FROM CONVENTIONAL TO LOW ENERGY FAMILY BUILDING IN SERBIA
A LIFE CYCLE PERSPECTIVE

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45. International Congress and Exhibition
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Regulations that stipulate energy efficiency in building sector

European Union

- Energy Efficiency Directive (2012/27/EU)
- Energy Performance Building Directive (2002/91/EC) and its recast edition (2010/31/EU)

Serbia

- Law on efficient use of energy (2013)
- Rulebook on the energy efficiency of buildings (2011)
- Rulebook on the conditions, contents and manner of issuing certificates of energy performance of buildings (2011)
- Law on planning and construction (2009)

Conventional building is “a building built according to the common practice of a specific country in a specific period”.
(Sartori and Hestnes, 2007)

Low energy building is generally known as building with a lower energy demand than a common building regulated in the national building code

Nearly zero-energy building is “a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby”
(Article 2, EPBD Recast, 2010)

“**Passive building** is a building in which the annual energy consumption for heating, per unit of floor area, does not exceed 15kWh/m^2”
(Rulebook on the energy efficiency of buildings in the Republic of Serbia, 2011)

Analysed life cycle phases:

1. extraction of raw materials from their natural environment
2. transportation to the production facility
3. production process and the completion of building materials
4. transportation to the construction site
5. material assembly and the construction on site
6. building utilisation
7. maintenance i.e. replacement, repair or improvement of building components
8. demolition and
9. recycling of certain building elements

System boundaries:

- cradle to gate (phases 1-3)
- cradle to site (phases 1-4)
- cradle to grave (phases 1-8)
- cradle to cradle (phases 1-9)

Categories of buildings life cycle energy use:

- initial embodied energy (phases 1-5)
- operational energy (phase 6)
- recurrent embodied (phase 7)
- demolition energy (phases 8 and 9)

