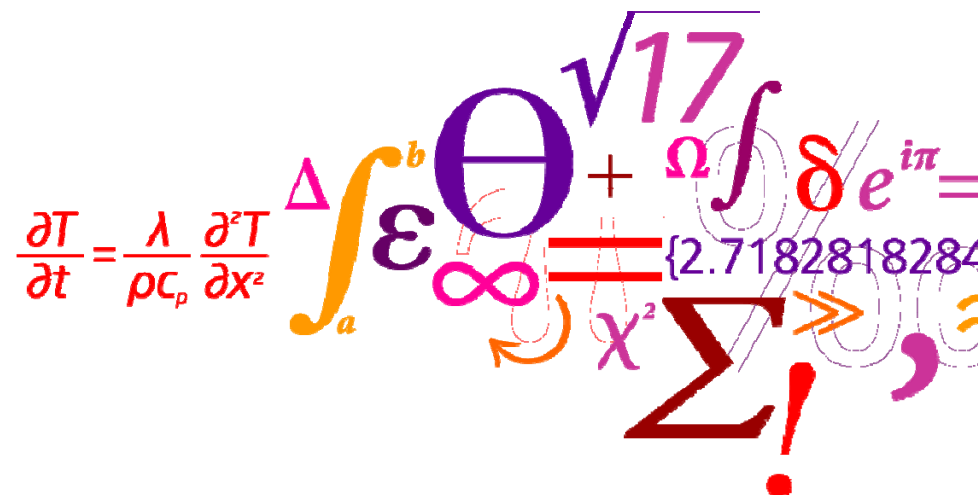


Holistic energy retrofitting of multi-storey building to low energy level

9 NSB conference, Tampere, Finland

June 2, 2011

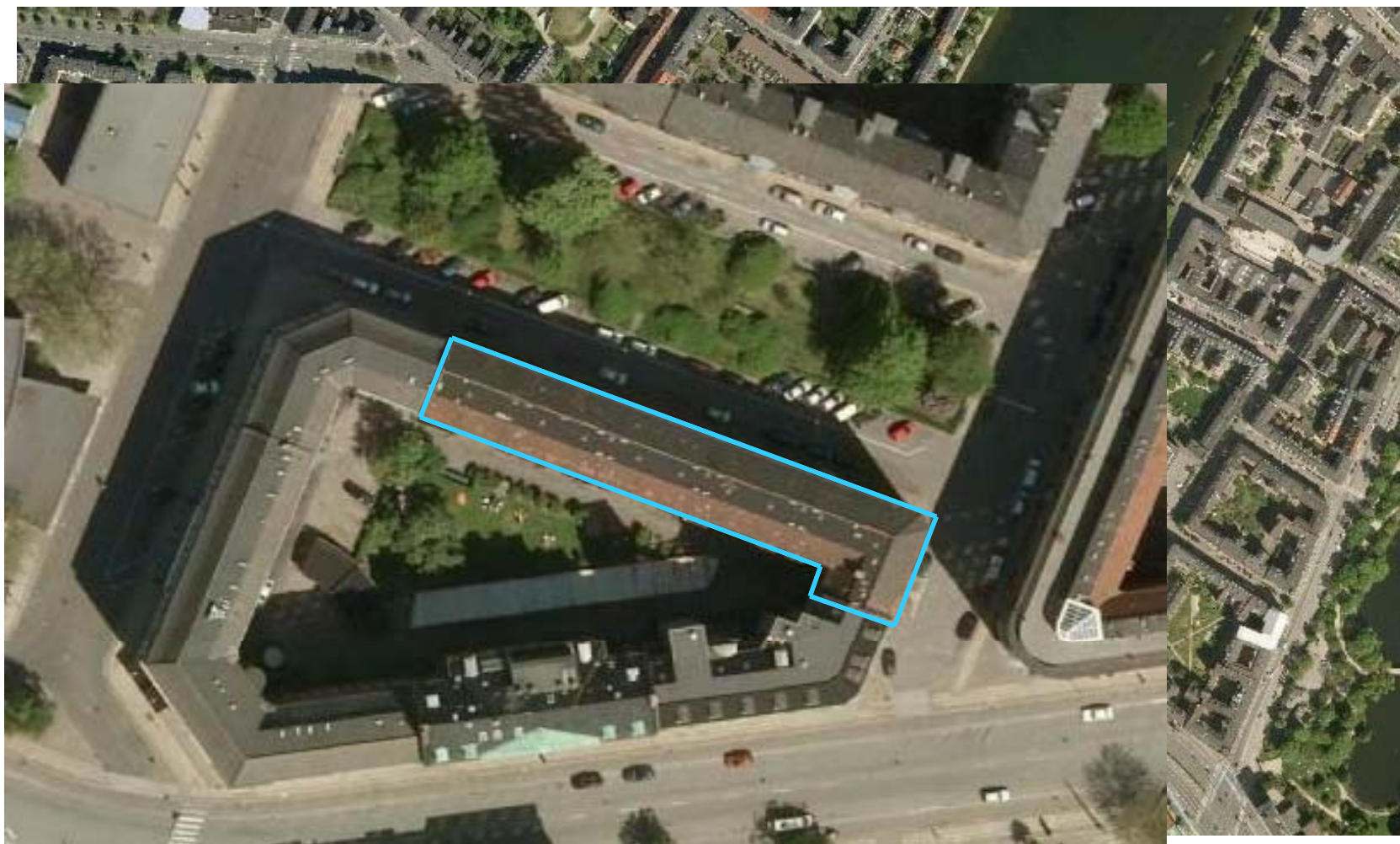
Martin Morelli, Henrik Tommerup, Morten Tafdrup & Svend Svendsen



