Low-energy buildings: the future of construction

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What is a low-energy building?

Using little primary energy and even less energy generated from fossil fuels

Ekonomično

≤ 50	A
51 - 90	B
91 - 150	C
151 - 230	D
231 - 330	E
331 - 450	F
≥ 450	G

XXX

$kWh_{pe}/m^2.year$

Heating
Cooling
Hot water
Ventilation
Light

Neekonomično

Passivhaus

effinergie
Qualité de vie et économie d'énergie

LEED
U.S. GREEN BUILDING COUNCIL
USGBC

CANADA GREEN BUILDING COUNCIL
CONSEIL DU BÂTIMENT DURABLE DU CANADA

MINERGIE
Mehr Lebensqualität, tiefer Energieverbrauch
Meilleure qualité de vie, faible consommation d'énergie

KlimaHaus
CasaClima

Energy consumption in Serbia

Ekonomično

≤ 50	A
51 - 90	B
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331 - 450	F
≥ 450	G

XXX

$kWh_{pe}/m^2.year$

Heating
Cooling
Hot water
Ventilation
Light

Neekonomično
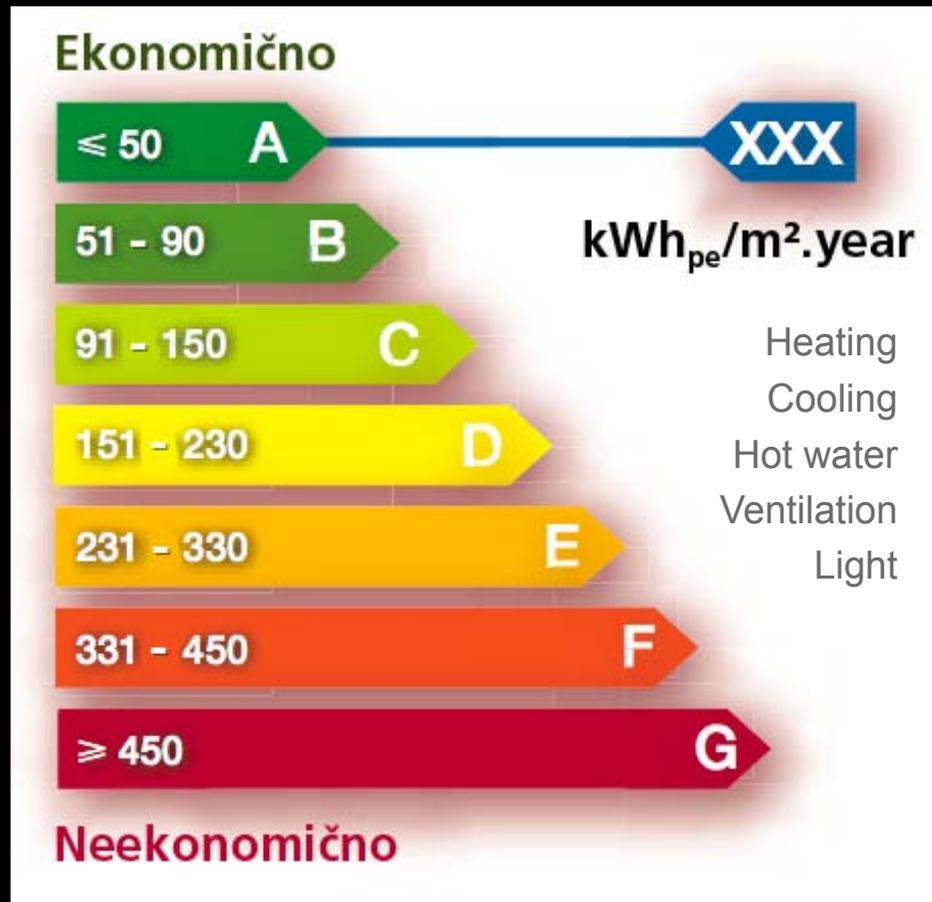
Heating alone

District hot water
171 kWh_{pe}/m^2.year

Natural gas
230 kWh_{pe}/m^2.year

Electricity
350 kWh_{pe}/m^2.year

Sanitary hot water
55 kWh/m^2.year

Source: The Energy Efficiency Agency of the Republic of Serbia

Two sides of low-energy

Energy efficiency
Use less primary energy

Renewable energy
Use less energy from fossil fuels

Primary/Renewable energy
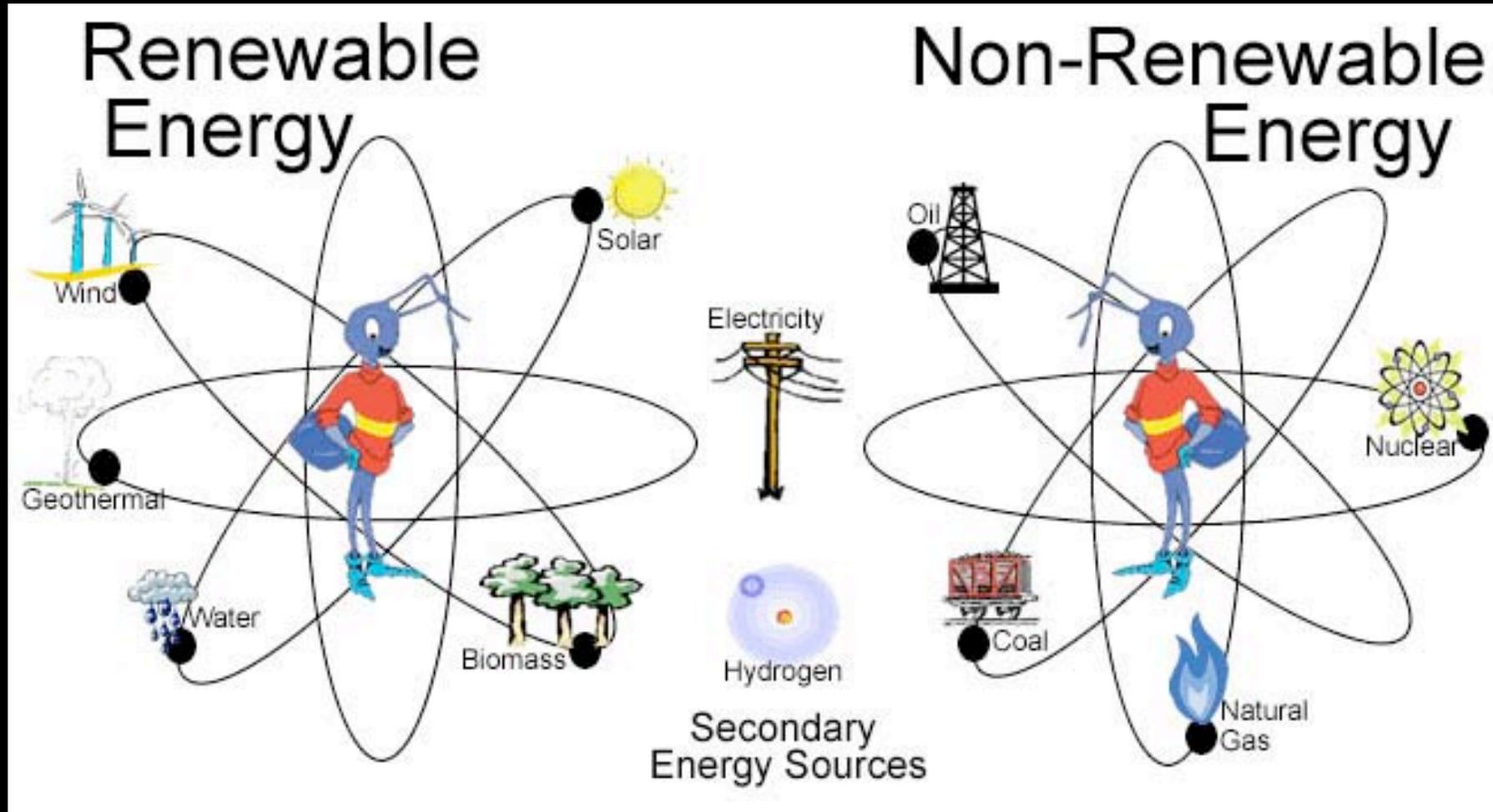
Why low-energy now?

