

Energy efficiency of buildings from 1000m² and above in R.M. Condition of buildings in R.M.



Old buildings , almost 90 years old

- With wood or metal windows with, some of them single glazed
- With 4mm glass getting 5,8 W(m²/k)
- No sound or thermo insulating on walls
- No sound or thermo insulating on basements
- No sound or thermo insulating on sealing

Educational buildings

Elementary schools	.....1 030
Hi-schools	.....101
Faculties	.....80

Building type

Massive	.....15 %
Half-massive	.....56 %
Montage	.....1 %

Constructing of public buildings 1851 – 2010 y.

1851-1920	.....2,2 %
1921-1930	.....1,7 %
1931-1940	.....1,9 %
1941-1950	.....9,1 %
1951-1960	.....11,3 %
1961-1970	.....25,7 %
1971-1980	.....26,8 %
1981-1990	.....19,1 %
1991-2010	.....2,2 %

Type of energy source

Wood	.....15 %
Oil	.....56 %
Petroleum	.....7 %
Brown coal	.....5 %
Electricity	.....1 %
Central heating	.....16 %
Renewal energy	.....0 %

Energy efficiency of buildings from 1000m2 and above in R.M.

Legal regulations

Law for construction materials

- There are no sub law acts for his implementation
- There is no use of harmonized standards with countries members of EU for energy efficiency

Law for energetic

- Making of regulations for energy efficient buildings – September 2009 without calculating methodology
- Lack of calculating methodology postpones his actual use until 01.01.2011
- No harmonized EN standards for designing of buildings

Law for constructions 2009

- No authorizations for engineer of construction physics
- No use of CEN standards from member countries of EU

No national council for sustainable development

- Inter-ministry organization for sustainable development
- Membership of several ministries: ministry of ecology, ministry of transport and communications , ministry of finance and economy

NO ESKO

- Founders are ELEM and Toplifikacija Skopje without any support from ministries of finance an economy

IPARD funds

- Implementation of the rest four components
- There is no possibility of technical assistance for companies in R.M.

Coordinative council for energy efficiency of buildings in public sector with several ministries participating (World bank , Holland)

- Data collecting for public sector building conditions
- Study for saving energy
- Partners in realisation
- decision for national program

ADA project with five components

- 1st component : Strengthening of capacities of agency of energetic of R.M.
- 2nd component : Synchronizing of national law regulations with EU directive for energy characteristics of buildings and development of tools for implementation of regulations
- 3rd component : Realization of pilot project for improving of energy efficiency on buildings from public sector
- 4th component : Implementing the faculties with final goal securing the sustainability of the program on long terms
- 5th component : Campaign for raising the public awareness

USAID energy efficiency of buildings with social elements

- Pilot project for buildings from 30 to 50 apartments
- Families from social groups with average pay income

UNDP – Lowering the climate changes using improvements in energy efficiency sector

- National base with climate parameters
- Inventory of greenhouse gases from public buildings priority for energy efficiency in particular municipalities in R.M.
- Education , knowledge I measures for energy efficient construction sector

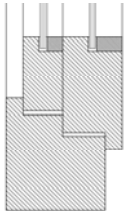
Energy efficiency of buildings from 1000m² and above in R.M. Recommendations for material selection

Joinery with LOW E insulating glass in R.M.

Roofs and basements

Exterior walls

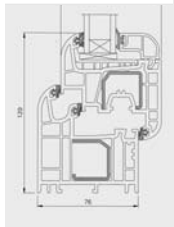
wood



Wood
Look-out
Thermo insulation
Sound insulation
Price
Lasts
Maintenance

natural/ralf
good thermo characteristics
good sound characteristics
Very hi price
10 years
very complicated

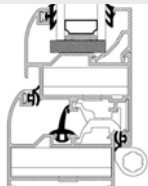
pvc



PVC
Look-out natural
Thermo insulation
Sound insulation
Price
Lasts
Maintenance

all RALF colors and wood designs
Good thermo characteristics
Good sound characteristics
Low price
30 years
very simple