Outline

- ❖ Introduction of building
- ❖ Retrofit approach and challenges
- ❖ Retrofit measures
- ❖ Results
- ❖ Conclusion and future work

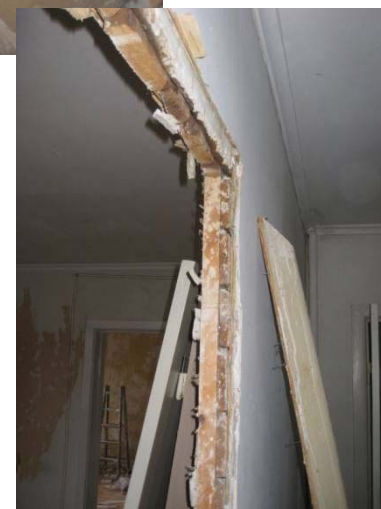
Location



Structures – envelope



Structures – inside

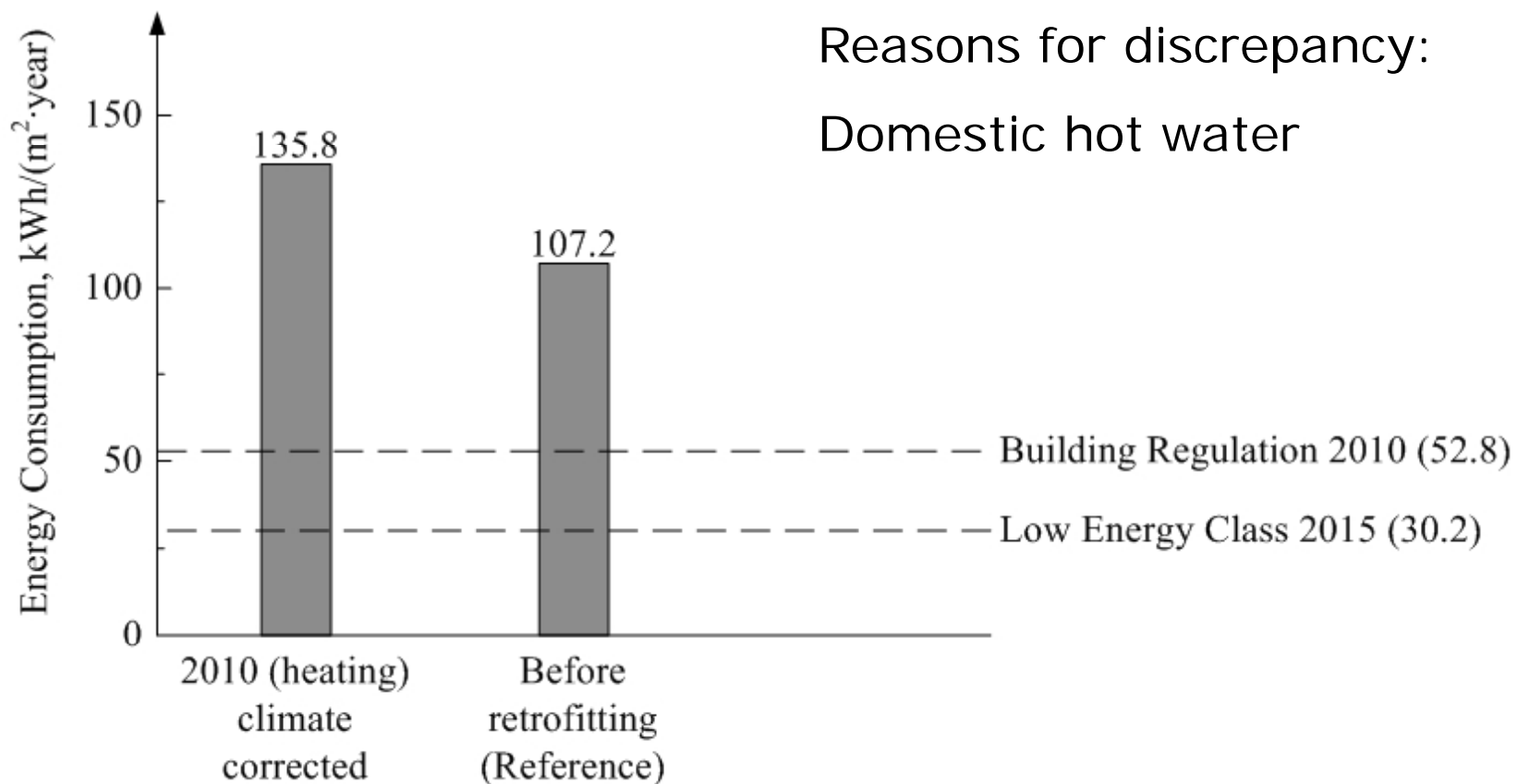