We've been on an unsustainable development track for too long

Economical reasons

Environmental reasons

Economical reasons

The era of cheap and abundant energy is behind us

Peak oil, Peak natural gas

Geographical repartition of fossil fuels

Peak oil

International Energy Agency,
World Energy Outlook 2008

"Without extra investment to raise
production, the natural annual rate
of output decline is 9.1 per cent"

Serbia is energy dependent
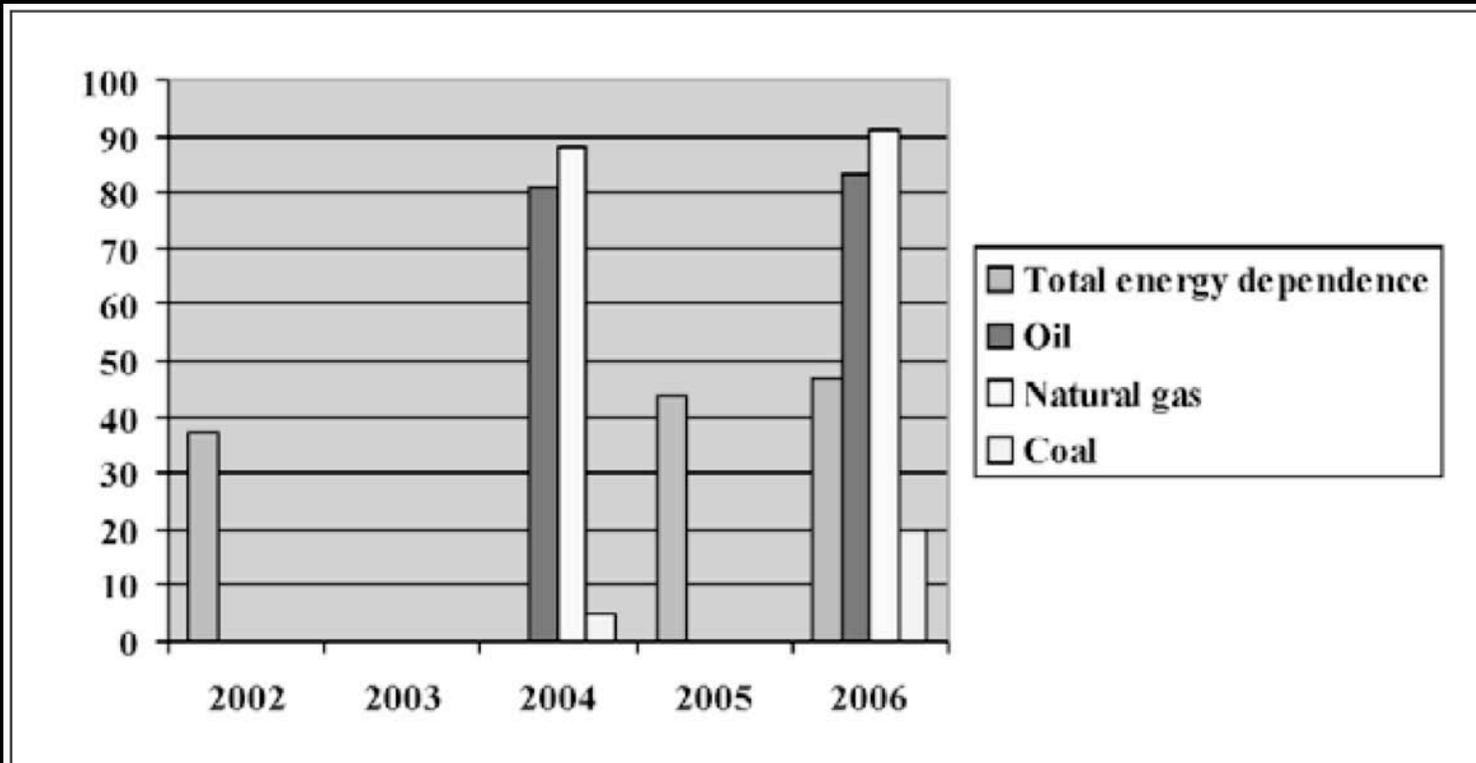
Total import dependence on primary energy sources, Energy Balance of the Republic of Serbia, 2004–2006.