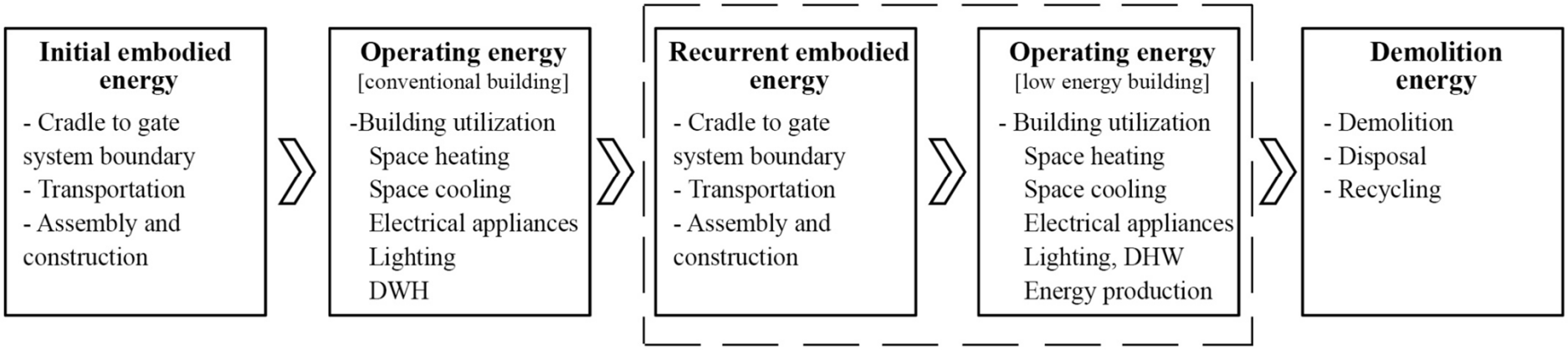


Figure 1. Categories of energy consumption and life cycle phases of the building

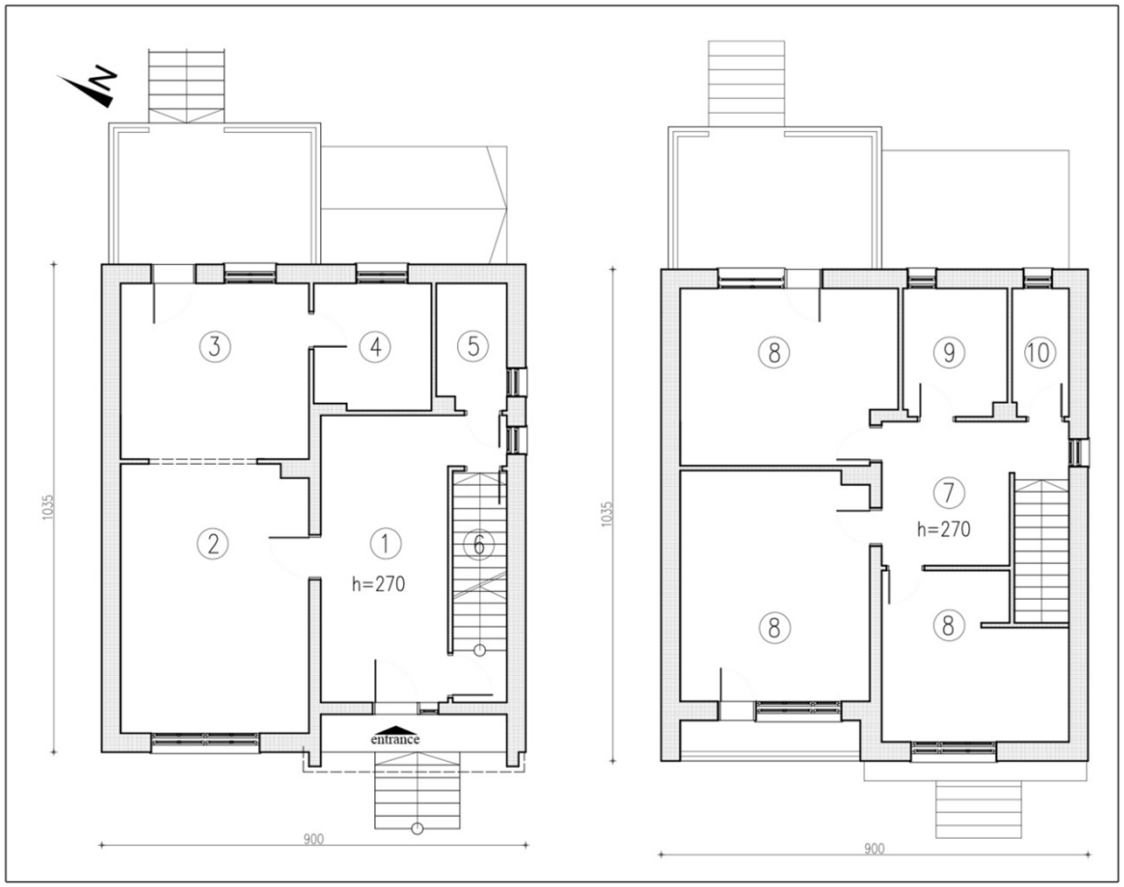


Figure 2. Floor plan of the case study single-family building

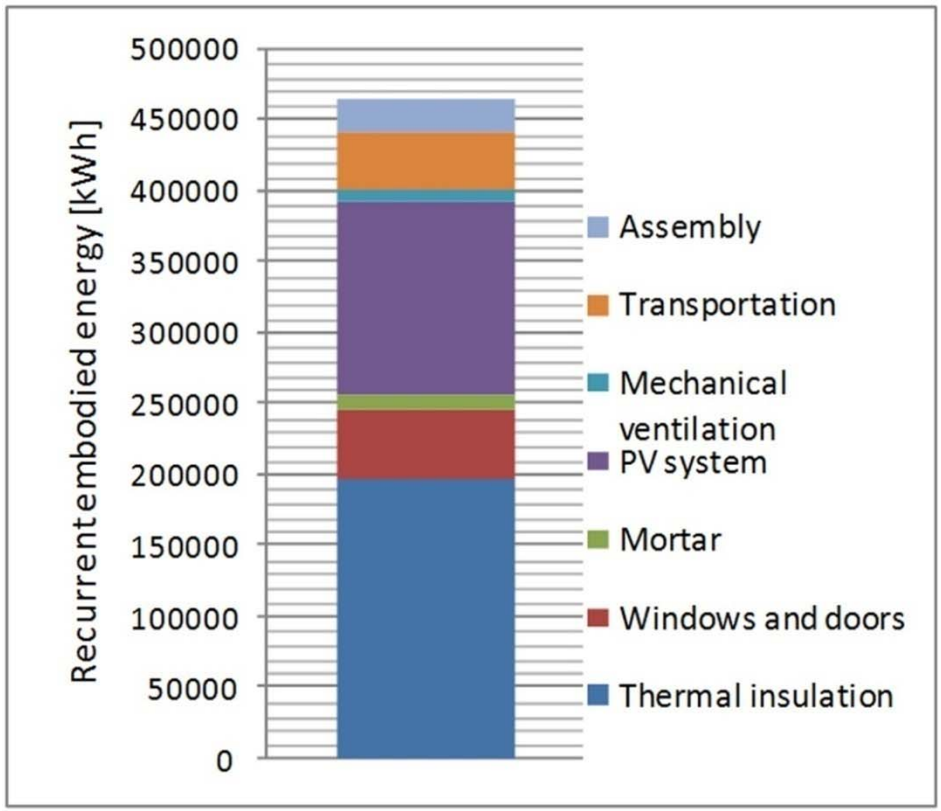
Current state

Year of construction 1973-1974
Assumptions: energy performance improvement in 2014 and residual service life 60 years

Theoretical energy performance improvement measures

- slight changes in the floorplan layout
- upgrade of the thermal envelope
- installation of the mechanical ventilation system
- roof-sized photovoltaic systems
- (heating system and boiler for water heating are considered adequate for the building use)

