

REHVA



Federation of
European Heating,
Ventilation and
Air-conditioning
Associations



REHVA Annual Meeting

TIMISOARA, ROMANIA April 17 - 20, 2012

HVAC Technology in Energy Retrofitting



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 .

Legislation

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. 325/ 2002, regarding the **Thermal refurbishment of the existing constructions and stimulating thermal energy savings** (followed by O.G.29/31.01.2000 – M.O.41/31.01.2000).
- Law no. 211/16 May 2003 regarding the **Implementation of special measures of thermal refurbishment of some multilevel buildings.** (followed by O.U.G174/9.12.2002 – M.O.890/9.12.2002).
- 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.

Legislation

- 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 foreseen 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 infrastucture in order to attain in an accelerated rithm the housing conditions according to the european requirements in order to increase the life quality;
- Increase the energy performance of appartement 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.
- Preparing 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.

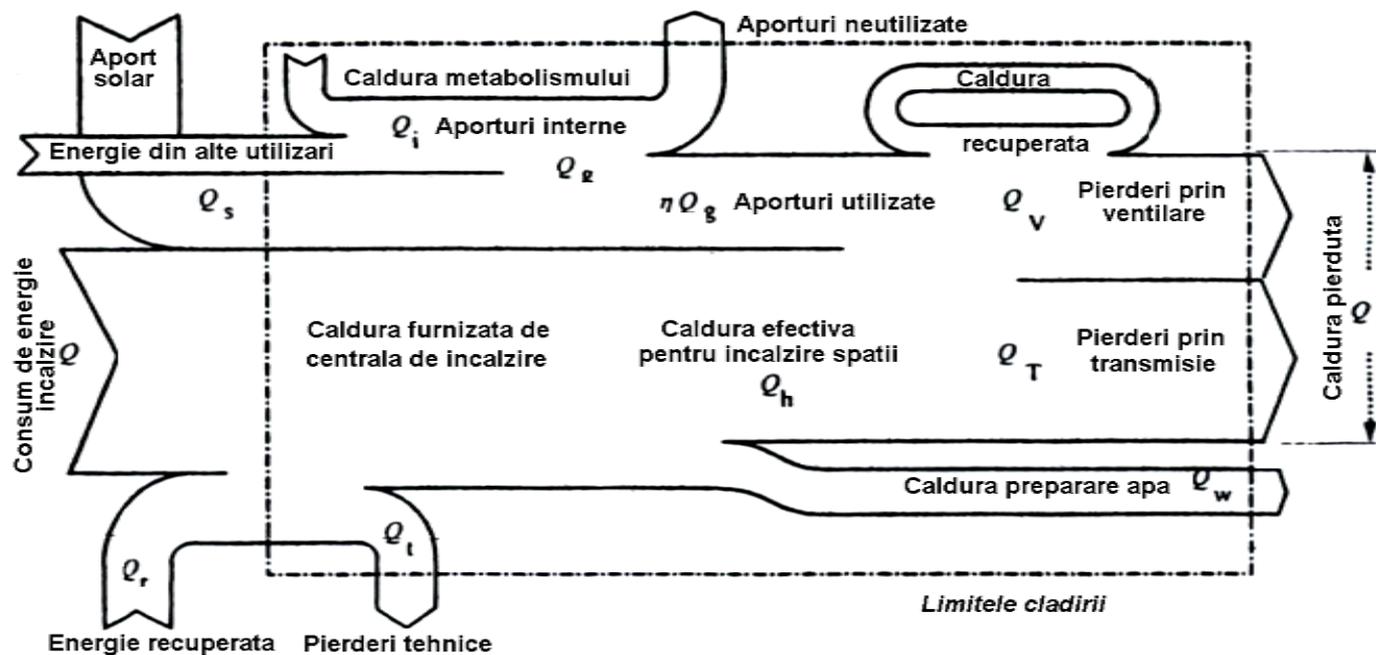


Fig. 1 A scheme for the balance sheet of the annual energy consumption for heating of buildings and hot water production.