Natural gas price: +60% in Serbia

Powercut in Belgrade?

"Serbia meets its increasing needs for energy products primarily through imports of oil and gas. The negative implications of import growth may be offset by means of **rationalizing the consumption** as well as by **gradual introduction of alternative energy sources**."

Environmental reasons

Global warming is a real threat to humankind

Reduce greenhouse gases emissions (CO2)

Reduce use of resources

Reduce ecological footprint

Implementation of Kyoto protocol

Concrete realization in Belgrade

Amadeo: 1st low-energy residential building in Serbia
844 m², 11 apartments, delivery 02/2009

Energy efficiency

Wall system: monolithic walls

Thermal performance, thermal inertia, durability, health

$U \approx 0.35$ W/m²K

Serbia: $U \leq 0.90$ W/m²K

Care of thermal bridges

Thermal bridges on balconies

Schoeck Isokorb: load bearing thermal break for balcony

Reduce average λ by 91%
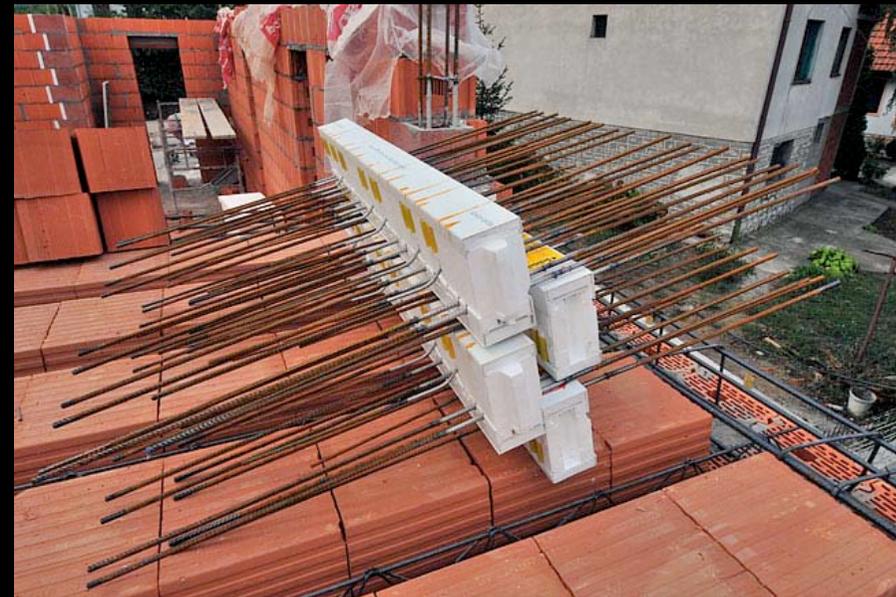
Thermal insulation: roof/floor

