STANOVANJSKI SKLAD REPUBLIKE SLOVENIJE

CoNZ€Bs
Solution sets for the Cost reduction of new Nearly Zero-Energy Buildings

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MODEL HOUSE F3 IN LJUBLJANA – Nearly Zero-Energy Building

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Main features

Development:

- Start of construction **2014**
- Completion of construction – structures and outdoor areas **2017**
- The concractual value of F3 construction and fitting-out is **7.3 million euros**

Brief description:

- 1 structure vertically divided into four lamellas
- floors: G+3+T, underground garage
- 52 apartments and 2 business premises,
- Net floor area of lamellas A, B, C, D: **5.500 m2**.

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Main features

- Construction:
  - one-level underground garage - reinforced concrete structure,
  - G+2 reinforced concrete structure,
  - 3+T wooden structure
- Façade:
  - P+2: TI, ventilated with fibre cement panels,
  - 3+T: TI, ventilated wooden
- Roof:
  - TI, flat roof, hydro insulation membrane
- Fenestration:
  - Aluminium-wood, triple glazing, external screen
- Interior surface finishes:
  - parquet flooring, ceramic tiles, epoxy floor coating, rubber flooring, linoleum, exposed concrete, wooden ceiling, ….

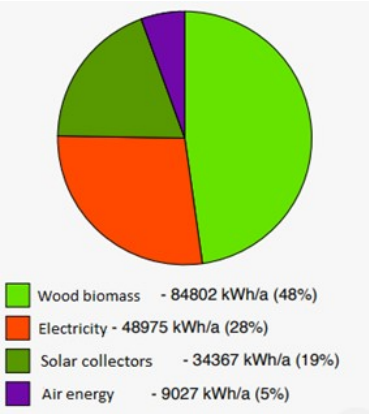


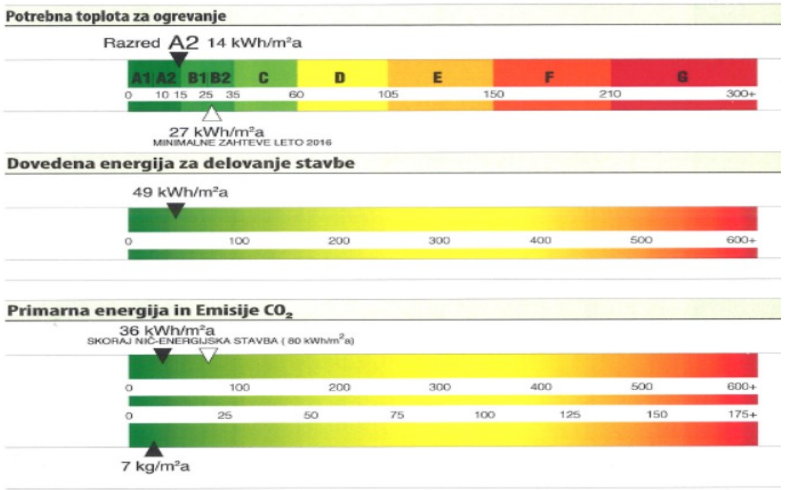

Energy efficiency

Nearly Zero Energy Building (definition):

- annual heat demand max. 25 kWh/m2a =>>> 14 kWh/m2a achieved
- primary energy max. 80 kWh/m2a =>>> 36 kWh/m2a achieved
- renewable energy sources >50% =>>> 72 % achieved

Energy performance certificate:





Construction process
Fenestration

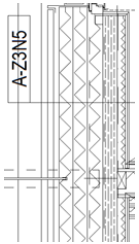
- wooden windows with alu protection (triple glazed with a gas fill and low-emittance coating)
- RAL installation standard with three-level sealing
- certified by Passivhaus

Specifications:

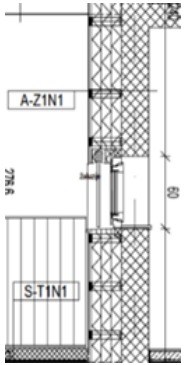
- Ug = 0,50 W/(m^{2}K)
- Uw = 0,68 W/(m^{2}K)
- R_w 36 dB
- g-value: 0,5

