energy audit through outline more possible variants of thermal and energetic refurbishment taking into account the supplementary thermal protection of the opaque and open elements as well as the modernization of thermal installations and of DHW, but the auditors cannot choose the suppliers.

- Apparently, some methods can be established for using renewable energy sources. The technical solutions are the most important part when preparing the refurbishment.

- Solutions for increasing the energy efficiency in buildings refer to the following components of building:
  - the envelope of the building, the construction part;
  - the central heating installation;
  - the ventilation installation;
  - the domestic hot water;
  - the lighting installation.
Funds

- Law 29/2000 provides a number of sources of funding and tax incentives, such as:
  - Allocations from the local budgets within the provisions approved by local councils, county councils and the General Council of Bucharest, under the conditions established by the law;
  - Fundraising from firms or management/energy services companies as well as from the city directions and firms for energy services;
  - Fundraising from heat supply and hot water distribution companies and city directions for the rehabilitation of distribution networks in the basements of apartment buildings and for the installation of meters;
  - Own funds of economic entities that own or manage public administration buildings;
  - ARCE funds;
  - Own funds of the rehabilitated buildings' owners. Since a large portion of individuals are unable to invest in energy conservation, they should be given low-interest bank loans guaranteed by the state.
Emergency Ordinance 18/2009

Financing of the intervention (due to changes in legislation in 2009, Emergency Ordinance to increase the energy performance of the blocks of flats in March 2009) will be conducted as follows:

- 50% from the state budget through the Ministry of Regional Development and Tourism, within the limits of approved annual program of thermal rehabilitation
- 30% of local budget funds within the approved annual Thermal Rehabilitation
- 20% of the owners association

Although the contribution of the association of owners decreased under the Emergency Ordinance no. 18/2009, some local authorities have decided to also support their contribution, depending on financial possibilities of local administrations, and not from an analysis that would demonstrate "the impossibility of providing the amount of money" from the owner or the association.
Conclusions

- During 1990 – 2005 the cost with house maintenance cost has raised 5 times in comparison with the inhabitants’ incomes which have raised with 1.5 times. In this context, the tolerance of users dropped significantly. In the same time the subsidies for house heating will be reduced and afterwards eliminated. The energy economy is therefore justified through thermal refurbishment works.

- A coherent policy at the governmental level is required in the energy economy field. Stimulating the refurbishment works by the state leads to diminishing the energy consumption at national level, reducing the energy dependence in regard to the imports and reducing the chemical and thermal pollution of the atmosphere.

Preparation the legislative base and the regulations related to this domain is realized, thus being systematized and improved along with the changes in the E.U.

- The specialists in the constructions and installations field, energy auditors will have to review about 75% of the existing buildings to adapt to new demands. In the future, energy prices will further increase and the amortization period of the rehabilitation will greatly reduce heat so that heat and energy rehabilitation will become more attractive.
Conclusions

It remains that in the future the technical regulations will foresee that the energy performance of buildings should include all quantities of heat and electricity: losses and contributions including free returns and balance sheet of final energy use (Fig. 1) for heat.

Fig. 1 A scheme for the balance sheet of the annual energy consumption for heating of buildings and hot water production.
Case study 1: Timişoara, Bl. 10, Str. Calea Al. I. Cuza, 88 apartments (3 and 4 rooms)

Before refurbishment

After refurbishment

Refurbished in 2006

Costs (including VAT):
A. Audit and design: 51,495 lei
B. Execution: 1,060,000 lei
   - MDLPL: 360,400 lei
   - Local Council: 349,800 lei
   - Owners’ association: 349,800 lei

Executed works:
- Thermoinsulation of exterior walls
- Thermoinsulation and hydroinsulation of the terrace
- Thermoinsulation slab over the basement
- Modernization of the exterior woodwork
- Modernization of thermic agent distribution installations and ACM
### 1. LOCALIZARE

<table>
<thead>
<tr>
<th>Clădirea investigată / Tip</th>
<th>Blocul de locuințe A2 situat în municipiul Timișoara, Calea Alexandru Ioan Cuza nr.10 / S+P+10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localizare termogramă</td>
<td>Fațada nordică, zona 1-2, partea superioară</td>
</tr>
</tbody>
</table>

**Imaginea în spectrul IR**

![IR_091206_001.jpg](attachment:IR_091206_001.jpg)

**Imaginea în spectrul vizibil**

![25 aprilie 2012](attachment:25_aprilie_2012.jpg)
Interpretation of the thermogram