Based on rock mineral wool / extruded polystyrene

Pitched roof/Flat roof
- 20cm
- U ≈ 0.18 W/m²K

Serbia: U ≤ 0.65 W/m²K
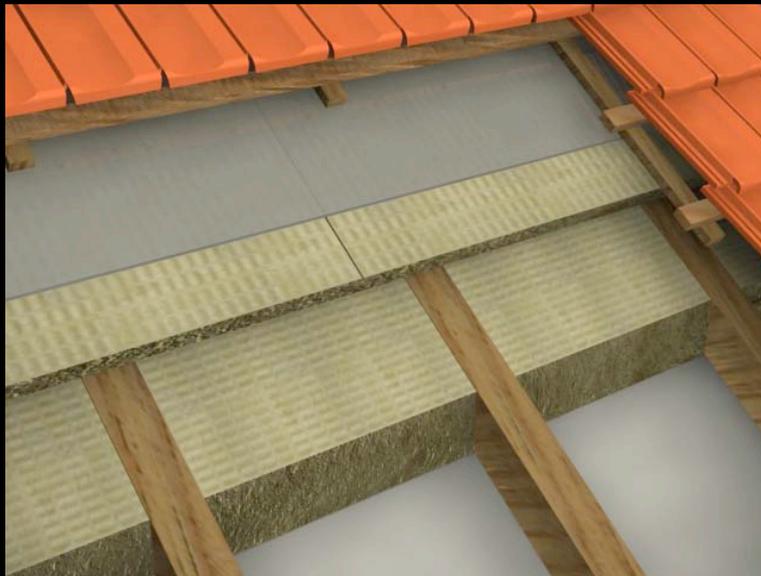
Floor
- 10cm
- U ≈ 0.36 W/m²K