Installations



District Heating
Exhaust hood in kitchen

Energy consumption



Approach and challenges

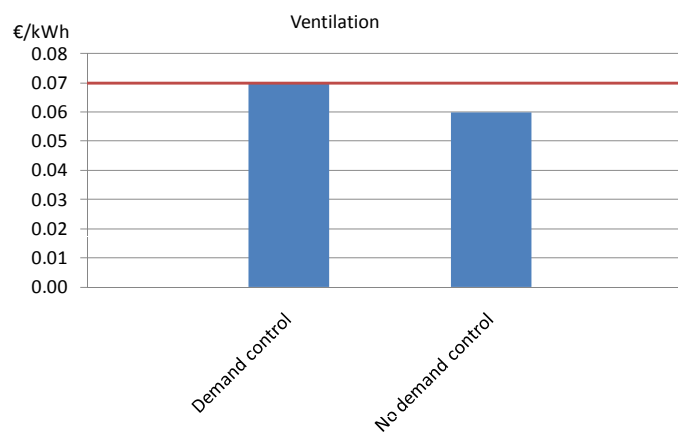
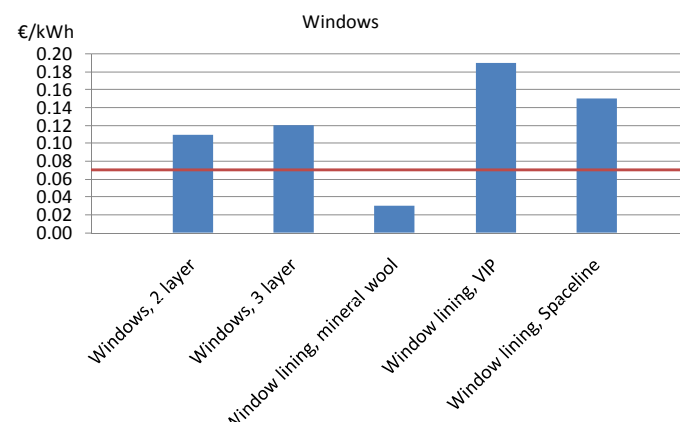
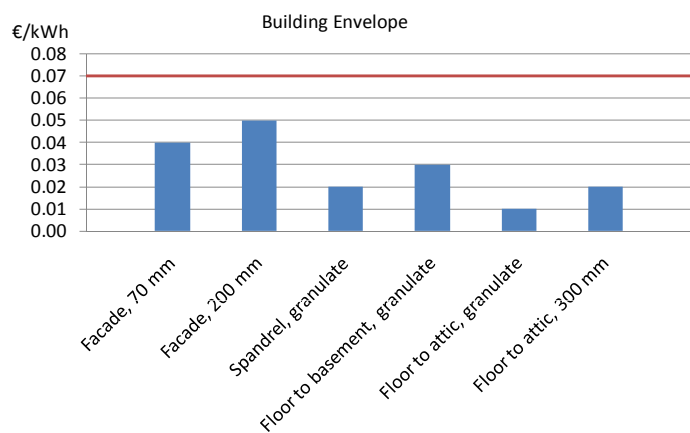
Retrofit approach

