Training initiatives
&
successful retrofitting of social housing
Practical examples from Slovenia

Workshop “Training for energy efficiency – know how from & for social housing organisations”, Brussels, Oct. 1, 2007, CECODHAS

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Facts: Building stock in Slovenia (2002)

Population	2 mio inhabitants
Area	20.000 km2

Number of residential buildings	463.029
Number of dwellings	777.772
Average number of dwellings per building	1.7

Total floor space of dwellings	58.031.187 m2	
Average floor space of dwelling	71.3 m2	8.000 dw./year

Average size of private household (persons)	2.8

Share of dwellings in urban settlements	51.6%
Share of population in urban settlements	50.5%
Occupation of dwellings in urban settlements	89.5%
Occupation of dwellings in rural settlements	81.2%

After privatisation in 90-ties 90% of flats are private

Source: SURS, Census, 2002

Facts: Ljubljana Housing Fund

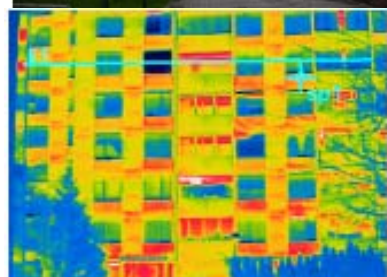
- 3200 flats owned by Ljubljana Housing Fund – public fund of Municipality Ljubljana (280.000 inhabitants)
- Mixed ownership – difficult decision making
- Low income tenants – paying the operational costs may become a problem and additional buden for Ljubljana Housing Fund
- Aim: EI-refurbishemnt of existing buildings and building of energy efficient new social housing
- Participation in EIE projects, FP5 demonstration projects, energy certification, passive house, LCC

Pipanova pot, Ljubljana, 20 new flats in low energy standard, design ongoing in 2007

1946-1980 apartment buildings

- 61% of all residential buildings are from 1946-1980 period,
- **1946-1953** rehabilitation of WW2 demolished buildings in war,
- **1954-1967** state owned social housing built,

- **late 60-ties and 70-ties - florishing period !**
- 1967 national regulation for design of dwellings
- 1973 Ljubljana - municipal rules for apartment buildings construction
- 1971 New construction technologies introduced – “outinord” cast in place concerete buildings
  up to 3 cm insulation obligatory – first attempt!