Case study 1: Timișoara, 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:

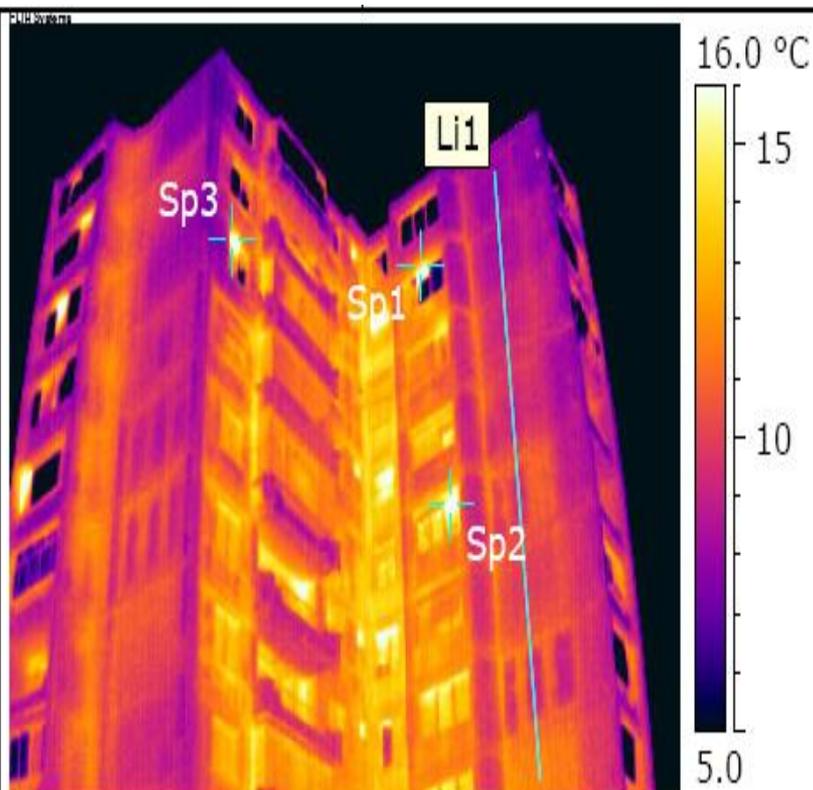
- Thermoinsulation of exterior walls
- Thermoinsulation and hydroinsulation of the terrace
- Thermoinsulation slab over the basement
- Modernization of the exterior woodwork
- Modernization of thermic agent distribution sinstallations and ACM

TERMOGRAMA nr. 1

Beneficiar	S.C. DOSETIMPEX S.R.L pentru Primăria Municipiului Timișoara	Data / Ora	09.12.2006 / 11:49:56
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1. LOCALIZARE

