Beodom

Two first low-energy residential buildings in Serbia Experience from the field

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Amadeo (July 2009)

Amadeo II (August 2010)

Amadeo: 1st low-energy residential building in Serbia
844 m², 11 apartments

Two sides of low-energy

Energy efficiency

Use less primary energy

Renewable energy

Use less energy from fossil fuels

Energy efficiency

Wall system: monolithic walls with clay blocks (38cm thick)

Thermal facade 4cm (λ = 0,09W/mK)

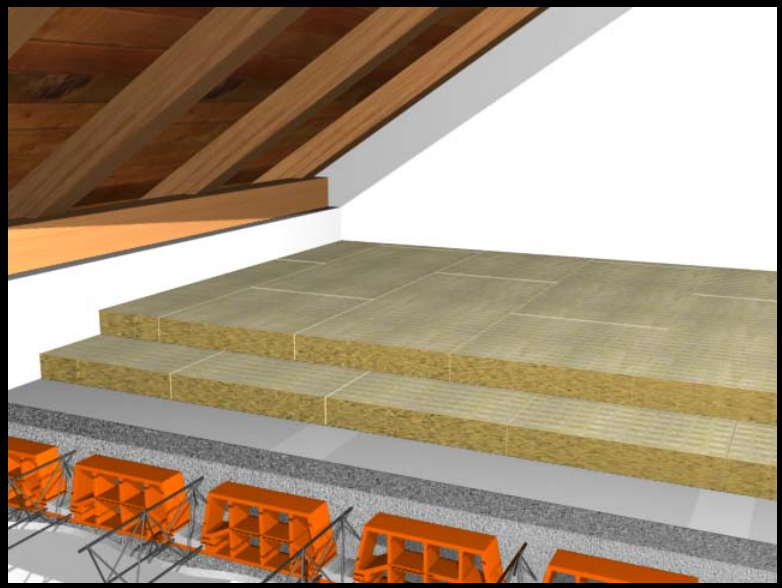
Care of thermal bridges

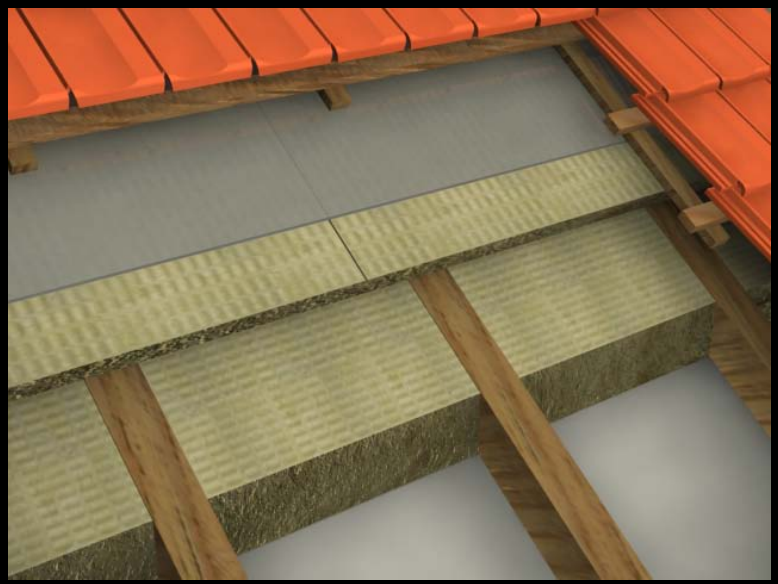
Care of thermal bridges on balconies

Load bearing thermal break for balconies