Energy simulation software PHPP – Passive House Planning Package



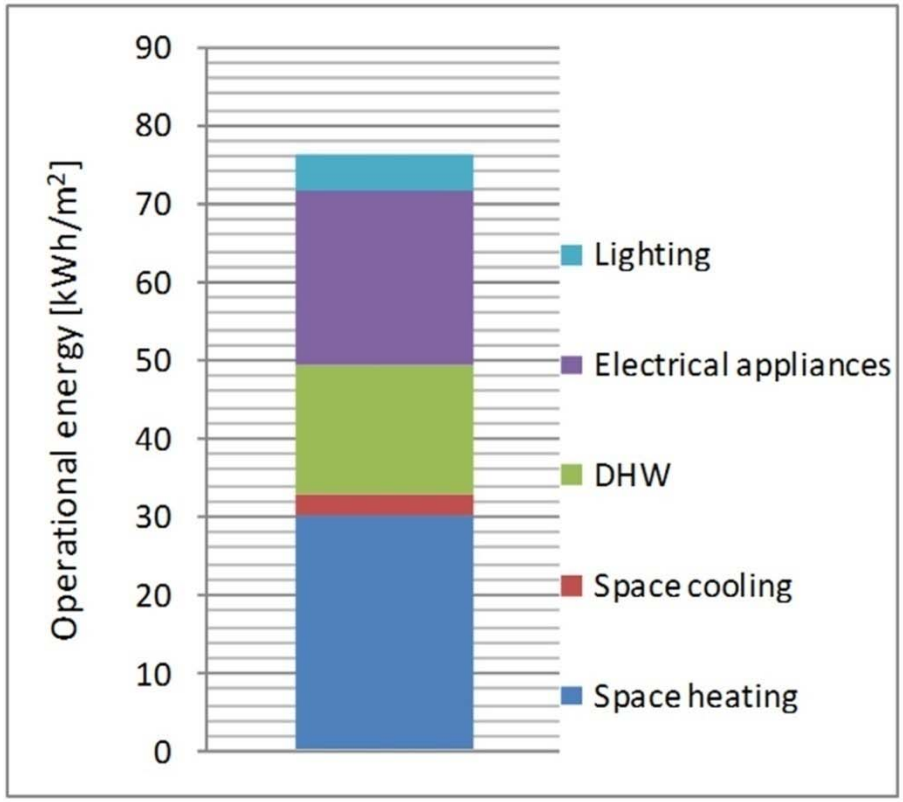


Diagram 1. Recurrent embodied energy during the residual service life of the building
Diagram 2. Annual operating energy after the building improvement process

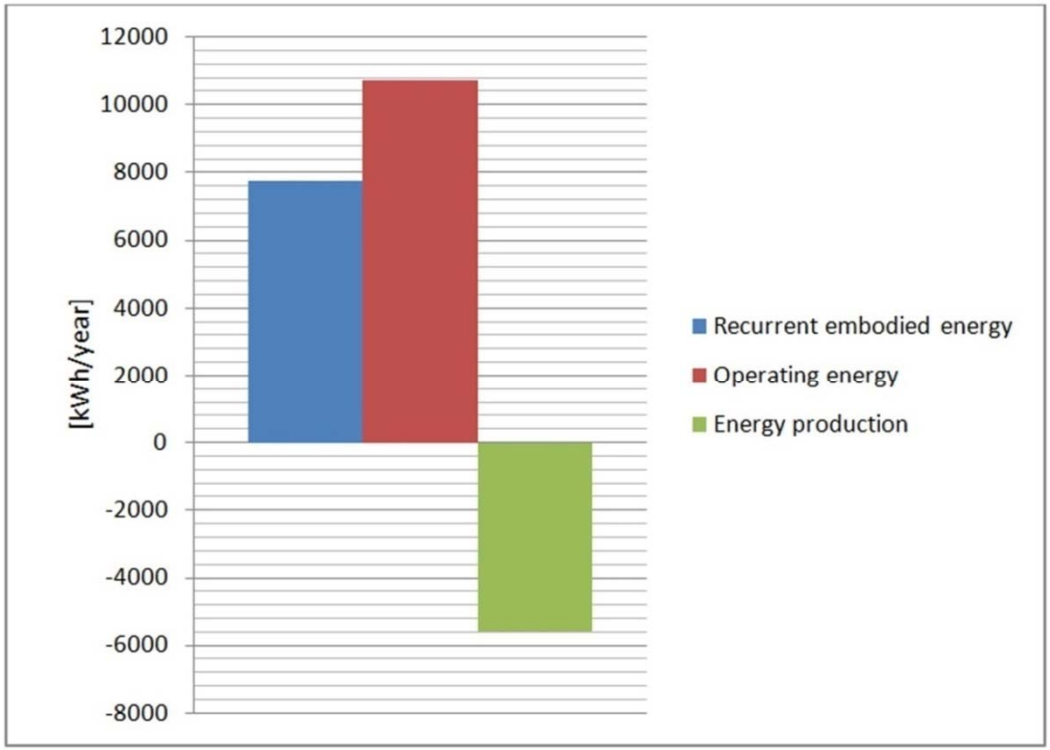


Diagram 3. Annualized energy balance after the improvement process and for the predicted residual service life of the building

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