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



Imaginea în spectrul IR

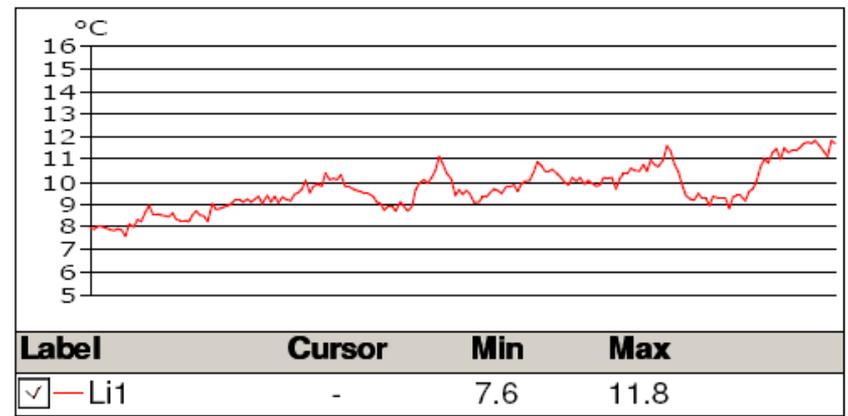
IR_091206_001.jpg

Imaginea în spectrul vizibil

Interpretation of the thermogramme

2. PARAMETRII / TEMPERATURI MĂSURATE / PROFILUL TERMIC

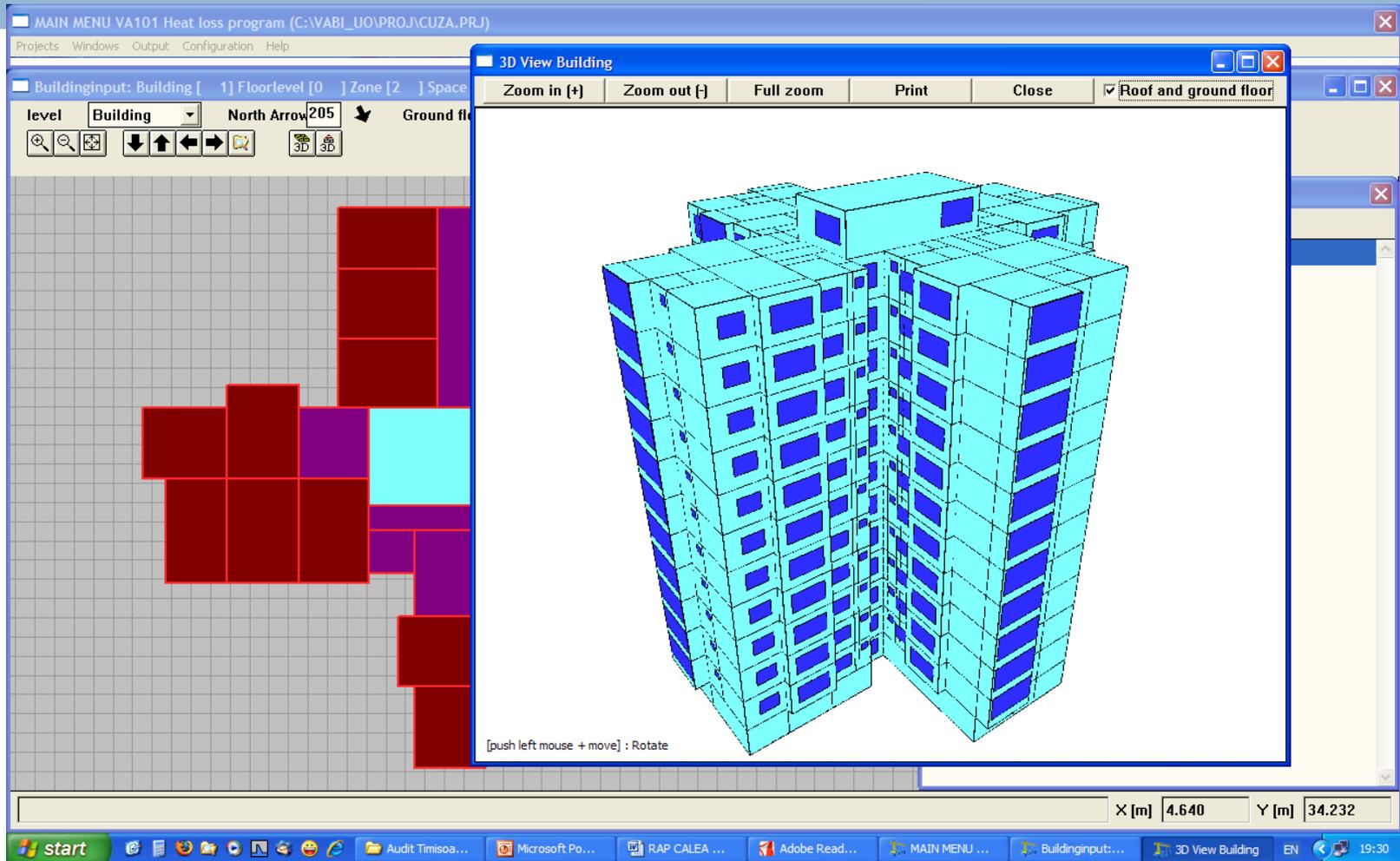
Object Parameter	Value
Emissivity	0.95
Object Distance	30.0 m
Reflected Temperature	6.0 °C
Atmospheric Temperature	5.0 °C
Relative Humidity	40.0 %
Label	Value
Sp1	14.9 °C
Sp2	18.3 °C
Sp3	20.3 °C
Li1: Max	11.8 °C



3. CONSTATĂRI

Maximele evidențiate prin intermediul spoturilor Sp1,2,3 sunt datorate căldurii pierdute prin ferestrele deschise. Fiecare din cele două zone vor fi analizate separat în cadrul termogramelor următoare.

