



AEE INTEC

Institute for Sustainable Technologies

Modeling Exercise Austria

Core technologies bundle for deep energy retrofit
and their characteristics optimization through
modeling

Technical Day, Tallinn_22.09.2014

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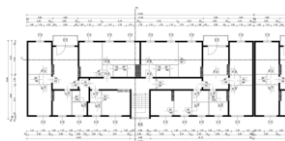
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Building model

IEA EBC ANNEX 61
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Multi-story housing block in the city of Kapfenberg



Number of floors	4
Heated gross floor area, m ²	2845
Site energy demand per m ² and year	184
Number of apartments	24

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Building model

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- Constructed 1960 – 1961
- Sandwich concrete elements without additional insulation
- Pitched concrete roof and concrete ceilings
- District heating (space heating + DHW)
- Lighting with normal bulbs
- Typical housing project for the period 1960 - 1970



Building model

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- External walls
Sandwich concrete elements without an additional insulation U-value: 0,87 W/m²K
- Roof
Pitched concrete roof with no insulation U-value: 0,87 W/m²K
- Basement ceiling:
Ceiling in concrete insulated with polystyrene U-value: 0,90 W/m²K
- Double glazed wooden windows U-value: 2,5 W/m²K
- The building envelope is characterized by a lot of thermal bridges (like balconies, walls to roof and basement ceiling)



Simulation methods

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- TRNSYS
- Modeling of a multi-zone building
- Internal and solar loads
- HVAC systems
- Dynamic simulation of heat transfer and air flows
- An Austrian Test Reference Year for the city of Graz (ASHRAE climate 5A) is used for outdoor climate:
 - Heating degree days 20°C/12°C are 3588
 - Standard-outdoor temperature -10,9°C



Simulation methods

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Internal heat gains for all scenarios

- 90 W/person
- Per flat 104 W (dependent from persons)
- Per flat 70 W (independent from persons)
- Lighting 5 W/m²
- Appliances and persons 3,25 W/m² gross floor area

DHW demand 12,8 kWh/m².a gross floor area

Airtightness n_{L50}

- 3,5/h (Scenario 0)
- 1,5/h (scenario 1 + 2)
- 0,6/h (scenario 3 + 4)



Economic calculations

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- Costs for maintenance, refurbishment, operation, replacement, synergies in downsizing of components are not accounted. The annual costs will be collected in a present value method.
- Energy price electricity: € 0,094
- Energy price district heating: € 0,079
- Inflation rate 2,20%
- Target rate 3,75%
- Inflation-adjusted target rate 1,52%
- Price rise electricity 3,90%
- Inflation-adjusted price rise electricity 1,66%
- Price rise district heating 4,80%
- Inflation-adjusted price rise district heating 2,54%

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Simulation scenarios

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Scenario 0: Baseline

Existing building

Scenario 1

Minimum Austrian requirements for retrofit

Scenario 2

Minimum Austrian requirements for new buildings

Scenario 3

Passive House standard

Scenario 4

PH-Standard + energy production on site (PV + Solar thermal system)

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