2. PARAMETRII / TEMPERATURI MĂSURATE / PROFILUL TERMIC

<table>
<thead>
<tr>
<th>Object Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissivity</td>
<td>0.95</td>
</tr>
<tr>
<td>Object Distance</td>
<td>30.0 m</td>
</tr>
<tr>
<td>Reflected Temperature</td>
<td>6.0 °C</td>
</tr>
<tr>
<td>Atmospheric Temperature</td>
<td>5.0 °C</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>40.0 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Label</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp1</td>
<td>14.9 °C</td>
</tr>
<tr>
<td>Sp2</td>
<td>18.3 °C</td>
</tr>
<tr>
<td>Sp3</td>
<td>20.3 °C</td>
</tr>
<tr>
<td>Li1 Max</td>
<td>11.8 °C</td>
</tr>
</tbody>
</table>

3. CONSTATĂRI
Maximele evidențiate prin intermediul spoturilor Sp1,2,3 sunt datorate căldurii pierdute prin ferestrele deschise. Fiecare din cele două zone for fi analizate separat în cadrul termogramelor următoare.
Use of the “VABI” software for obtaining the Energy Performance and Energy Audit Certificate
Case study 2: Timișoara, Bl. 1, Str. Martir O. Țintaru, 55 apartments (1, 2, 3 and 4 rooms)

Refurbished in 2006

Costs (including VAT):
A. Audit and design: **39,357 lei**
B. Execution: **591,000 lei**
   - MDLPL: **200,940 lei**
   - Local Council: **195,030 lei**
   - Owners association: **195,030 lei**

Executed works:
- Thermoinsulation of exterior walls
- Transformation terrace roof in a frame work roof
- Thermoinsulation slab over the basement
- Modernization of the exterior woodwork
- Modernization of thermic agent distribution installations and ACM
CERTIFICAT ENERGETIC

Bloc 36
Timișoara
Jud. Timiș

Date de identificare clădire:
Bloc 36
Proprietari: Asociația de Proprietari
Adresa: Calea Mariță Octavian Tamara Nr. 1

Date de identificare auditoari energetici:

Nume: Bratu
Prenume: Silviu
Universitatea Politehnica Timișoara
Telefon: 0723142250
Nr. certificat auditor: 00041

Nume: Rotean
Prenume: Ioan Adrian
Universitatea Politehnica Timișoara
Telefon: 0727881079
Nr. certificat auditor: 00022

Nume: Doboș
Prenume: Ioan Silviu
S.C. DOSETIMPEX S.R.L. Timișoara
Telefon: 0722259249
Nr. certificat auditor: 00040

Nume: Dană
Prenume: Ștefan
S.C. DOSETIMPEX S.R.L. Timișoara
Telefon: 0722514305
Nr. certificat auditor: 00039

Anal/periocada construirii: 1971
Suprafața: 2325,19 m²
Volumul clădirii: 8075,67 m³

Indice de necesar de căldură pentru incălzirea spațiilor: 108,2 kWh/m²an
Aferent constructiei: 188,46 kWh/m²an

Motivul:
- conform normelor
- asigurare
- certificatul energetic
- înzestrare termică

Consum de căldură:
- încălzire și a.c.e.
- 80,6 C

Notă:

Clasificare energetică:

<table>
<thead>
<tr>
<th>INCALZIREA SPAȚIILOR</th>
<th>APA CALDA MENAJERA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clădire foarte eficientă energetic</td>
<td>Clădire foarte eficientă energetic</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>J</td>
<td>J</td>
</tr>
</tbody>
</table>

Clădiri cu eficiență energetică foarte redusă
Case study 3: Timişoara, Bl. 1, Str. Aleea Cristalului,  

52 apartments (2, 3 and 4 rooms)  

Refurbished in 2009  

Works to be executed:  
- insulation of the terrace with 8 cm polystyrene  
- insulation of the exterior walls with 10 cm polystyrene  
- energy modernization of exterior wood wall  
- thermoinsulation of the concrete floor over the unheated basement  

Evaluation of the installing constructions (including VAT):  
- 850,792,18 lei
Case study 4: Timișoara, Bl. 6, Str. Zlatna, 20 apartments

Refurbished in 2009

Works to be executed:
- insulation of the terrace with 8 cm polystyrene
- insulation of the exterior walls with 10 cm polystyrene
- energy modernization of exterior wood wall
- thermoinsulation of the concrete floor over the unheated basement

Evaluation of the installing constructions (including VAT):
- 850.792,18 lei
### Certificat de performanță energetică