Use of the “VABI” software for obtaining the Energy Performance and Energy Audit Certificate



CERTIFICAT ENERGETIC

NR.TM 00002 -06

din 11.12.2006

Bloc A2
 Timișoara
 Jud. Timiș

Date de identificare clădire:

Bloc A2
 Proprietar: Asociația de Proprietari
 Adresa: Calea Alexandru Ioan Cuza Nr. 10

Date de identificare auditori energetici:

Nume: Brata
 Prenume: Silvana
 Universitatea Politehnica Timișoara
 Telefon: 0723142250
 Nr. certificat auditor: 00041

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

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

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

Anul/perioada
 construirii: 1976
 Suprafața
 încălzită (m²): 4842,86
 Volumul clădirii (m³): 16192,61

Indicele de necesar de
 căldura pentru
 încălzirea spațiilor
 aferente construcției: 123,4 kWh/m²an

Motivul eliberării certificatului energetic	<input type="checkbox"/> informativ <input type="checkbox"/> asigurare <input type="checkbox"/> vânzare <input checked="" type="checkbox"/> reabilitare termică	Consum de caldură încălzire și a.c.c. 183,6 kWh/m ² an	Nota 82,3	C
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Clasificare energetica

INCALZIREA SPATIILOR		APA CALDA MENAJERA	
Clădire foarte eficienta energetic		Clădire foarte eficienta energetic	
A		A	
B		B	
C	c	C	c
D		D	
E		E	
F		F	
G		G	
H		H	
I		I	
J		J	
Clădire cu eficienta energetica foarte redusa		Clădire cu eficienta energetica foarte redusa	

Case study 2: Timișoara, Bl. 1, Str. Martir O. Țintaru, 55 apartments (1, 2, 3 and 4 rooms)



Before refurbishment

Refurbished in 2006



After refurbishment

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

NR.TM 00004 - 06

din 11.12.2006

Bloc 36
 Timișoara
 Jud. Timiș

Date de identificare clădire:

Bloc 36
 Proprietar: Asociația de Proprietari
 Adresa: Calea Martir Octavian Tantarau Nr. 1

Date de identificare auditori energetici:

Nume: Brata
 Prenume: Silvana
 Universitatea Politehnica Timișoara
 Telefon: 0723142250
 Nr. certificat auditor: 00041

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

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

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

Anul/perioada construirii:	1971	Indicele de necesar de căldura pentru	108,2
Suprafața încălzită (m ²)	2325,19	încalzirea spațiilor	kWh/m ² an
Volumul clădirii (m ³)	8075,57	afereente construcției	

Motivul eliberării certificatului energetic	<input type="checkbox"/> informativ <input type="checkbox"/> asigurare <input type="checkbox"/> vânzare <input checked="" type="checkbox"/> reabilitare termică	Consum de caldură încălzire și a.c.c. 188,46 kWh/m ² an	Nota 80,6	C
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Clasificare energetica

INCALZIREA SPATIILOR		APĂ CALDĂ MENAJERĂ	
Clădire foarte eficientă energetic		Clădire foarte eficientă energetic	
A		A	
B		B	
C		C	
D		D	
E		E	
F		F	
G		G	
H		H	
I		I	
J		J	
Clădire cu eficiența energetică foarte redusă		Clădire cu eficiența energetică foarte redusă	

Case study3: Timișoara, 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

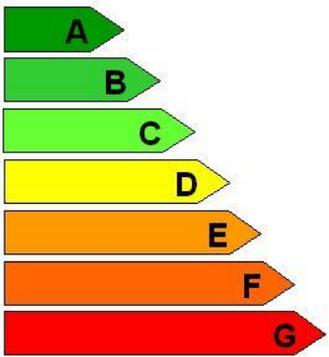
Cod poștal
localitateNr. înregistrare la
Consiliul LocalData
înregistrării

3 0 0 6 8 7

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Certificat de performanță energetică