- Reduce energy consumption to 30.2 kWh/m²/year
- No renewable energy
- Single and holistic measures
- Cost of conserved energy (CCE)

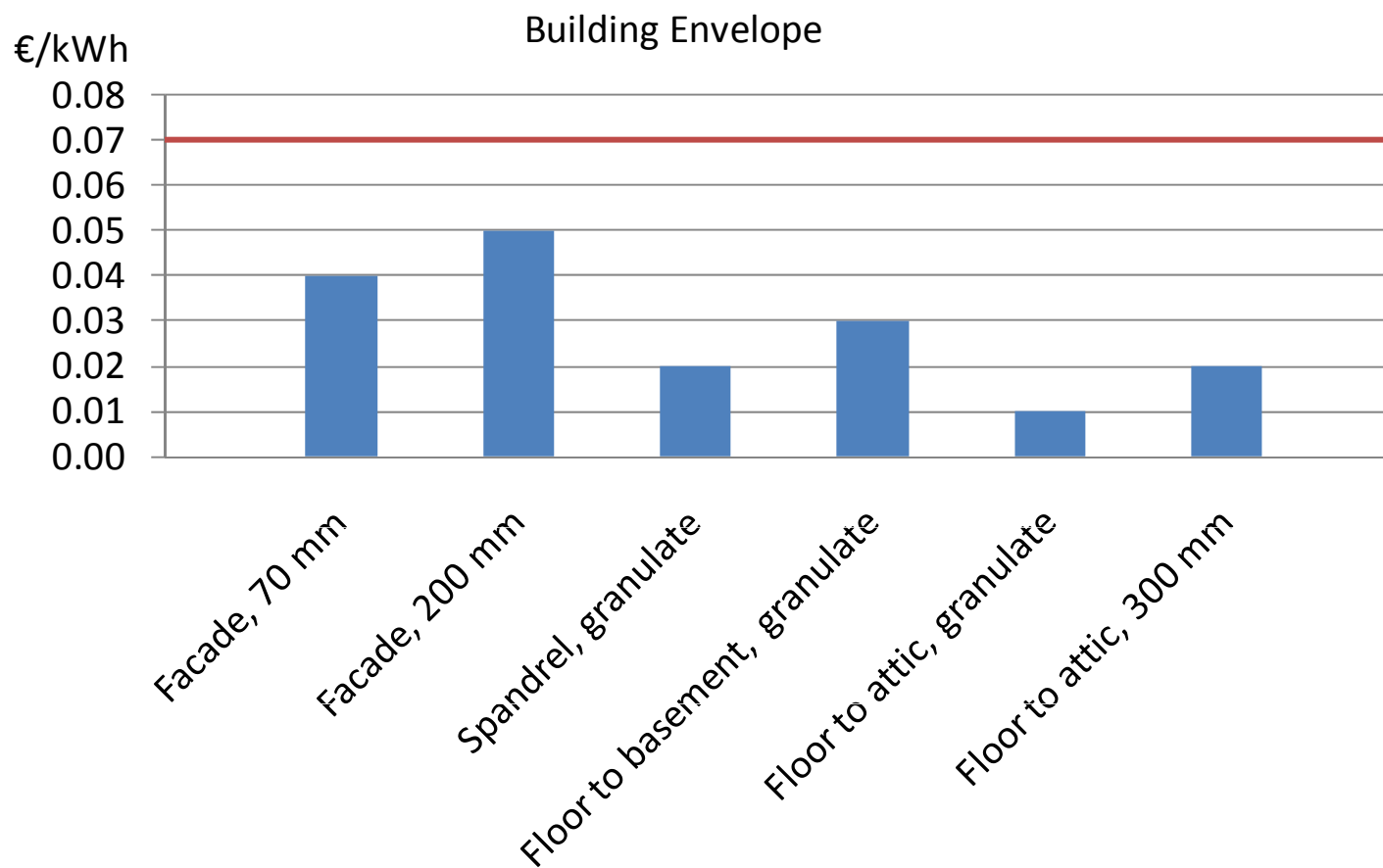
Retrofit challenges

- Facades worthy of preservation -> inside insulation
- Storage rooms in the attic -> less effective insulation
- Increased air tightness -> mechanical ventilation