Residential buildings in urban areas

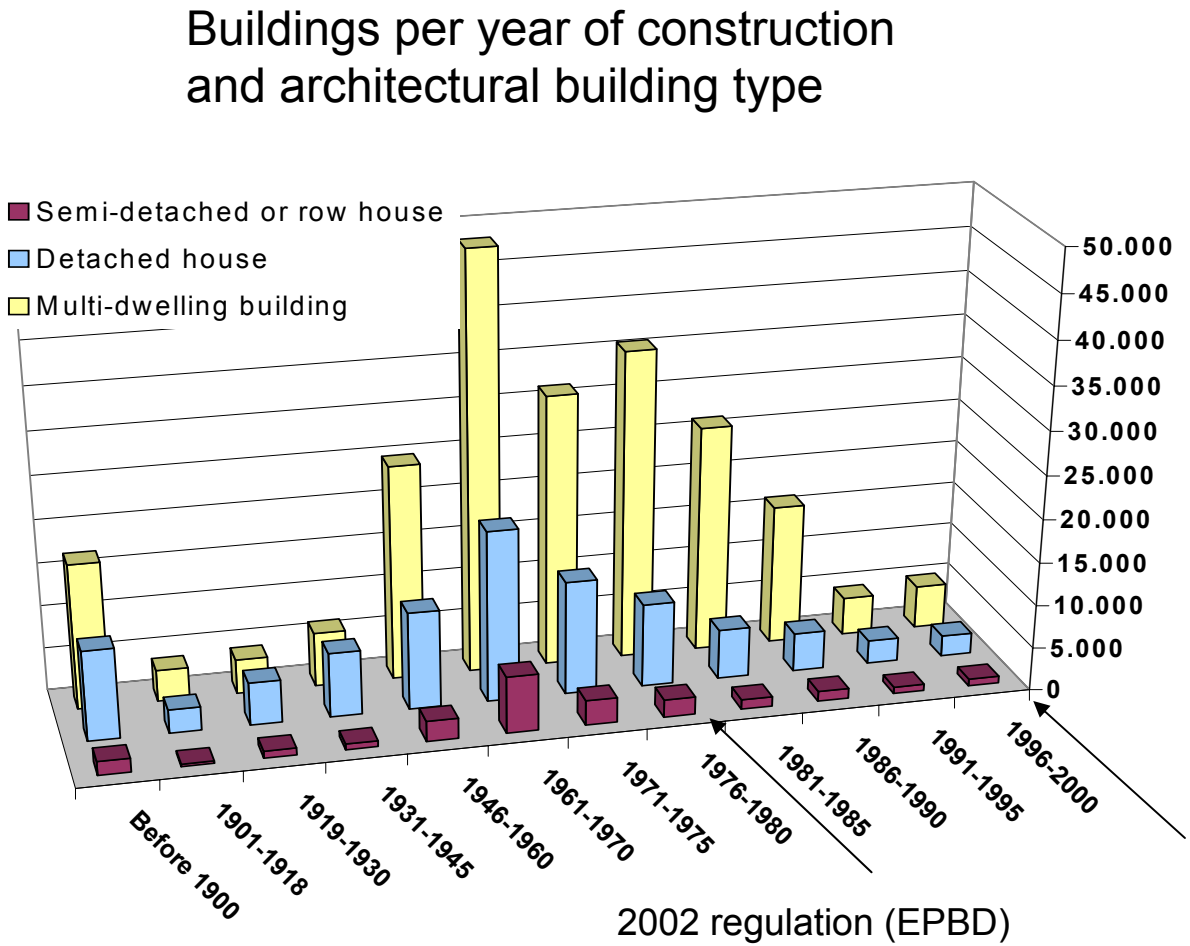


Figure: Distribution of houses and buildings in urban settlements by their age (Source: SURS, Census, 2002).

Some buildings from the most frequent groups subject to refurbishment

50-ties, masonry, no TI, GF + 3 storeys

late 50-ties, masonry, no TI, high rise building

early 60-ties, masonry, no TI, self-standing building

late 70-ties, reinforced concrete, pre-cast large panels; low TI , thermal bridges, envelope elements, masonry, GF + 4 storeys

late 70-ties, cast in place reinforced concrete “self standing” blocks, low TI

late 70-ties, concrete high multi-story buildings having pre-cast large panel envelope elements

Status and needs of 1946-1980 buildings / envelopes

Technical needs:

Energy efficient building envelope **Energy refurbishment is a priority!**

- Thermal insulation Umax = 0,3 W/m2K
- Low –e glazing Ar , i.e. windows Umax < 1,6 W/m2K

Improvement earthquake resistance

Repair of deterioration due to moisture

- inadequate detailing of façade of water drainage
- interstitial and surface condensation
- thermal bridges, mould grow

Financial needs:

Subsidies for energy refurbishment investments

(since 2004 subsidies are available for energy refurbishment of apartment buildings! 6 EUR/m2 and up to 20% of investment!)

Organisational needs:

Building owners need information programmes (incl. Energy issues)

Checklists and tools for building managers (renovation plan)

Comprehensive methods for designers planning refurbishment (LCC)

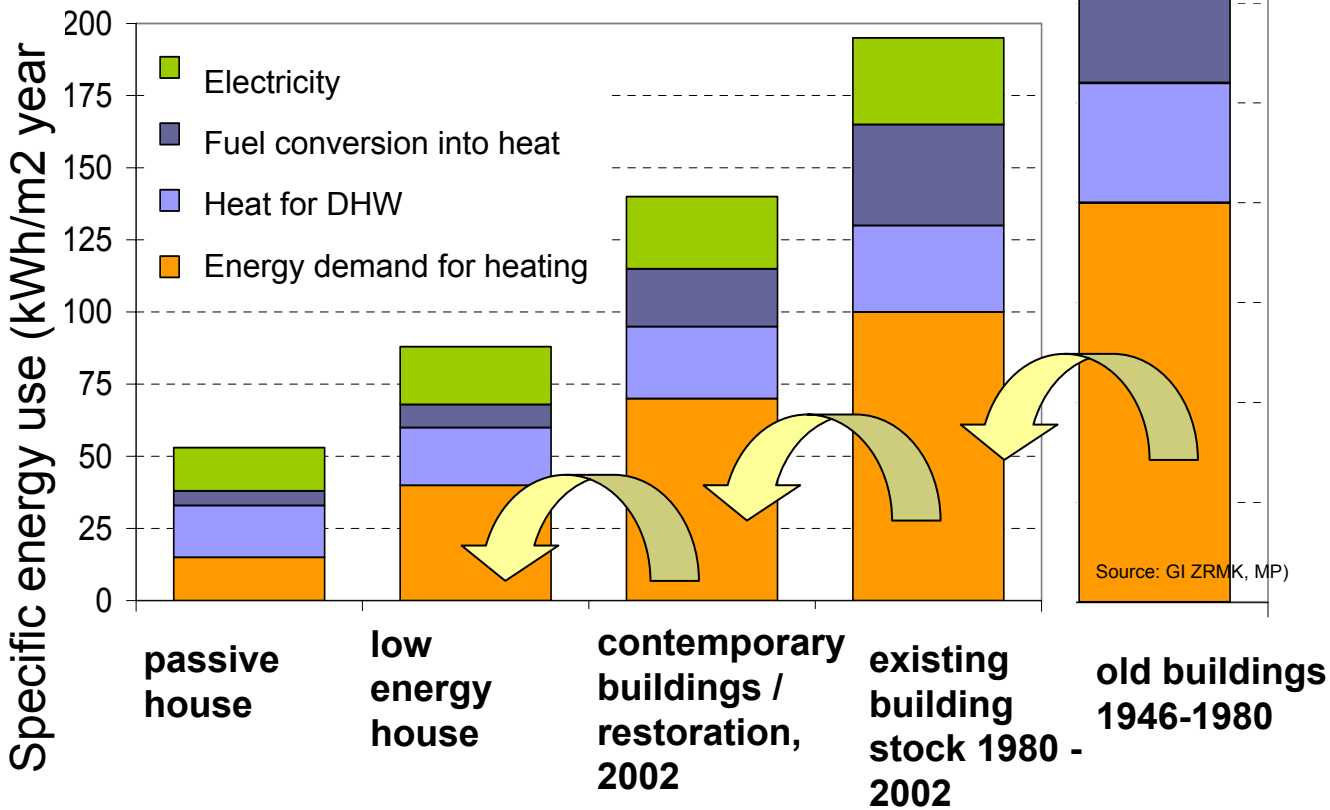
Institutional:

Implementation of regulation refering to maitenance (EPBD, EUROCODE)

Upgrading quality standards…




Energy use for heating and DHW, electricity consumption



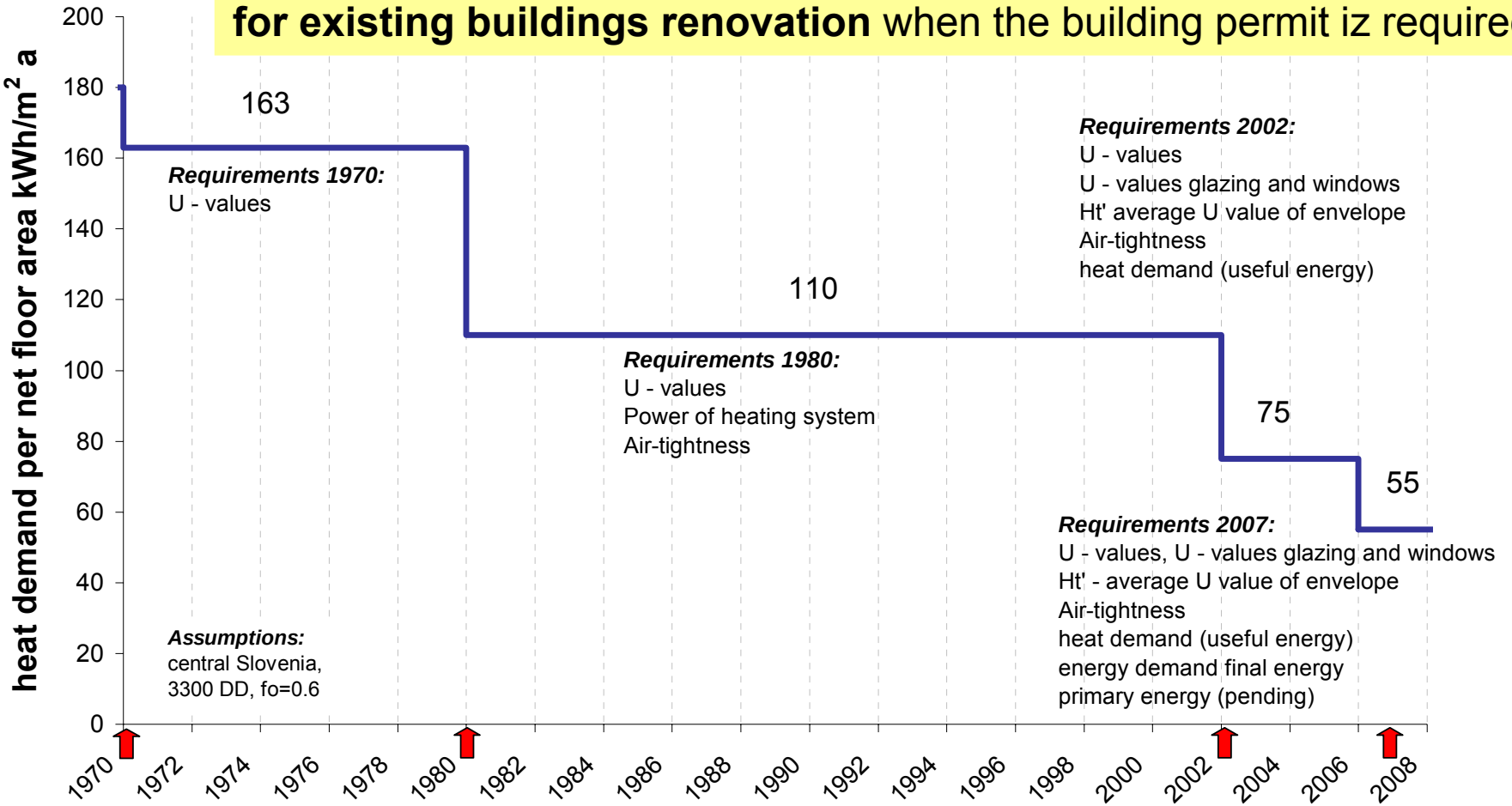
EPBD legislation 2007:

Reduction of heat demand by improved envelope and beyond, by mechanical ventilation heat recovery min. 0.8

Supported:: RES for DHW and for space heating

Minimum requirements on thermal insulation and energy efficiency

NEW end/2007: Min. requirements are valid for new buildings and **also for existing buildings renovation** when the building permit iz required!