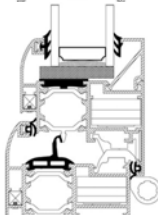
al



AL
Look-out natural
Thermo insulation
Sound insulation
Price
Lasts
Maintenance

all RALF colors and wood designs
bad thermo characteristics
bad sound characteristics
Low price
10 years
very simple/very complicated

al thermo



Al thermo
Look-out natural
Thermo insulation
Sound insulation
Price
Lasts
Maintenance

all RALF colors and wood designs
improved thermo characteristics
improved sound characteristics
average price
10 years
very simple/very complicated

al thermo
and wood



ALthermo/wood
Look-out natural
Thermo insulation
Sound insulation
Price
Lasts
Maintenance

all RALF colors and wood designs
Good thermo characteristics
Good sound characteristics
High price
10 years
very simple/very complicated

Glass wool insulation

- in roofs
- in slating roofs
- under floors

Stone wool insulation

- in roofs
- in slating roofs
- under floors
- on facades

- Styrofoam- expanded polystyrene
- 30MM – 100MM in R.M.
- In Norway and Finland up to 300mm
- Possibility for using on floors

- Extruded polystyrene
- 30mm-100mm in R.M.
- In Norway and Finland up to 300mm
- Possibility for using on floors
- Better mechanical characteristics
- Can replace 3-5 cm , and save useful space on building

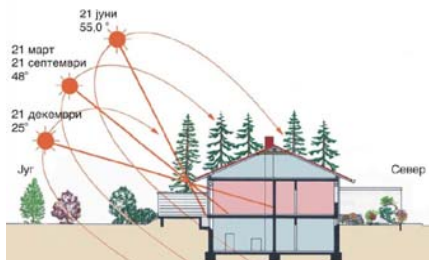
Coating/ mortar for final layers on facades

From import and own production :
Knauf, Renova Pofix

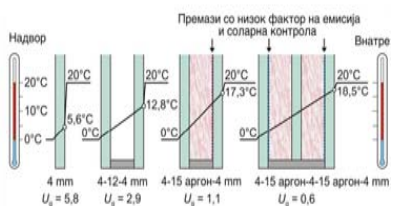
Energy efficiency of buildings from 1000m2 and above in R.M.

Thermal bridges

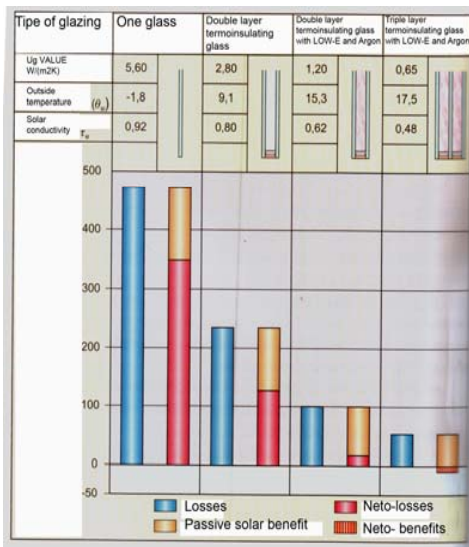
Reinforced concrete for exterior parts, Joints of windows with exterior walls, balcony , greenhouses , basements, ceilings



1. Insolation of southern facade

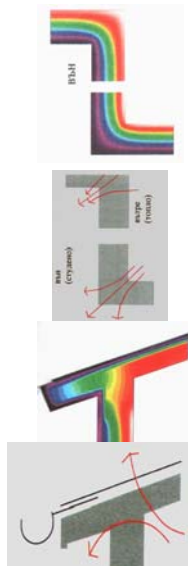
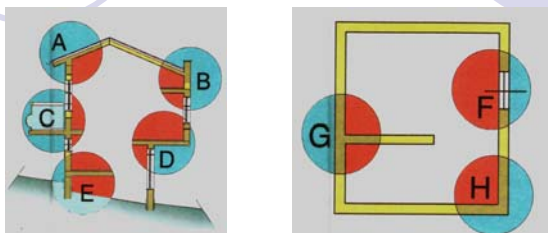


7. Temperature differences in outside layer depending on Ug W/m2



2. Thermal bridges

A - eaves B - box for shades C - balconies & loggias
 D - Erkers & hallways E - Flat roofs - construction between floors
 F - windows and balcony doors
 G concrete canvas for facades , pillars & girder H - corners for objects