Serbia: U ≤ 0.75 W/m²K

Windows and shutters

Rolling shutter with thermal insulation
PVC-frame 5-chambers

Double-glazing, low-e, argon fill
$U \approx 1.20$ W/m²K

Summer / Leto

Winter / Zima

Low-E Coating on 2

Spacer

Inside

Outside

1 2 3 4
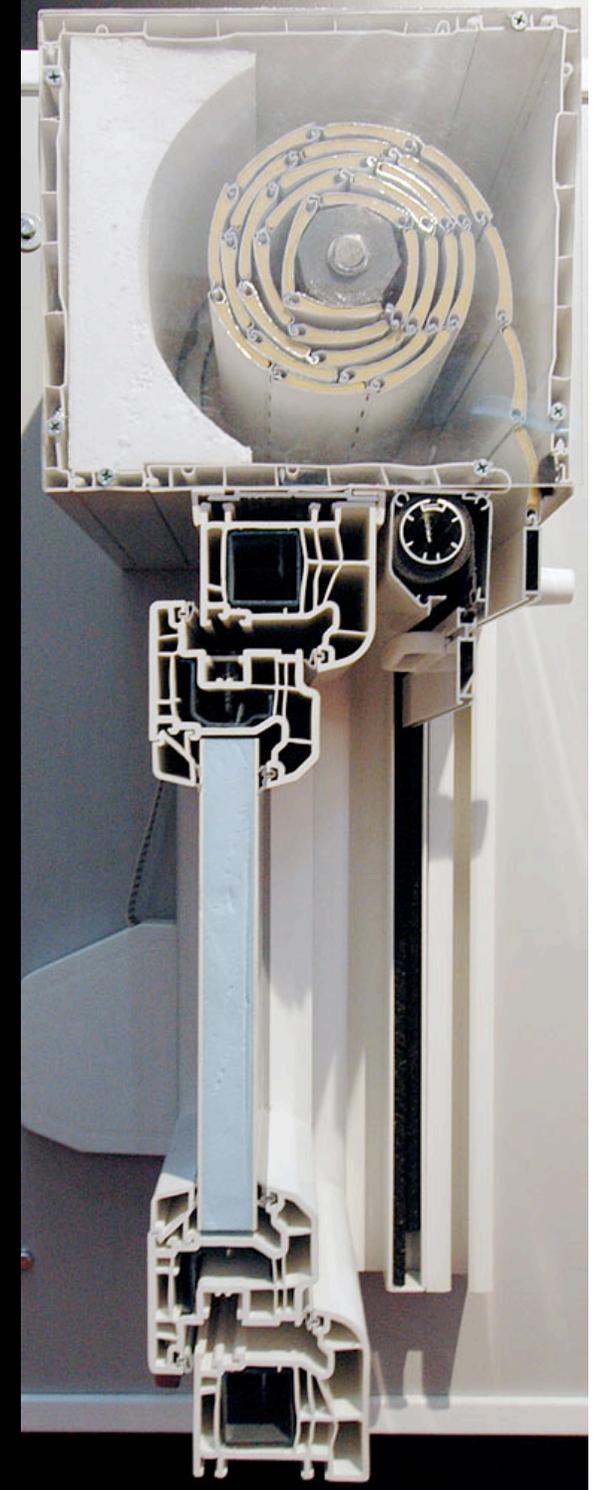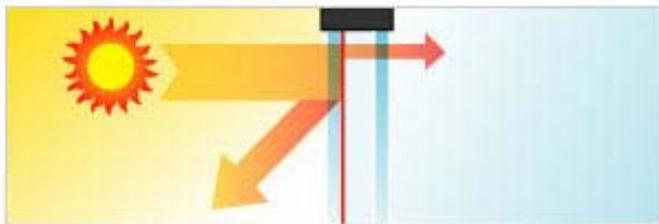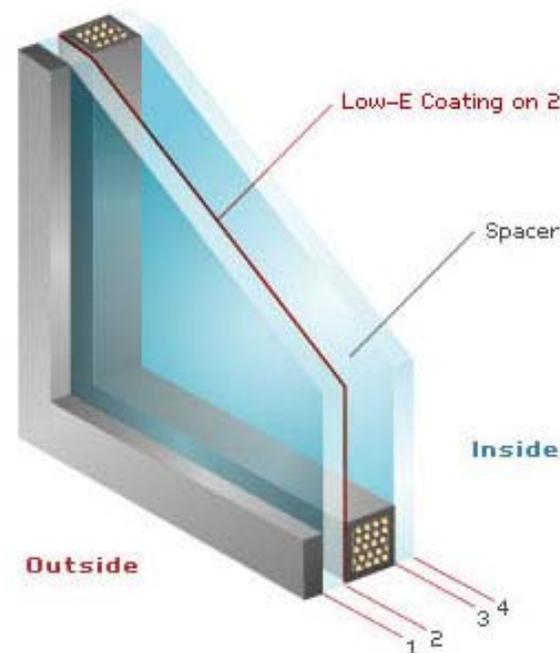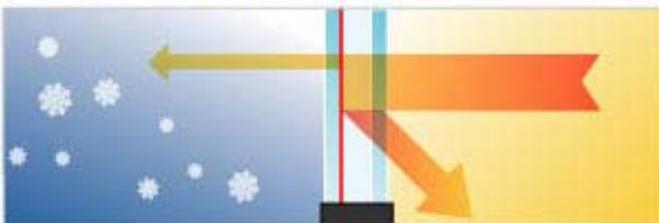
Renewable energy