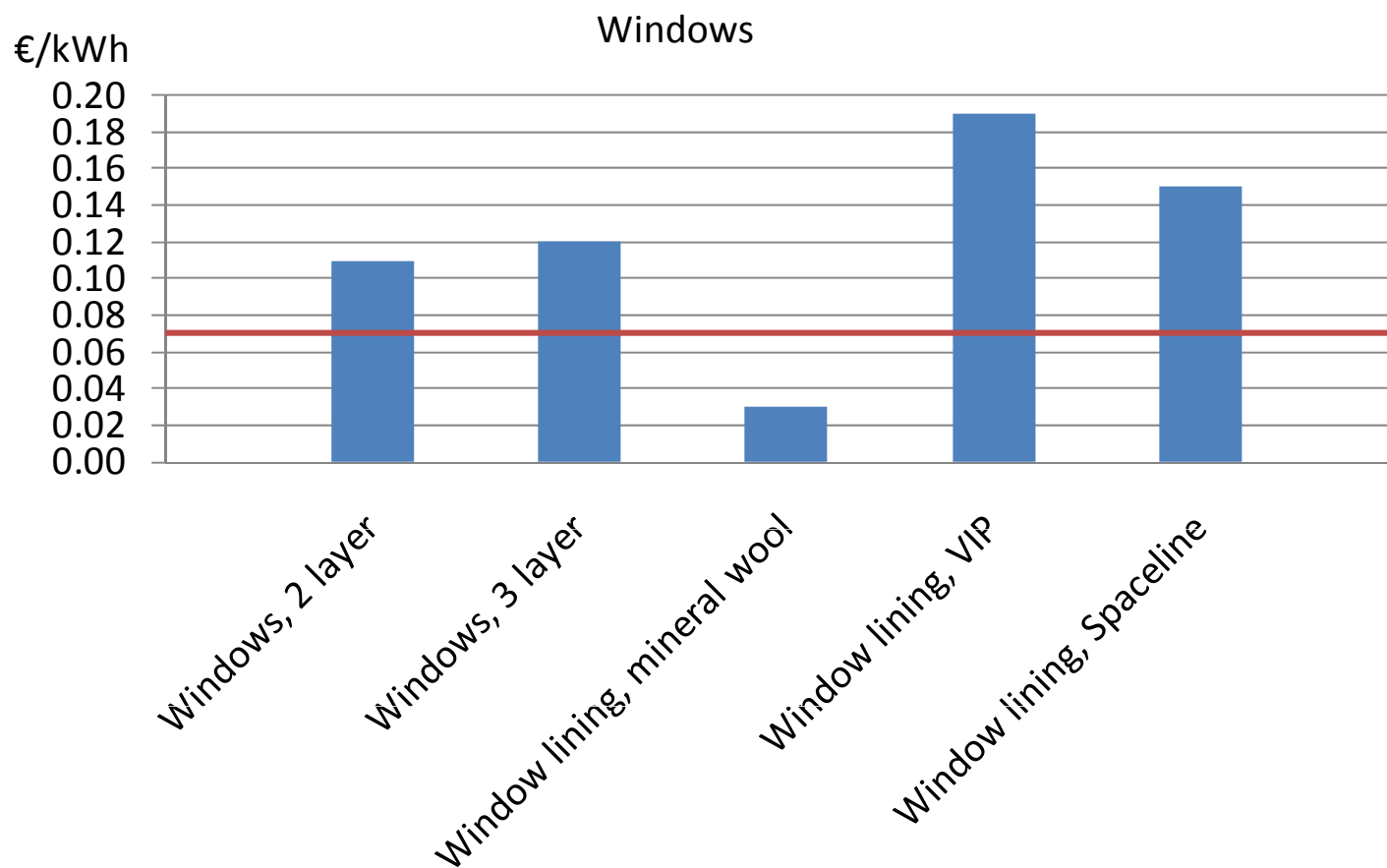
Single measure



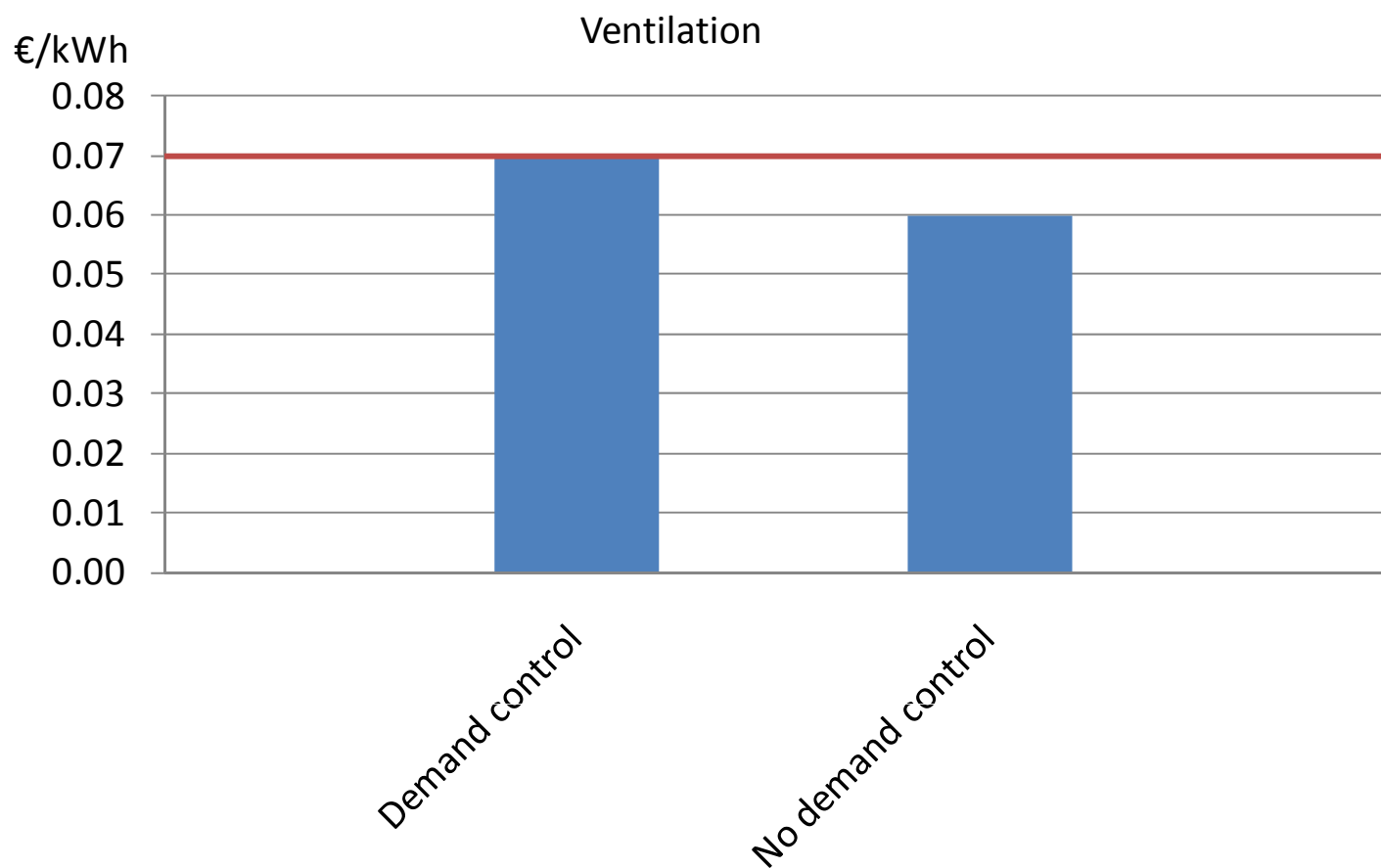