Reduce average λ by 91%

Thermal insulation: roof/floor





Based on rock mineral wool / extruded polystyrene

Pitched roof/Flat roof

- 20cm
- U ≈ 0.18 W/m²K

Serbia: U ≤ 0.65 W/m²K

Floor

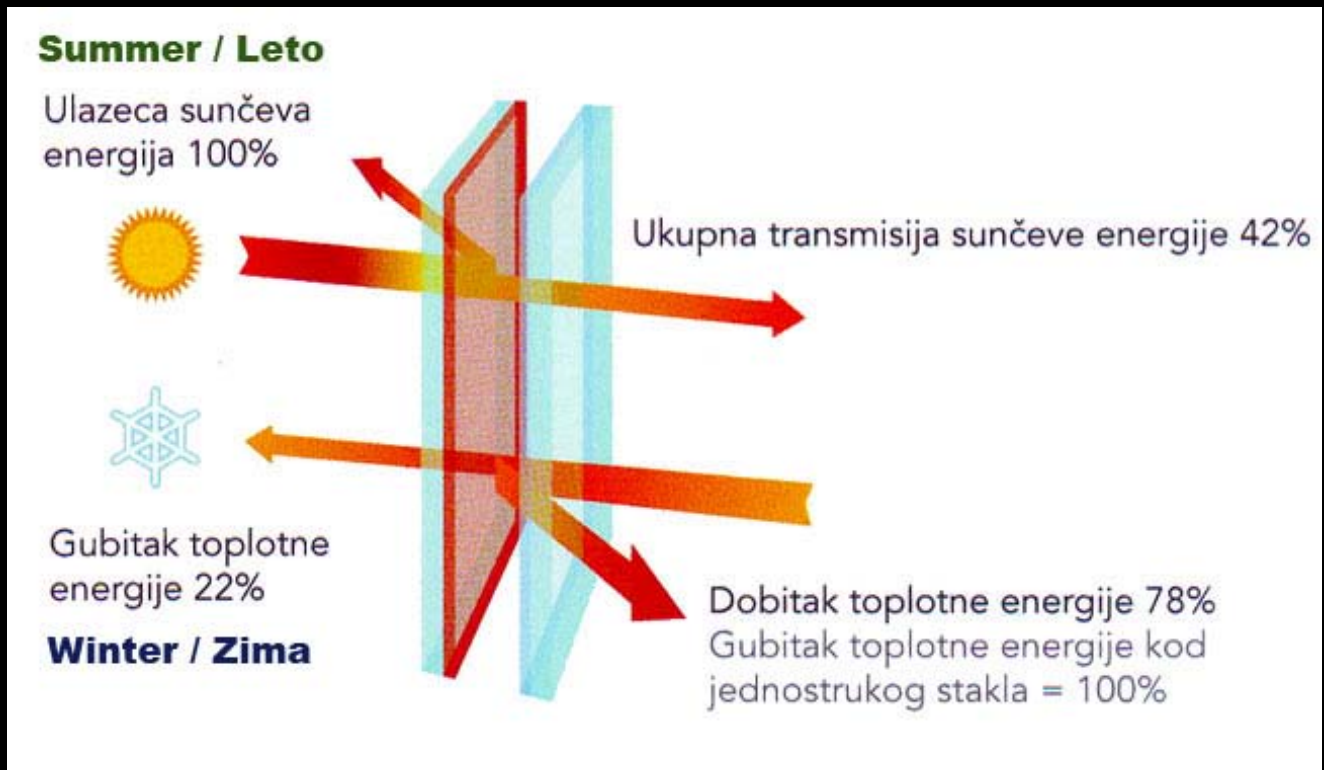
- 10cm
- U ≈ 0.36 W/m²K

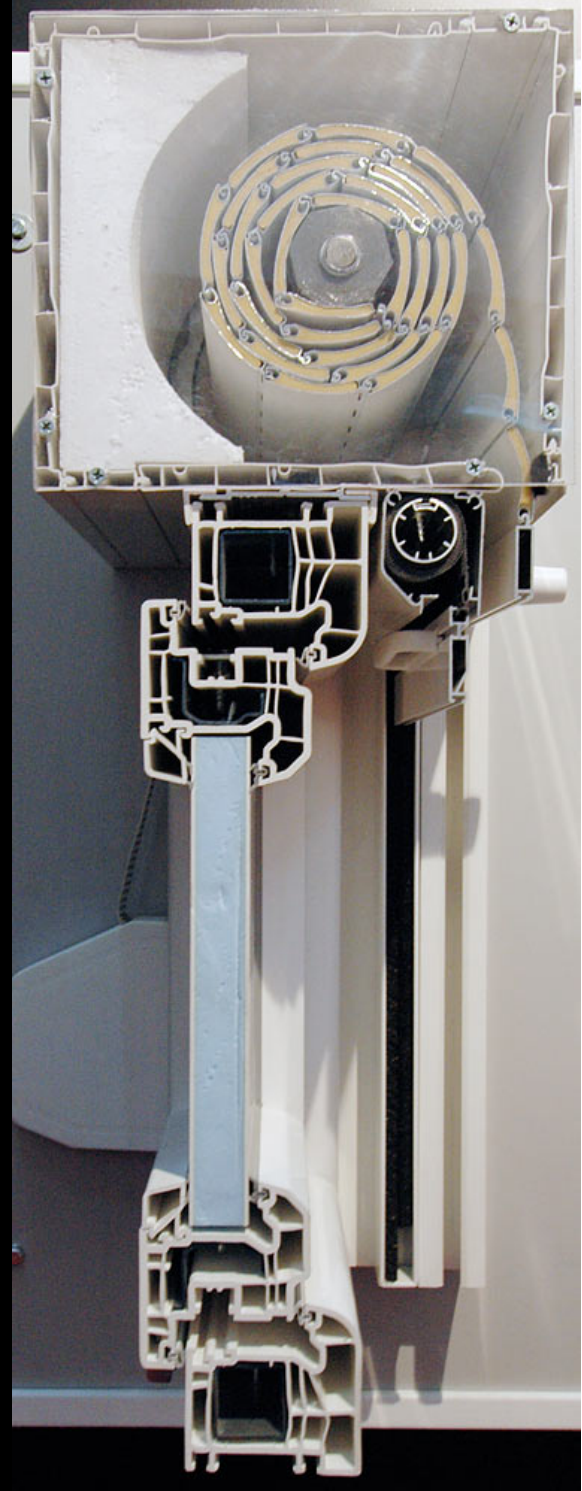
Serbia: U ≤ 0.75 W/m²K