Geothermal heating/cooling

Takes heat from the ground in winter
Releases heat in the ground in summer
Save up to 75% of electric energy
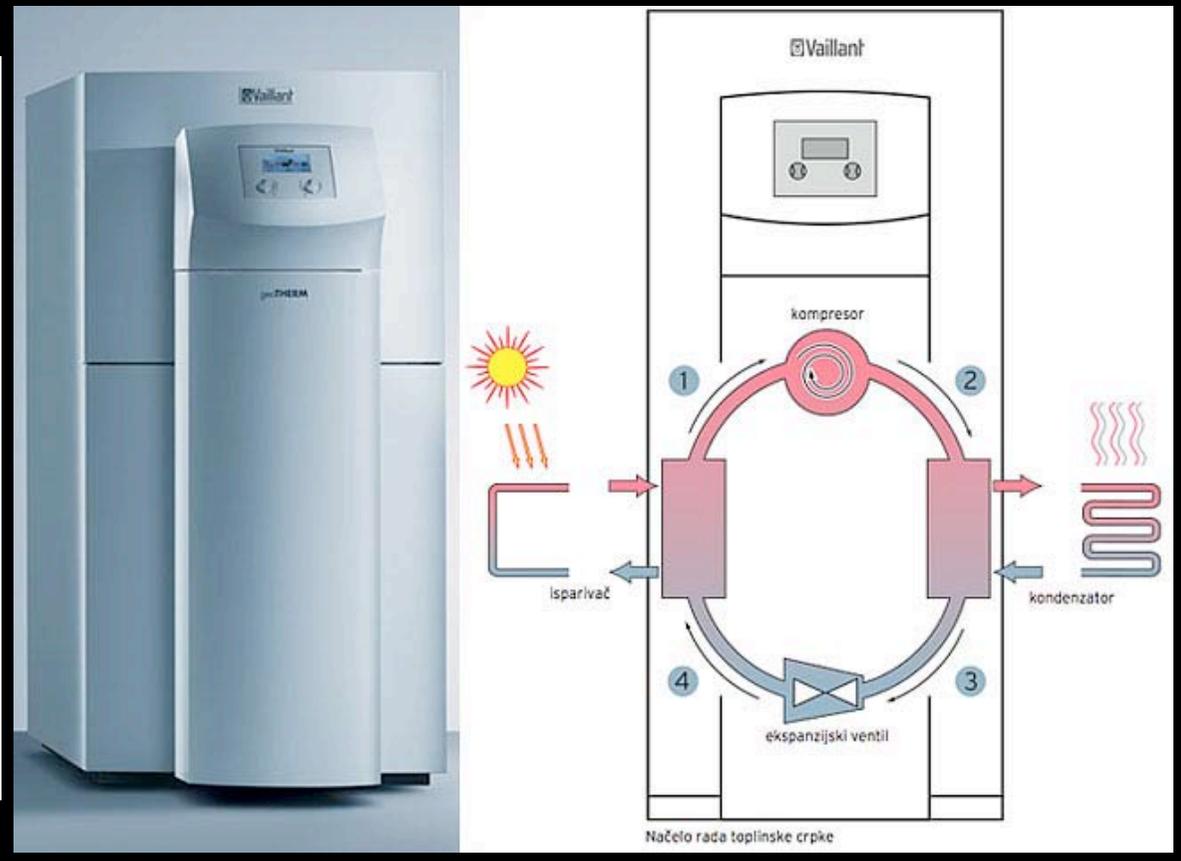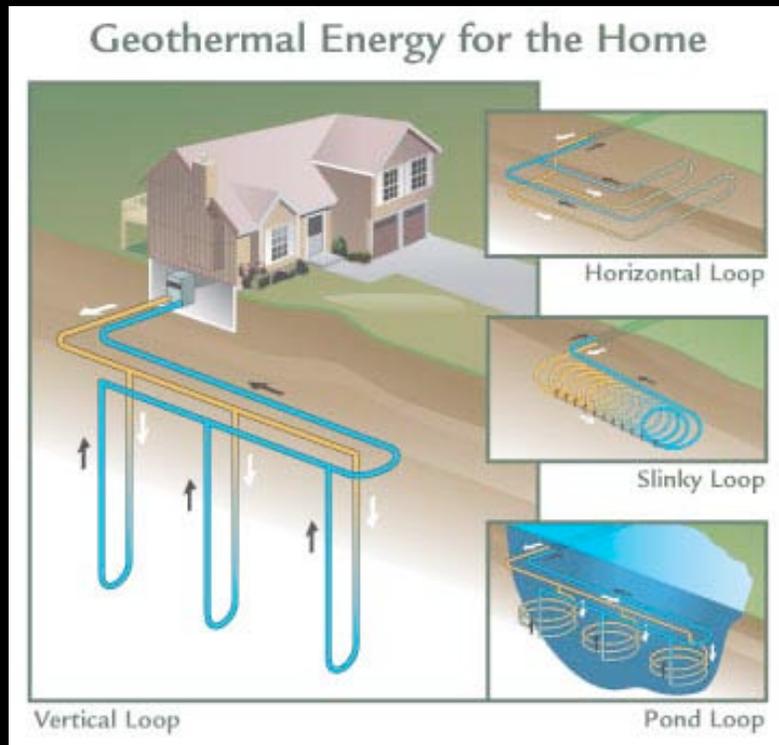
Geothermal heating/cooling