Construction process
External walls

Structure of external wall wood construction	Thickness [cm]
	56.0
vertical, massive wooden battens 2×7/2 cm, larch	4.00
air layer	6.00
wind barrier	0.02
Insulation: two-layer boards made of rock mineral wool (0.035 W/mK)	28.00
cross laminated timber (CLT)	9.50
installation plane: metal subconstruction, in between rock mineral wool boards	6.00
Two-layer gypsum boards	2.50



Structure of external reinforced concrete wall	Thickness [cm]
	55.5
fibre cement facade boards	0.80
air layer	3.20
wind barrier	0.02
Insulation: two-layer boards made of rock mineral wool (0.035 W/mK)	26.00
reinforced concrete wall C 25/30	25.00
internal finishing layer	0.50



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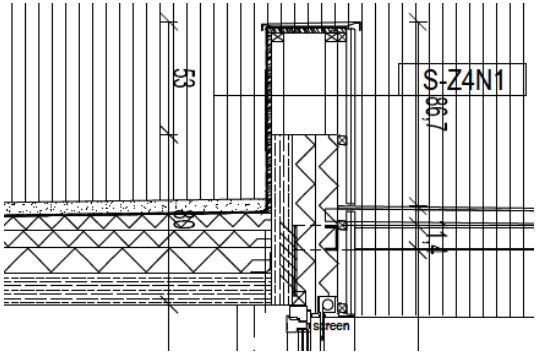
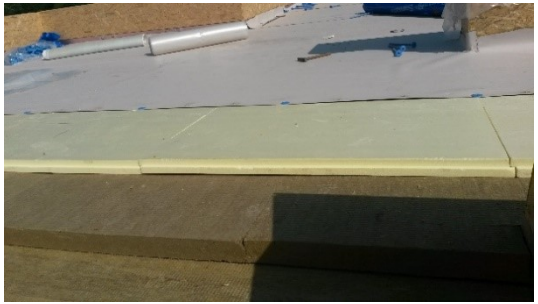
Construction process
Roof system





- Flat roof
- Slope: 1,5%
- Thermal insulation:

  rock mineral wool 36 cm
  + XPS 5 cm
- Sika waterproofing membrane

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Construction process
From the perspective of the investor

- project complexity
- high level of professional skills from design engineers and field operators
- highly qualified supervision
- high level of regular quality monitoring – contractor‘s internal control and control of other participants

Mechanical installation and equipment

- building as a whole is NZEB
- RES 72%: biomass (woodchips), solar energy collectors, air/water heating pump
- mechanical ventilation with heat recovery, humidity-sensitive ventilation
- PHPP energy performance certificates for 31 passive dwellings
- energy standard: energy class A2 – heat demand 14 kWh/m2a

Mechanical installation and equipment

Mechanical ventilation with heat recovery

- Types of heat recovery ventilation systems:
  - wall/ceiling units, air flow rate 180 m3/h
  - free-standing units, air flow rate 270 m3/h

- certified by Passivhaus Institut
- thermal efficiency ≈ 82 % at an average airflow of 55 m3/h

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Air tightness testing

Workflow:

- technological study: project details, materials, certificates, work protocol, responsible persons
- pilot dwellings determination
- contractor training
- preparation of dwelling air tightness plane
- Blowerdoor test implementation
- corrective actions
- Blowerdoor test reimplementation
- further test implementation with internal control

Air tightness testing

- air tightness measurements were made for all dwellings of a single lamella at a time
- lamella A and B: common pipe system, i. e. “octopus“
- lamella C and D: including interior corridors