Implementation of EI-Education training course

Training workshop in the frame of EIE EI-Education project

Energy intelligent refurbishment of social apartment buildings

Date: June 15, 2007, at 9.00,

Venue: Hotel Mons, Ljubljana, Slovenia

Number of participants: 23

Number of lecturers: 9

Topics:

status in social housing sector, financing, subsidies, soft loans,

EI-Education training, case studies,

experiences from Ljubljana, Jesenice,

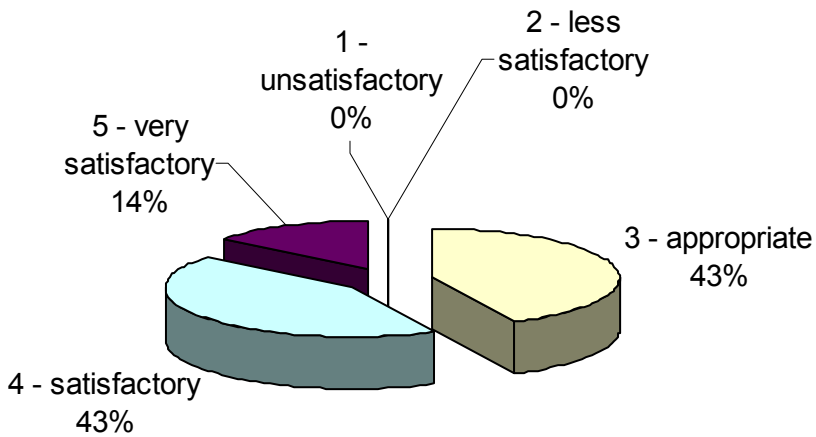
role of architects

Topics discussed

- Many of buildings from recent past were declared as architectural heritage – is this a barrirer of a challenge for EI-Refurbishemnt
- EE refurbishment is seldom innitiated by building owner(s), more often the key actor is building management company –
- but not many innitiatives are realized, since in mixed ownership (private – public / municipal Housing Funds) financing (loans) is subject to complicated procedures
- Energy certificate is expected to stimulate EE refurbishment
- The rents in social housing are fixed, without considering the energy efficiency and lower running costs in EI-refurbished buildings