**Performanța energetică a clădirii**

**Nota energetică:** 73.6

<table>
<thead>
<tr>
<th>Sistemul de certificare:</th>
<th>Nota energetică</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metodologia de calcul al Performanței energetică a Clădirilor</td>
<td>73,6</td>
</tr>
</tbody>
</table>

**Eficacitate energetică ridicată**

- **A**

**Eficacitate energetică scăzută**

- **D**

**Consum anual specific de energie [kWh/m².an]**

<table>
<thead>
<tr>
<th>Clădirea certificată</th>
<th>Clădirea de referință</th>
</tr>
</thead>
<tbody>
<tr>
<td>310</td>
<td>120</td>
</tr>
</tbody>
</table>

**Indice de emisii equivalent CO₂ [kg CO₂/m².an]**

<table>
<thead>
<tr>
<th>Clădirea certificată</th>
<th>Clădirea de referință</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>29</td>
</tr>
</tbody>
</table>

**Consum anual specific de energie din surse regenerabile [kWh/m².an]**

<table>
<thead>
<tr>
<th>Clădirea certificată</th>
<th>Clădirea de referință</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Date privind clădirea certificată:**

- **Adresa clădirii:** Str. Zlatna nr. 6
- **Locanță:** Aria utilă: 2118.5 m²
- **Anul construirii:** 1969
- **Regim de încălzire:** S + P + 4 Etaje
- **Volumul interior al clădirii:** 7423 m³
- **Aria construită desfășurată:** 2542.2 m²

**Programul de calcul utilizat:** Dose-Pec, versiunea: 0.0.0.1

**Date privind identificarea auditorului energetic pentru clădire:**

- **Specialitatea:** tehnică energetică
- **Numele și prenumele:** Dobrescu Ioan Silviu
- **Seria și Nr. certificat de atestare:** 0004202003
- **Nr. și data înregistrării certificatului în registru:** 0004202003
- **Semențura și ștampila auditorului:**

---

Classificația energetică a clădirii este determinată prin metodologia de calcul a clădirilor, studiată pentru performanța energetică a construcției și instalațiilor oferite.

Atât nivelul energetic al clădirii, cât și performanța energetică a clădirii trebuie să fie verificate în perioada de utilizare a clădirii.

Procedeul de valoareați a performanței energetice este de 10 ani de la data clădirii construită.
Statistics regarding thermal refurbished apartment buildings in Timisoara and Lugoj

Applied Laws

- Legea nr.211/16 Mai 2003: 9%
- OU nr.18/4 Martie 2009: 91%
Statistics regarding thermal refurbished apartment buildings in Timisoara and Lugoj

### Roof type
- **Terasa**: 78%
- **Framing**: 22%

### Constructive system
- **Panouri prefabricate BA+BCA 6 cm**: 72%
- **Diafragme BA+BCA 6 cm**: 9%
- **Zidarie caramida portanta**: 19%
Statistics regarding thermal refurbished apartment buildings in Timisoara and Lugoj

**Thermal insulation exterior walls**
- EPS 8 cm: 87%
- EPS 10 cm: 13%

**Thermal insulation roof**
- XPS 8 cm: 94%
- Vata minerala 12 cm: 6%

**Thermal insulation basement**
- EPS 8 cm: 9%
- EPS 10 cm: 3%
- Fara termoizolarea subsolului: 88%
Information regarding the apartment buildings thermal refurbished in Timisoara and Lugoj

Number of thermal refurbished buildings: 32
Total included apartments: 827
Total refurbished leaving surface: 48201 m2
Specific medium cost: 50,73 Euro/m2 including VAT

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of average resistance of</td>
<td>0,546 m2K/W</td>
<td>2,41 m2K/W</td>
</tr>
<tr>
<td>exterior walls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific average consumption</td>
<td>231,66 kWh/m2</td>
<td>86,05 kWh/m2</td>
</tr>
<tr>
<td>for heating</td>
<td>year</td>
<td>year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bibliographical sources:

- NP 048/2000
- NP 049/2000
- Law Nr. 211/2003
- Emergency Ordinance Nr. 18/2009 regarding the increase of energy performance of apartment buildings
- Method of calculation the energy performance of buildings MC 001/1-2006
  Part I – Building cover
- Method of calculation the energy performance of buildings MC 001/2-2006
  Part II – Energy performance of installations of buildings
- Method of calculation the energy performance of buildings MC 001/3-2006
  Part III – Audit and performance certificate of the building
- Implementation of the EPBD in Romania: Status and Planning – May 2008
- Considerations regarding the thermic refurbishment of buildings – Maricica Vasilache
THANK YOU FOR YOUR ATTENTION!