Windows and shutters

Rolling shutter with thermal insulation
PVC-frame 5-chambers

Double-glazing, low-e, argon fill
U ≈ 1.10 W/m²K

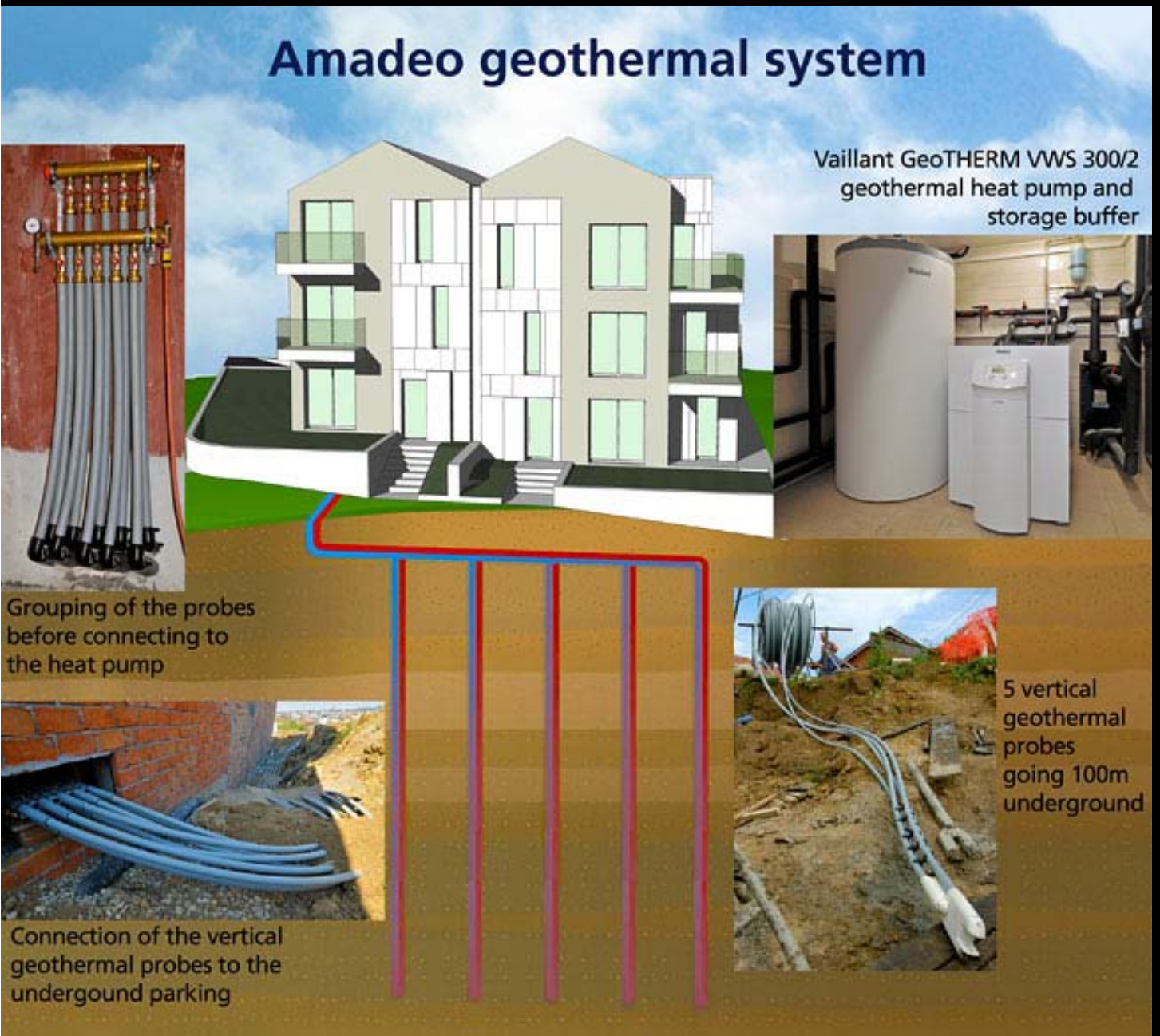




Pipes insulation

Renewable energy

Geothermal heating/cooling



- Heat pump powering underfloor heating and cooling
- Save up to 75% of electric energy