Performanța energetică a clădirii		Notare energetică: 78,8		
Sistemul de certificare: Metodologia de calcul al Performanței energetice a Clădirilor elaborată în aplicarea Legii 372/2005		Clădirea certificată	Clădirea de referință	
Eficiență energetică ridicată  Eficiență energetică scăzută				
Consum anual specific de energie [kWh/m²an]		240	101	
Indice de emisii echivalent CO ₂ [kgCO ₂ /m²an]		58	24	
Consum anual specific de energie [kWh/m²an] pentru:		Clasă energetică		
		Clădirea certificată	Clădirea de referință	
Încălzire:	210	D	B	
Apă caldă de consum:	14	A	A	
Climatizare:	-	-	-	
Ventilare mecanică:	-	-	-	
Iluminat artificial:	16	A	A	
Consum anual specific de energie din surse regenerabile [kWh/m²an]:		0		
Date privind clădirea certificată:				
Adresa clădirii: Cristalului Nr.1 Bl.74		Aria utilă: 4609,17 m ²		
Categororia clădirii: Locuințe		Aria construită desfășurată: 5531,004 m ²		
Regim de înălțime: S + P + 8 Etaje		Volumul interior al clădirii: 12613,76 m ³		
Anul construirii: 1984				
Scopul elaborării certificatului energetic:				
Programul de calcul utilizat: Doset-PEC, versiunea: 0.0.0.1				
Date privind identificarea auditorului energetic pentru clădiri:				
Specialitatea (c, i, ci)	Numele și prenumele	Seria și Nr. certificat de atestare	Nr. și data înregistrării certificatului în registrul auditorului	Semnătura și ștampila auditorului
ci	dr.ing.Dobosi Ioan Silviu	MTCT 00040/2003		
ci	dr.ing.Duna Stefan	MTCT 00039/2003		

Clasificarea energetică a clădirii este făcută funcție de consumul total de energie al clădirii, estimat prin analiză termică și energetică a construcției și instalațiilor aferente.

Obținerea energică a clădirii ține seama de penalizările datorate utilizării neraționale a energiei.

Perioada de valabilitate a prezentului Certificat Energetic este de 10 ani de la data eliberării acestuia

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

Cod poștal
localitateNr. înregistrare la
Consiliul LocalData
înregistrării

3 0 0 1 0 0

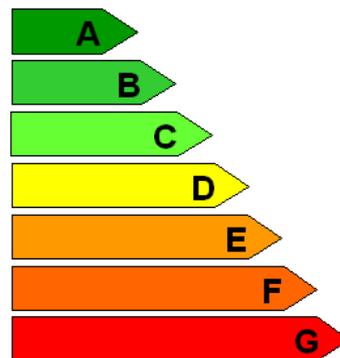
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Certificat de performanță energetică

Performanța energetică a clădirii

Notare
energetică: **73,6**Sistemul de certificare: Metodologia de calcul al
Performanței energetice a Clădirilor elaborată în
aplicarea Legii 372/2005Clădirea
certificatăClădirea de
referință

Eficiență energetică ridicată



Eficiență energetică scăzută

D

A

Consum anual specific de energie [kWh/m²an]

310

120

Indice de emisii echivalent CO₂ [kgCO₂/m²an]

74

29

Consum anual specific de energie [kWh/m ² an] pentru:		Clasă energetică	
		Clădirea certificată	Clădirea de referință
Încălzire:	288	E	B
Apă caldă de consum:	15	A	A
Climatizare:	-	-	-
Ventilare mecanică:	-	-	-
Iluminat artificial:	7	A	A
Consum anual specific de energie din surse regenerabile [kWh/m ² an]:		0	

Date privind clădirea certificată:

Adresa clădirii: Str. Zlatna nr. 6 Aria utilă: 2118,5 m²
 Categoria clădirii: Locuințe Aria construită desfășurată: 2542,2 m²
 Regim de înălțime: S + P + 4 Etaje Volumul interior al clădirii: 7423 m³
 Anul construirii: 1969
 Scopul elaborării certificatului energetic:

Programul de calcul utilizat: Dosec-PEC, versiunea: 0.0.0.1

Date privind identificarea auditorului energetic pentru clădiri:

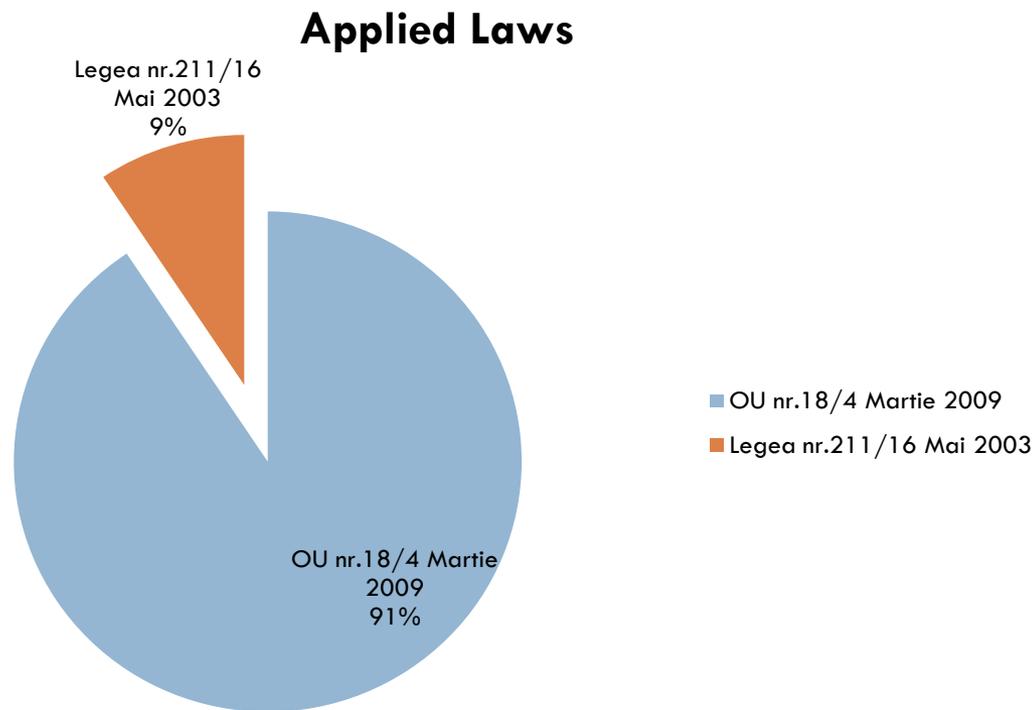
Specialitatea (c, i, ci)	Numele și prenumele	Seria și Nr. certificat de atestare	Nr. și data înregistrării certificatului în registrul auditorului	Semnătura și ștampila auditorului
ci	dr. ing. Dobosi Ioan Silviu	00040/2003		
ci	dr. ing. Duna Stefan	00039/2003		

Clasificarea energetică a clădirii este făcută în funcție de consumul total de energie al clădirii, estimat prin analiză termică și energetică a construcției și instalațiilor aferente.

Notarea energetică a clădirii ține seama de penalizările datorate utilizării neraționale a energiei.

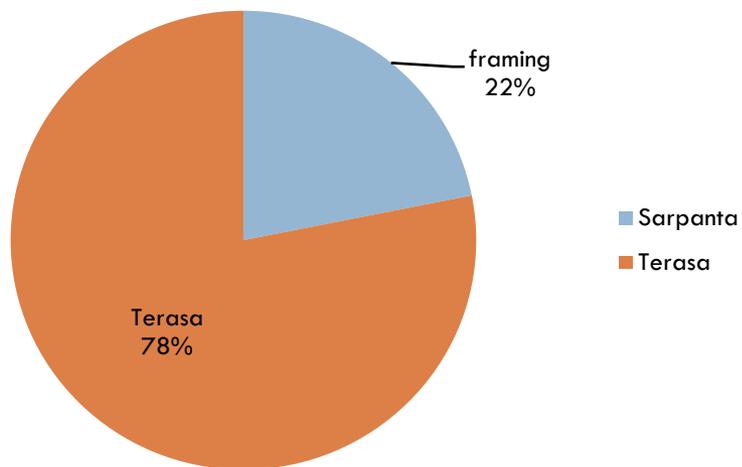
Perioada de valabilitate a prezentului Certificat Energetic este de 10 ani de la data eliberării acestuia

Statistics regarding thermal refurbished apartment buildings in Timisoara and Lugoj

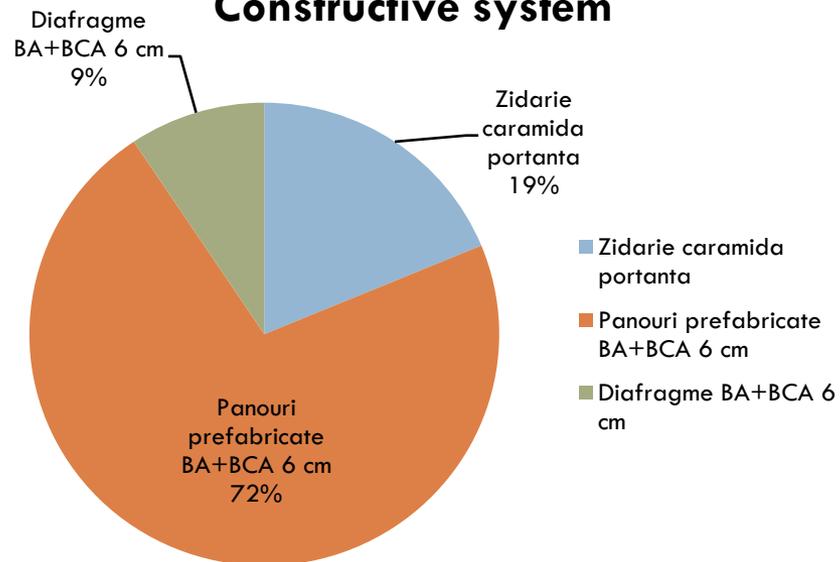


Statistics regarding thermal refurbished apartment buildings in Timisoara and Lugoj