Evaluation of EI-Education training course in Slovenia

Contents and adequacy of the lectures

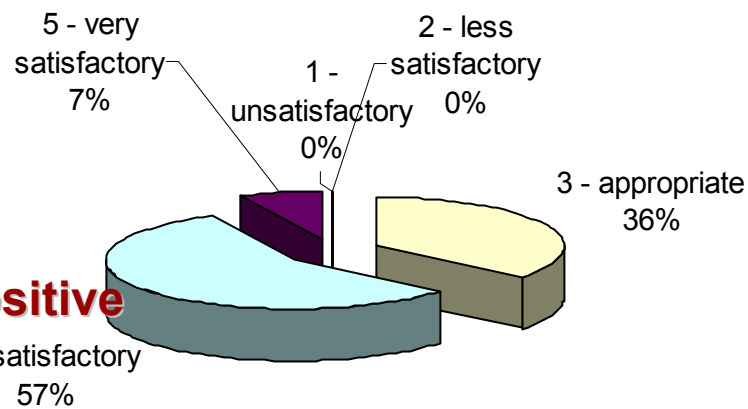


57% ++

43% +

90% positive

Evaluation of workshop benefits

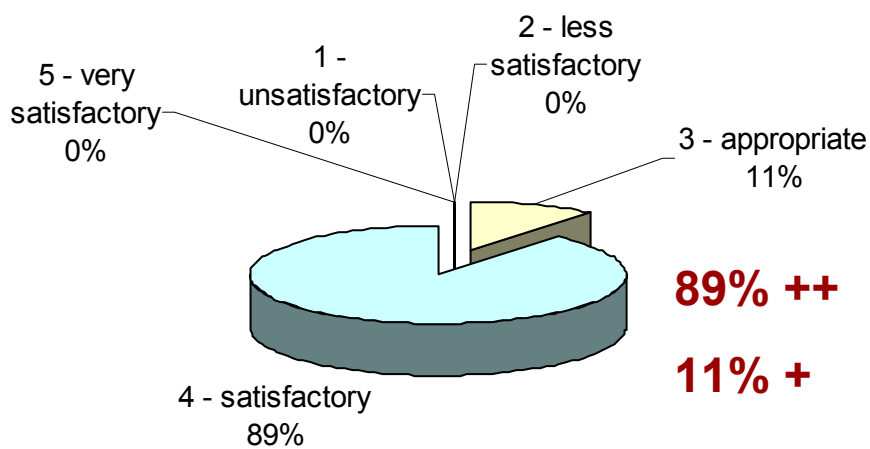


54% ++

36% +

90% positive

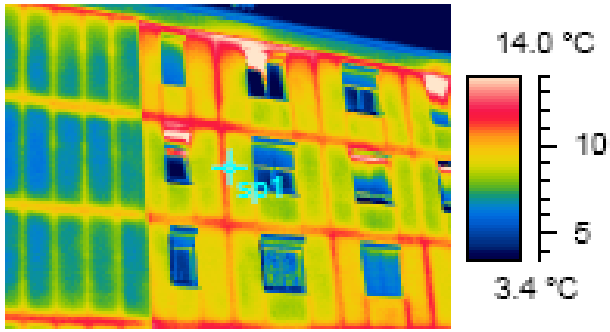
EI Education web site with guidelines



89% ++

11% +

Typical renovation case study



1960

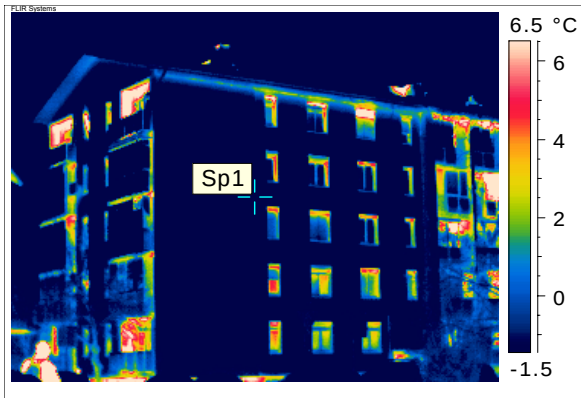
40 flats, 95 residents, 1860 m2

Walls: prefabricated conrete plates mixed with wooden chips

U=1,3 W/m2K

Windows U=2,7

Non-renovated apartment house Sisenska 42-44 in Ljubljana. IR thermography detected cold bridges in the envelope: (joints of concrete panels).



2005

(investment 100.000 EUR, 10% subisdy)

Wall: 0,35 W/m2K (67.100 EUR)

Windows: U glazing=1,1 W/m2K (31.300 EUR)

Savings: 125.000 kWh (21%)

7.000 EUR/year, PB 14y (total), PB incremental investment PB 3-4 years

Outer wall: thermal insulation of outer wall with 8 cm thick polystyrene layer.
Windows: installation of energy efficient windows with low-e double glazing (Uglazing=1,1 W/m2K with six chambers PVC window frames, where the U value for the entire window is 1,1 W/m2K.

How to support decission making -

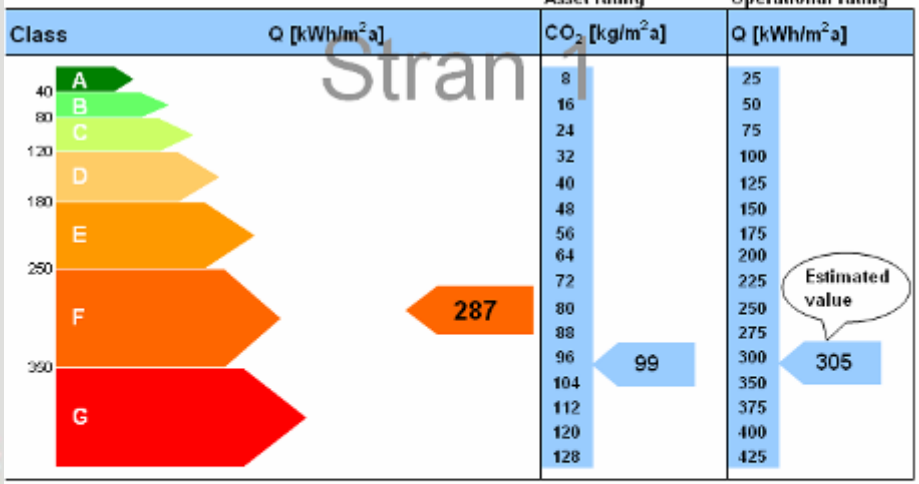
Energy certificate for existing buildings (since Jan. 2009)

Incl. advice for refurbishment

BUDI ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Šišenska 36, Ljubljana
Heated area	805 m^2
Building manager	Financa operativa d.o.o.
Building owner	Mixed ownership
Number of stories	6
Year of construction	-
Year of renovation	1993

Delivered energy and CO_2 emission



Stran 1

CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0010
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubljana

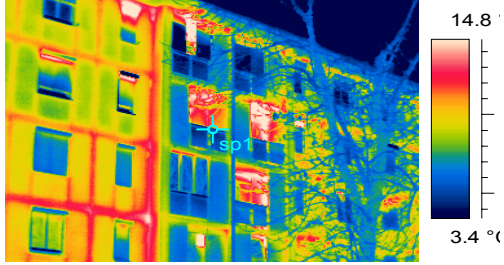
BUDI ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,49 1/m	Massive construction
Heated area A_u	605 m^2	Flat roof with 2 cm insulation
Gross volume V_e	1890 m^3	Facade without insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	665 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,374 W/m^2K	0,604 W/m^2K
Heating demand Q_H	150 kWh/m^2	53 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	483 m^2	1,66 W/m^2K
WINDOWS FACING SOUTH	23 m^2	2,40 W/m^2K
NEW WINDOWS FACING SOUTH	40 m^2	1,40 W/m^2K
WINDOWS FACING WEST	23 m^2	2,40 W/m^2K
NEW WINDOWS FACING WEST	40 m^2	1,40 W/m^2K
WINDOWS FACING WEST	64 m^2	2,40 W/m^2K
FLOOR ON THE GROUND	130 m^2	0,39 W/m^2K
ROOF	130 m^2	0,45 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

Stran 1

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,72
Heat emissivity	Radiators	Emissivity	0,87
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Electricity	Primary energy	2,15
Generation	Local boilers	Generation	0,90
Distribution	No circulation	Distribution	0,92



Intelligent Energy Europe

e-tool

GENERAL CHARACTERISTICS OF THE BUILDING

1- CLIMATIZATION SYSTEMS

1.1- HEATING 107,06 KWh/m2

1.1.1-HEATING SYSTEM
- (•) YES ( ) NO

1.1.2- TYPE
- ( ) INDIVIDUAL (•) CENTRAL

1.1.3- PRINCIPAL SYSTEM
- (•) BOILER+RADIATOR
- ( ) INDIVIDUAL HEATERS
- ( ) HEAT PUMP
- ( ) DISTRICT HEATING

1.1.4- STATE OF THE INSTALLATION
- (•) >20 YEARS
- ( ) 10-20 YEARS
- ( ) <10 YEARS

1.1.5- FUEL TYPE
- Fuel-Oil

1.1.6-OTHER
- [ ] DIRTY BURNERS
- [ ] PIPE WITHOUT INSULATION
- ( ) WITH REGUALTION SYSTEM
- (•) WITHOUT REGULATION SYSTEM

1.1-SAVING MEASURES
- [x] INSTALLING A MODERN BOILER
- [ ] CHANGING BOILER+FUEL
  - ( ) GAS ( ) FUEL-OIL ( ) BIOMASS
- [ ] INSTALLING AN INDIVIDUAL HEAT PUMP
- [ ] CLEAN THE BURNERS
- [ ] INSULATE THE PIPES 20 total lenght (m)
- [x] INSTALLING THERMOSTAT 120 units
- [x] REDUCING HEATING SET POINT (°C) 1

E-TOOL SET

4- THERMAL ENVELOPE

4.1- INSULATION

4.1- INSULATION

4.1.1- EXTERNAL WALL INSULATION
- 3 INITIAL INSULATION (cm)

4.1.2- INSULATION ON CEILING/ WALLS IN CONTACT WITH NO HEATED SPACES
- 0 INITIAL INSULATION (cm)

4.1.3- ROOF INSULATION
- 3 INITIAL INSULATION (cm)

4.1- SAVING MEASURES
- 8 ADITIONAL INSULATION (cm)
  - (•) PLACING EXTERNAL
  - ( ) PLACING INTERNAL
  - ( ) PLACING IN AIR CHAMBER
- 10 ADITIONAL INSULATION (cm)
- 20 ADITIONAL INSULATION (cm)

4.2- OPENINGS

4.2.1-WINDOWS CHARACTERISTICS

GLAZING
- ( ) SINGLE
- (•) DOUBLE (6)
- ( ) DOUBLE (12)
- ( ) TRIPLE(6/6)

FRAME MATERIAL
- ( ) METALLIC
- ( ) METALLIC WITHOUT THERMAL BRIDGE
- ( ) WOOD
- (•) PVC

WINDOW AIR LEAKAGE
- ( ) VERY HIGH
- ( ) HIGH
- (•) MEDIUM

4.2.2- SHADOWING
- [ ] NO OPAQUE SHUTTER
- [ ] NO BLIND
- [ ] NO AWNING
- [ ] NO REFLECTIVE CURTAIN

4.2- SAVING MEASURES
- [ ] CHANGE GLAZING
- [ ] SEALING WINDOW'S AIR LEAKS
- [x] CHANGE WINDOW

GLAZING
- 1,1 K (W/m2°K)