Energy production: Geothermal Heat Pump

Energy distribution: underfloor heating and cooling

Thermal solar production of sanitary hot water

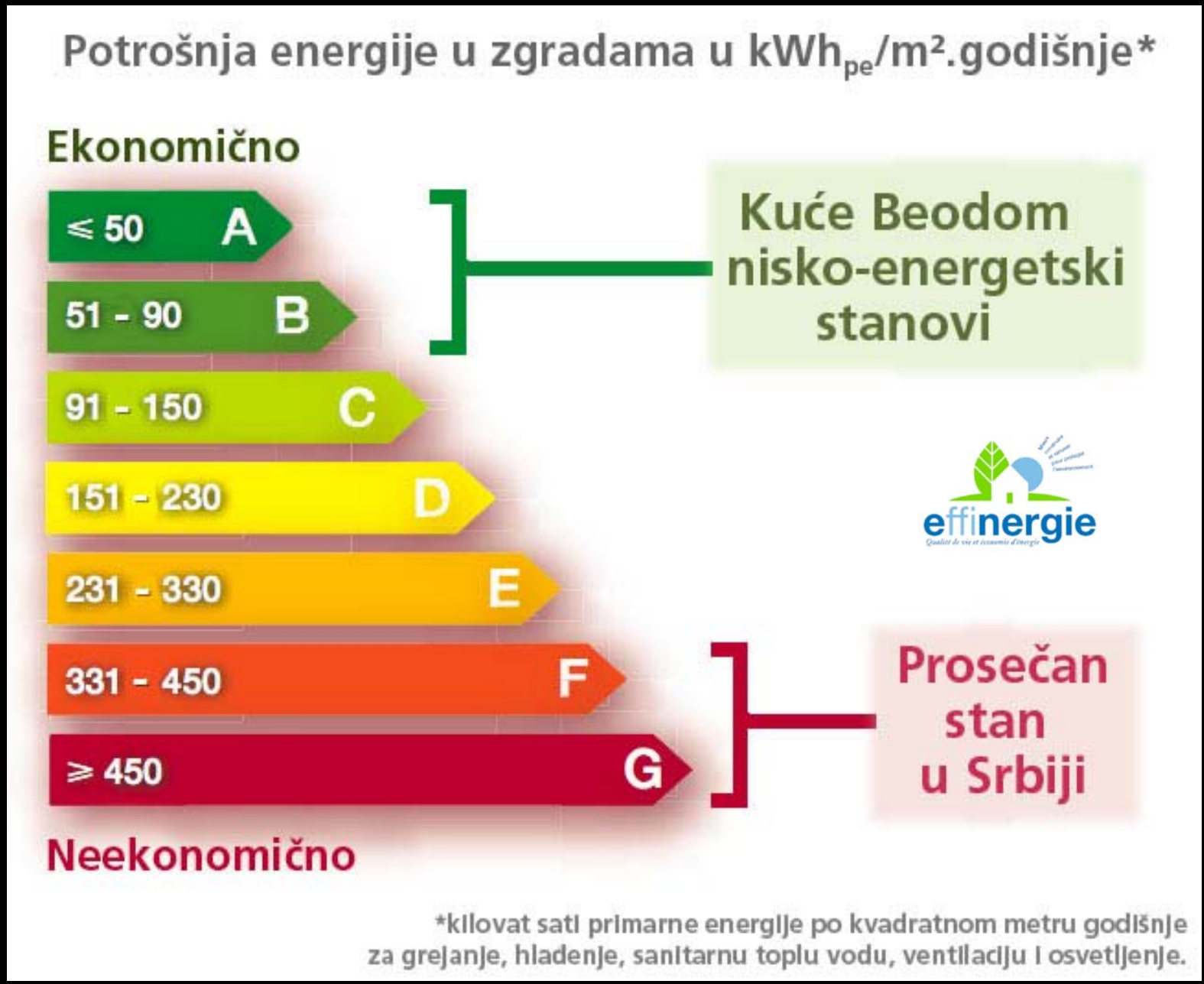
12 solar collectors, useful surface on the roof: 26m²

2 water cylinders of 500 liters each (1000 liters)

Covers 85% of yearly use of sanitary hot water in Belgrade

Solar collectors for hot water

What do we expect?



Confusion on energy

Electricity : secondary energy

Energy spending kWh / m^2.year	District heating	Natural gas	Electric
Heating	171	230	130
Sanitary hot water	55	55	55
Cooling	25	25	25

Less than 30% of the primary energy used to produce electricity is converted into useable electric energy.

Primary energy = Electric energy x 3

Spending in primary energy

Energy spending kWh / m^2.year	District heating	Natural gas	Electric
Heating	171	230	390
Sanitary hot water	165	165	165
Cooling	75	75	75
Total	411	470	630

Difficulties

- We started very early
- Little help or support at the time
- Forming the right team
- Lack of awareness in EE

BELRE 2008: Visit of Oliver Dulić

AUREA 2009: Specijalno priznanje za društvenu korisnost

Amadeo in the European Carbon Atlas 2010

Low Carbon Urban Built Environment

European Carbon Atlas

Editors: Phil Jones, Paulo Pinho, Jo Patterson, Chris Tweed

cost

Case study 1: Amadeo, energy efficient house in Belgrade

Context

In the Southeast part of Belgrade, in Zvezdara municipality, precisely in the part of Veliki Mokri Lug, the energy-efficient apartment house Amadeo is located. The location is in the larger-city area, close to the highway, on the northeast, and to the housing settlement Medakovic III, on the northwest (Figure XV.iii).