Single measure



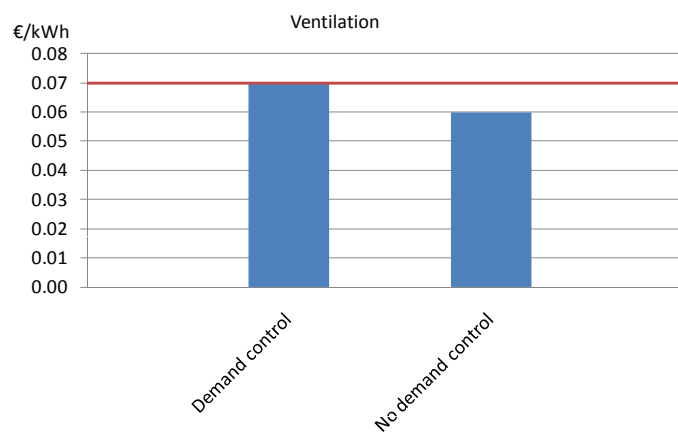
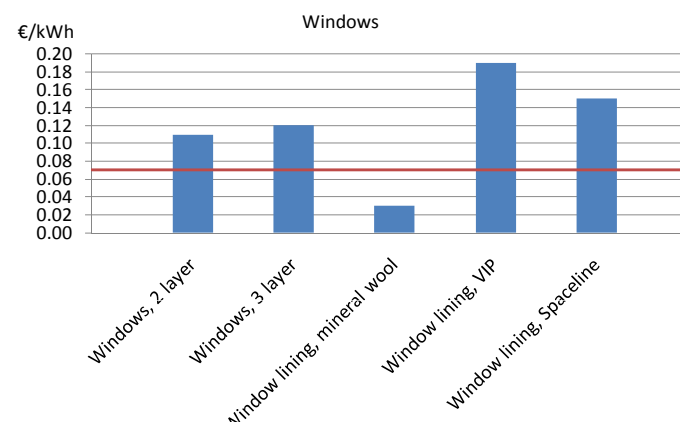
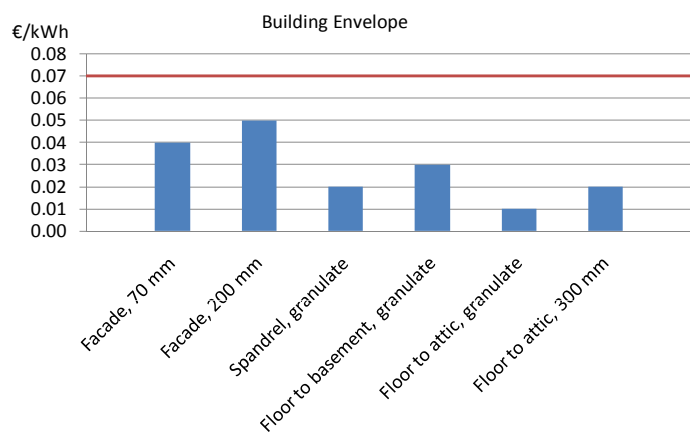
Single measure