FRAME MATERIAL
- ( ) METALLIC WITHOUT THERMAL BRIDGE
- (•) WOOD
- ( ) PVC

- [ ] PLACING OPAQUE SHUTTER
- [ ] PLACING BLIND
- [ ] PLACING AWNING
- [ ] PLACING REFLECTIVE CURTAIN

SUMMARY

	POTENTIAL SAVINGS (kWh/year)	INITIAL INVESMENT (euros)	PAY-BACK (years)	CO_2 SAVINGS (kg)
☑ INSTALL MODERN BOILER	39827,85	40000,0	13,54	10554,38
☐ REDUCE HEATING SET POINT	16542,44	9600,0	7,82	4383,75
☐ INSTALLING A SOLAR COLLECTOR SYSTEM	45455,92	99000,0	29,37	12045,82
☐ CHANGING ALL LIGHTS TO LOW CONSUMPTION	23575,00	12000,0	6,59	13202,00
☐ INSTALLING PRESENCE DETECTOR	2875,00	600,0	2,57	1610,00
☑ INSULATING EXTERNAL WALLS(in the outer side of the wa	36506,46	21086,0	7,20	9674,21
☑ CHANGE WINDOWS	38846,09	45486,0	15,79	10294,21
☑ INSULATING WALLS CLOSE TO UNCONDITIONED SPACE	7348,41	7400,0	12,55	1947,33
☑ INSULATING ROOF	27758,19	18500,0	8,31	7355,92
☐			0,00	
☐			0,00	
☐			0,00	
☐			0,00	
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☐			0,00	

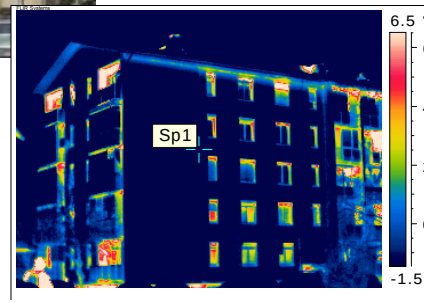
SELECT

COST-EFFECTIVE ANALYSIS SUMMARY

ENERGY SAVING MEASURES ADOPTED
INSTALL MODERN BOILER
INSULATING EXTERNAL WALLS(in the outer side of the wa
CHANGE WINDOWS
INSULATING WALLS CLOSE TO UNCONDITIONED SPACE
INSULATING ROOF

TOTAL POTENTIAL SAVING	112336,	kWh/year
TOTAL INVESTMENT COST OF ENERGY SAVING MEASURES	132472,	€
PAYBACK TIME OF THE ENERGY SAVING MEASURES	11,44	Years
CO_2 SAVINGS	29769,1	kg CO2
INITIAL E-TOOL BENCHMARK (WITHOUT ENERGY SAVING MEASURES)	172,46	kWh/m2
FINAL E-TOOL BENCHMARK- (WITH ENERGY SAVING MEASURES)	121,39	kWh/m2

e-tool



Raba energije pred predlaganimi ukrepi z E-Tool : 172 kWh/m2

Raba energije po predlaganih ukrepih z E-Tool : 121 kWh/m2

Supported by the European Commission under the Intelligent Energy - Europe Programme

cener
centro nacional de energías renovables
FUNDACIÓN CENER CIEMAT

Energy certificate

Building Energy Performance	Initial	Final
Very energy efficient		
A		
B		
C		D
D		
E	E	
F		
G		
Not energy efficient		
DELIVERED ENERGY (kWh/m²)	172,46	121,39

Building name	*Večstanovanjska stavba*
Owner	
Address	*Šišenska 42-44*
City	*Ljubljana*
Type of building	*Block of dwellings*
Year of construction or last renovation	*1960*
Climatized area (m²)	*1860*

Intelligent Energy Europe

JSS MOL – Hermana Potocnika, Ljubljana
Passive House Refurbishment




1975/2004, EU FP5 Large High Rise Reconversion Housing - University of Ljubljana, Faculty of Civil Engineering & Ljubljana Housing Fund JSS MOL;

- energy savings - 63%
- Insulation of facades
- insulation of roof
- Insulation of ground floor
- New balconies without thermal bridges
- Solar protection roller blinds + night insulation
- High efficiency insulation glazing and frames
- Management and control system: BMS, heating system management and control

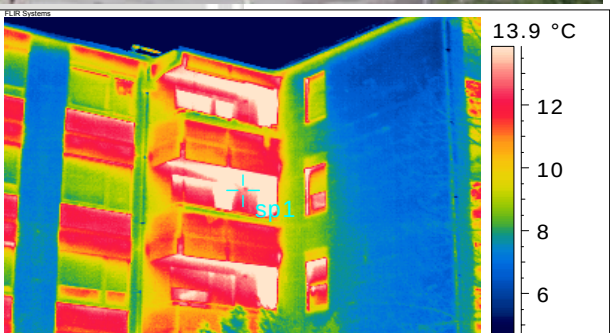
Ljubljana Housing Fund Challenge: social housing – towards passive standard

- Program EU IEE 2005 (Intelligent Energy - Europe), REBECEE – Renewable Energy and Building Exhibitions in the Enlarged Europe

- Energy demand in new buildings less then 40 kWh/m²year (target 20 kWh/m²year).
- Reduction of energy consumption in refurbishment by 30% - 40%.