Figure XV.iii - Location of apartment house Amadeo on the map of central and south-east area of Belgrade

The location is characterised by low residential density. It is detached house with no shading obstructions in the surroundings, giving favourable conditions for solar systems integration. Belgrade has a moderate continental climate, with four seasons which influenced building construction design. The characteristic of Belgrade climate is also Košava - the southeast-east wind, with an average speed of 25-43km/h, but certain strokes can reach up to 130 km/h. Košava is the largest air cleaner of Belgrade.

Apartment house Amadeo is energy efficient building designed and constructed by Kuce Beodom, contractor that is committed to build apartments spending less than 90kWhpe/m²year (kilowatt hour of primary energy for square meter and per year for heating, cooling, sanitary hot water, ventilation and light). Regarding the threshold of primary energy consumption apartments are rated as class B according to the France norm Effinergie (www.beodom.com). Low-energy consumption is obtained by energy

efficient building construction and using renewable energy to replace the energy derived from fossil fuels (Figure XV.iv).

Figure XV.iv - South facade of Apartment house Amadeo (photo Kuće Beodom, www.beodom.com)

Apartment house Amadeo has 11 apartments, from 44 to 85m², on 3 levels (Figure XV.v). Usable floor area is 607m², but including balconies about 650 m².

Figure XV.v - Apartment house Amadeo-layouts of the first (left) and the second floor (right) www.beodom.com

The Building

Energy efficiency comes with excellent thermal insulation and smart choice of building materials and usage of renewable energy sources.

Building Structure

Structure of apartment house Amadeo is built with clay blocks, with thermal bridges break, and windows with low-e glazing filled with argon are applied.

Walls made of POROTHERM 38 clay blocks with thermal mortar (Figure XV.vi), have a thermal transmittance U=0.35W/m²K, i.e. total thermal resistance R=2.86m²K/W (www.beodom.com). The wall system fulfils both static and thermal insulation function, provides healthy indoor climate and very good thermal inertia needed for comfort in summer.

Figure XV.vi - Placing horizontal and vertical cerclage elements with thermal insulation on Apartment house Amadeo (photo Kuće Beodom, www.beodom.com)

The thickness of clay blocks allows thermal bridges to be broken on the floor slabs by placing a cerclage element with thermal insulation all around the concrete floor. For vertical reinforcements typical corner elements are used. They are specially designed to fit in a POROTHERM 38 wall together with 5cm of thermal insulation and a POROTHERM 8 brick. For the part of the ceiling that is directly under the roof, the insulating material is applied directly under the roof (20cm thick layer, or two 10cm thick layers of the same material). That gives a thermal transmittance around 0.18 W/m²K.

Windows are a key component of a low-energy construction. Ideally, they should have a U-factor as close as possible to the one of the walls. Windows made of Alphacan 5-chambers PVC profiles, with low-e double-glazing and argon fill, having U-value around 1.2 W/m²K, are selected. Rolling shutters with thermal insulation are integrated in the wall on top of the frame.

Usage of Renewable Energy

Because the construction of apartment house Amadeo is energy efficient, the demand on heating and cooling is greatly reduced. To further save energy, renewable energy is used to provide heating and cooling.

Figure XV.vii - Passage of the geothermal probes into Amadeo building (photo Kuće Beodom)

Ideas for improvement

Education and promotion of EE

- Education in schools / universities
- The Internet (portal for EE)
- Make people responsible in their use of energy

- Small reference object

Concrete support of investors

- Problem with electricity
- Thickness of the walls
- Extra costs for EE

- Missed opportunity : Dulić program of mass construction

Conclusion

- The financial and economical crisis have been positive
- Interest for EE is growing

- Can we expect more than moral support for a large scale project?

www.beodom.com