Vertical loop, 5 boreholes, 100m each, ground-water, heat pump powering underfloor heating
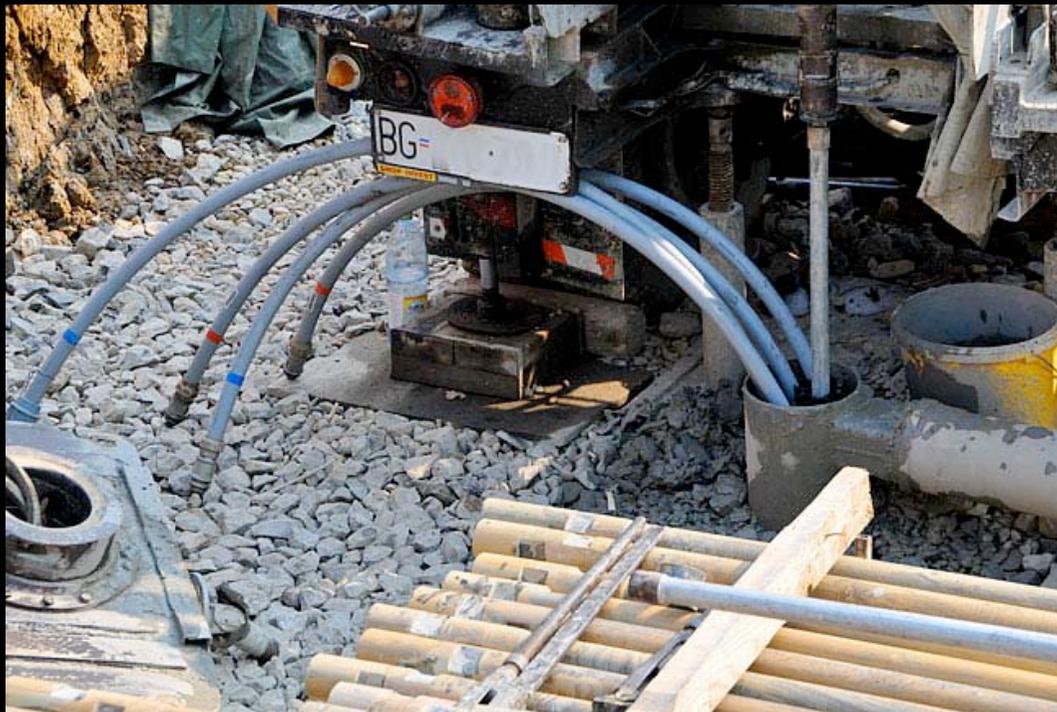
Solar collectors for hot water

12 solar collectors, total surface on the roof of 30,6m²

2 water cylinders of 500 liters each (1000 liters)

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

What do we expect?

Somewhere here

Heating
Cooling
Hot water
Ventilation
Light

Conclusion

It can be done!

Low-energy buildings should be

Facilitated (fast lane / one stop counter)

Encouraged (subventions / tax break)

Compulsory (new norms / higher standards)

Time

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www.beodom.com