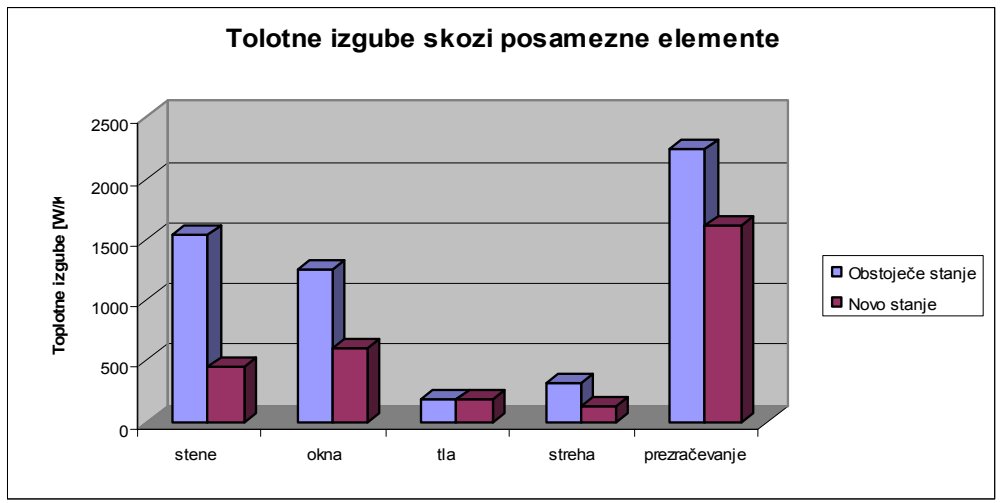
Passive standard renovation
Steletova 8, Ljubljana, 1.800 m2, 60 flats

- additional thermal insulation — target Q_{NH} **5 kWh/m2a**
- energy efficient windows and doors
- adaptation of heating systems
- mechanical ventilation , 75% heat recovery



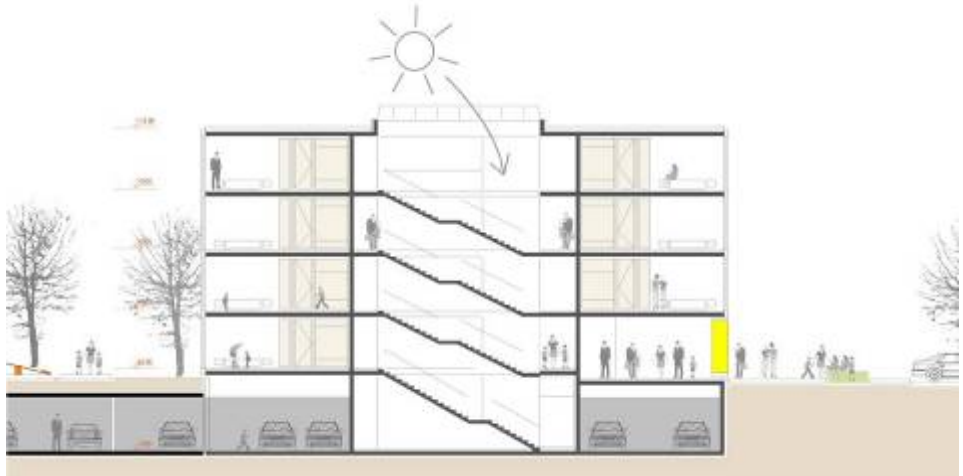
A	**25-40 kWh/m2**
B	**40-55 kWh/m2**
C	**55-70 kWh/m2**
D	**75-85 kWh/m2**

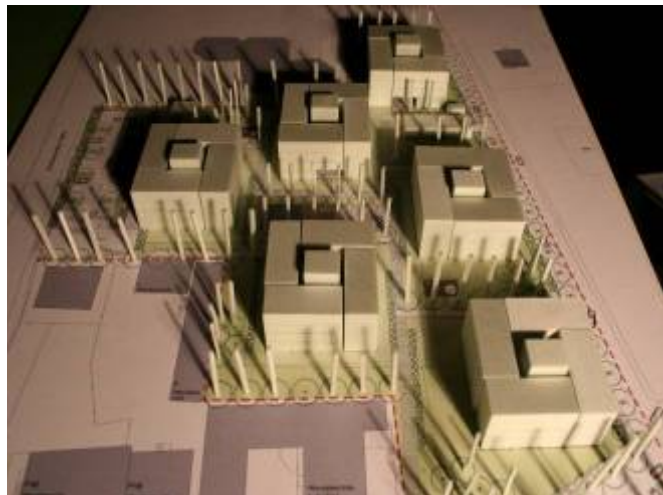
	<25 kWh/m2
A	**25-40 kWh/m2**
B	**40-55 kWh/m2**
C	**55-75 kWh/m2**



New social housing Polje II, Ljubljana

- Low energy buildings
- Controlled ventilation incl. humidity control
- Local d.h. system
- Solar collectors for DHW 50m2 /bld.
- 1 PV power plant 12 kW
- Design: ongoing in 2007
- Construction: 2009





ZRMK INSTITUT

Gradbeni inštitut ZRMK

Thank you for your attention!

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