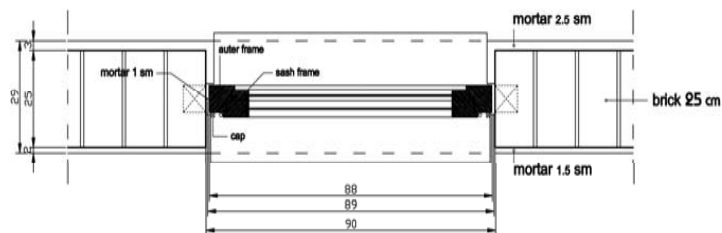


3. Heat passing across the thermal bridge

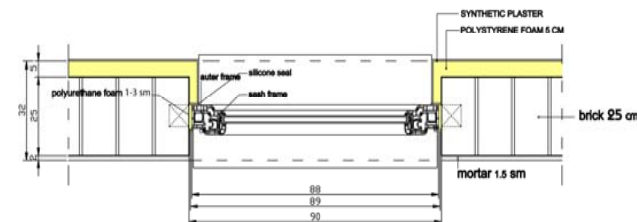
Amount of energy spent on heating and air-conditioning	kWh/m2 per year 300-250	kWh/m2 per year 150-100	kWh/m2 per year 50-30	kWh/m2 per year under 15
Construction standard	Without insulation	Insufficient insulation	Energy efficient buildings	Passive buildings
Amount of energy spent in liters of fuel per year	60kg/m2 Per year	30kg/m2 Per year	10kg/m2 Per year	2kg/m2 Per year
Carbon emissions		6CM	16CM	30CM

4. Energy source ≈ CO2 greenhouse gasses

5. WOODEN WINDOW -TYPE SASH ON SASH



6. PVC WINDOW - SYSTEM 5 CHAMBER PROFILE WITH 3 SEALING LEVELS



Energy efficiency of buildings from 1000m² and above in R.M. Recommendations for renovating of buildings in public property

-Study for energy efficiency of buildings accented on money spent on heating in last 5 years, for heating, air-conditioning, and illuminating

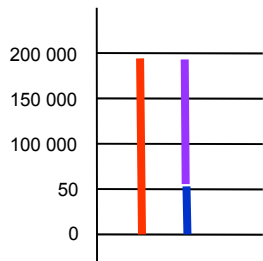
-Analyses of the fonts spend on actual components for renovation for energy efficiency like windows, walls, basements, heating,, exterior sound and thermo insulation, renovating of old electrical installation and air-conditioning

-Analysis of extraneous costs

Nikola Karev Hi-school Local community Strumica

Colored thermo façade local community Karpos

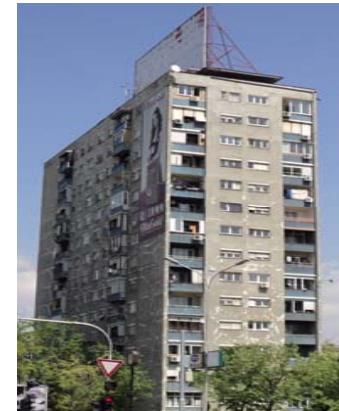
Energy sources-Oil



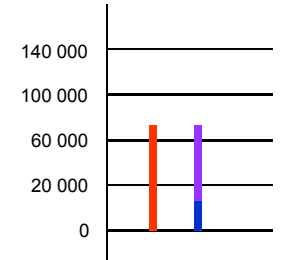
■ Before ■ After ■ Savings



- Annual costs for diesel for heating 8.100.000 lit.
- Sanction of the boiler
- Total investment costs 318.450,00 €
- Actual costs –joinery and heating 247.330,00 €
- Extraneous costs – 71.120,00 €
- Lowering the annual diesel spending for 50.00,00 lit.
- Investment payoff in 3-4 years , depending from weather conditions
- With extraneous costs 2,6 y./season
- With all costs 3,6 y./ season



Expenses €



■ Before ■ After ■ Savings

- Apartment building 40x15 H 42m/ 14 floors
- volume 25200m³, facade area 4620m², roof area 600m², basement area 600m²
- Total outside area 5820 m²
- Heating area 7000m², windowed area 1400m², climate zone 2
- Outside project temperature $\Theta_e = -15$ C
- Inside temperature $\Theta_i = 20$ C
- Day degree for Skopje 2500
- Annual heating costs 65.560 €
- Thermal insulation on façade walls 8cm Styrofoam
- Heat transmitting coefficient is downsized from 1.58 W(m²/k)
- Thermal lost are lowered for 75%
- Total investment 135.000,00 €
- Savings 48.900 €
- Investment payoff 3 y. depending from climate conditioning