- **air tightness result: 0,6 h^{-1}** at pressure difference of 50 Pa

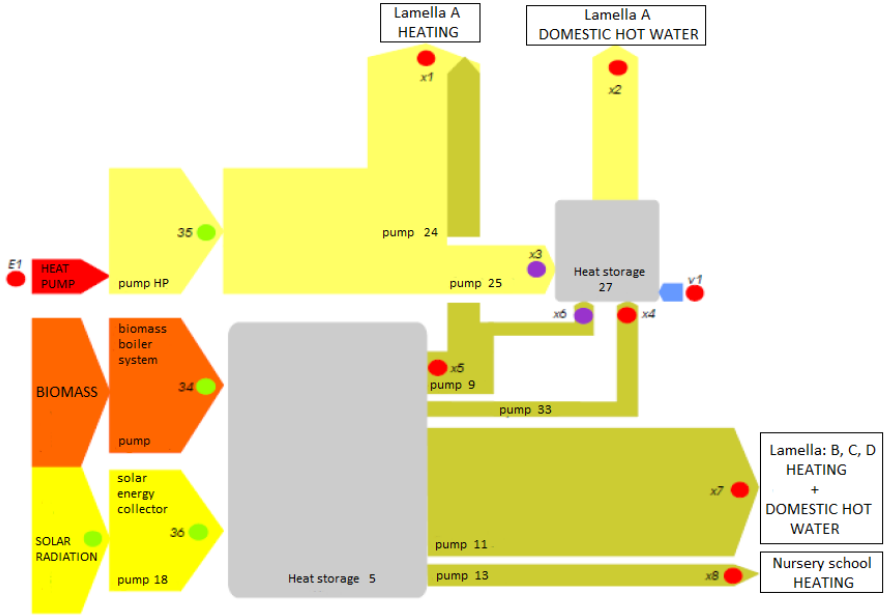
Monitoring

Concept of monitoring:

- energy efficiency
- architectural design, use of materials
- sociological aspects

Monitoring of energy efficiency and well-being of residents:

- 6 dwellings for monitoring (2 with humidity-sensitive vent., 2 with HRV in reinforced concrete structure, 2 with HRV in wooden structure)
- measuring equipment for parameters of indoor environment – data loggers: temperature, humidity, CO2
- surveys



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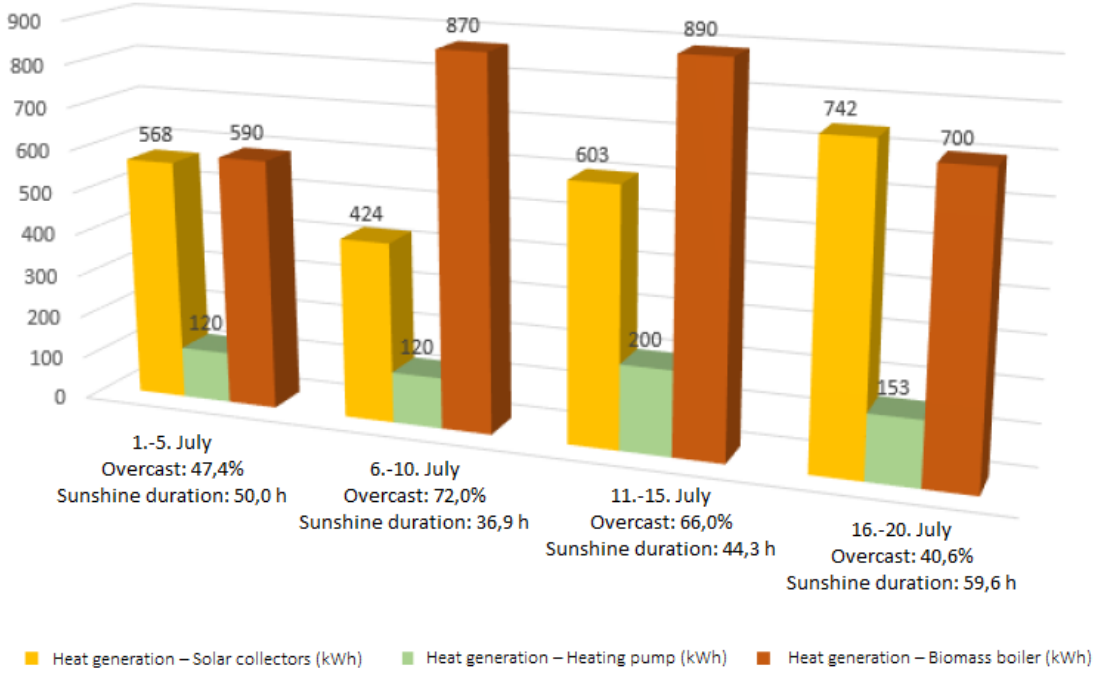
Monitoring

Amount of energy generated in four different 5-day periods in July, depending on the type of heat generator



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Conclusions

Use of NZEB:

- enhanced living comfort for residents
- high level of professional qualifications of the facility manager
- more complex maintenance of common and individual installation systems/equipment
- co-operation challenge between residents (owners) and facility manager

Key factors are overall performance and optimized operation settings of embedded systems.

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Thanks!

Questions and Comments

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