Single measure



Single measure



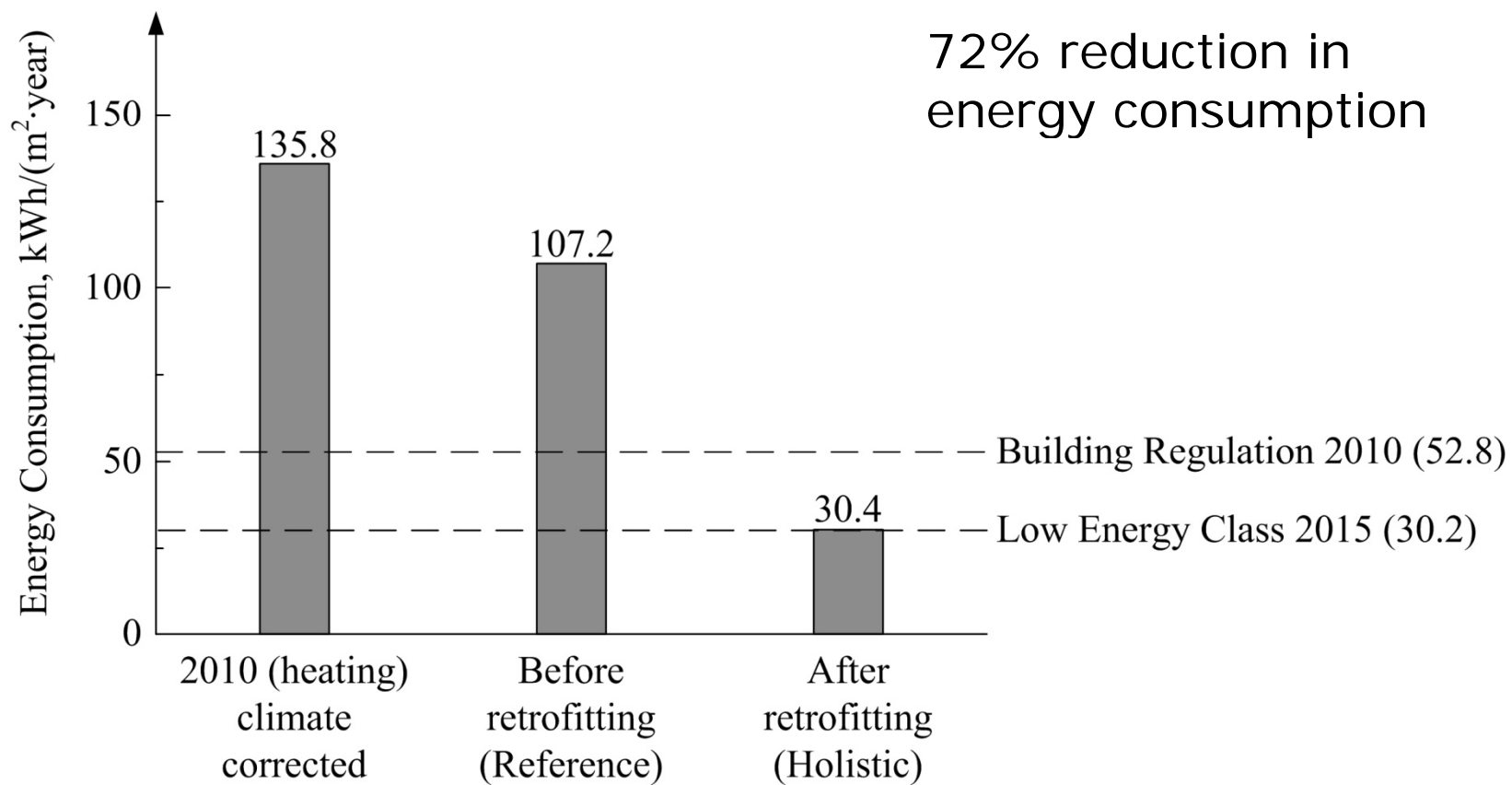
Holistic measure

- Facade, 200 mm insulation
- Spandrel, granulate
- Floor to basement, granulate
- Attic ceiling, 300 mm insulation
- Window, 3 layer energy glazing
- Window lining, mineral wool
- Demand controlled ventilation

$$CCE = 0.09$$

Building element	U-value; before, W/(m ² K)	U-value; after, W/(m ² K)
Solid masonry wall	1.23	0.19
Spandrel (cavity wall)	1.26	0.19
Windows and doors	2.30	0.92
Floor to basement - iron beam	0.97	0.42
Ceiling - wooden beam	0.81	0.12

Results



Conclusion and future work

Main conclusion

- ✓ Large energy savings can be achieved without renewable energy (72%)
- ✓ Today's building regulation can be obeyed when holistic energy retrofiting
- ✓ Holistic retrofiting is not cost-effective

What's next?

- Energy saving measure will be tried out in different apartments
- Retrofitting will be done when people move out of the apartments (up to 10 years)
- Building roof dwellings instead of roof insulation?

Thank you for your attention

Questions and comments?