Roof type

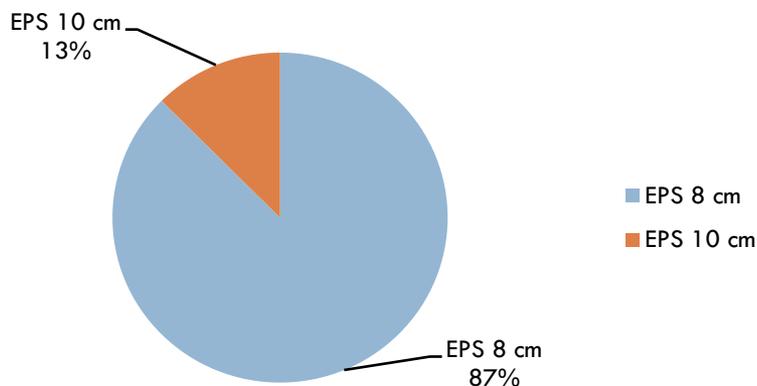


Constructive system

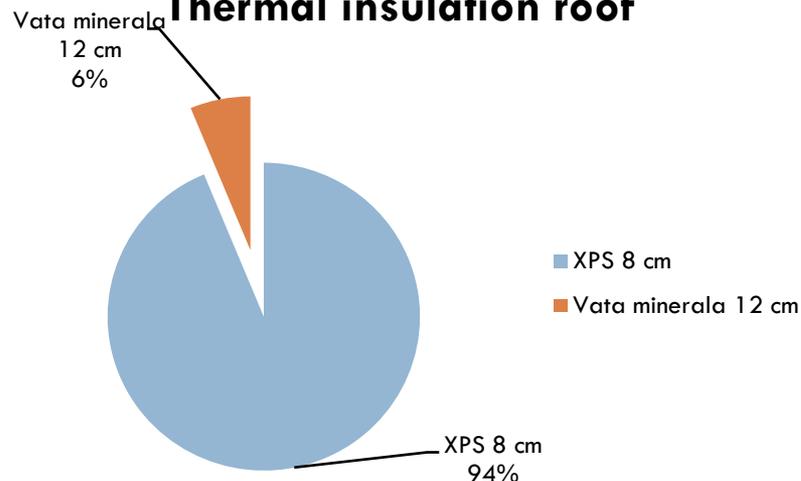


Statistics regarding thermal refurbished apartment buildings in Timisoara and Lugoj

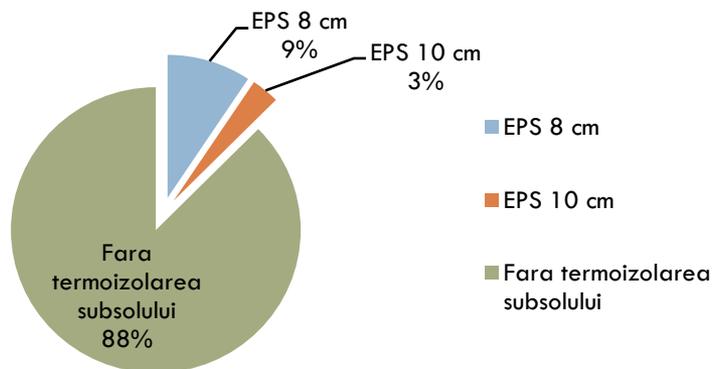
Thermal insulation exterior walls



Thermal insulation roof



Thermal insulation basement



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

	Before	After
Value of average resistance of exterior walls	0,546 m ² K/W	2,41 m ² K/W
Specific average consumption for heating	231,66 kWh/m ² year	86,05 kWh/m ² year

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 Energy Performance of Buildings Directive Country Reports 2008
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!***