

Seminar 11 # Prediction and Verification of Energy Performance in Energy Efficient Multi-Family Dwellings

Learning Objectives

- Explain misaligned expectations between architects and buildings engineers.
- Describe how customized workflow maps can optimize the energy modeling process.
- Have gained knowledge from experience from an evaluation of nine properties with energy efficient multi-family dwellings.
- Have an insight to what might be the reasons to the gap between measurements and simulation results.
- Distinguish between the two general factors causing the discrepancy between predicted energy performance and actual energy consumption.
- Recognize that even projects following the LEED process do not always perform as well as predicted.

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Acknowledgements

- Dennis Johansson, Lund University, Building Services

Energy Requirement, the housing exhibition Bo01

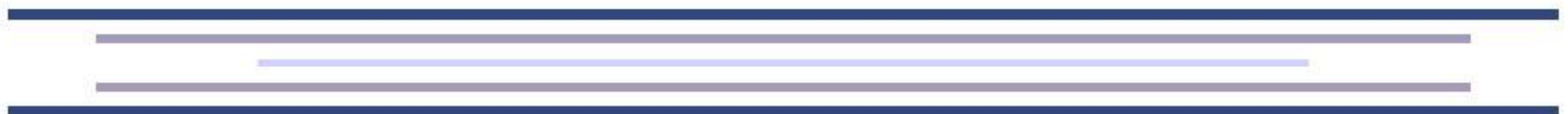
- Space Heating
- Domestic Hot Water Heating
- Common Electricity
- Household Electricity

<105 kWh/m² and year



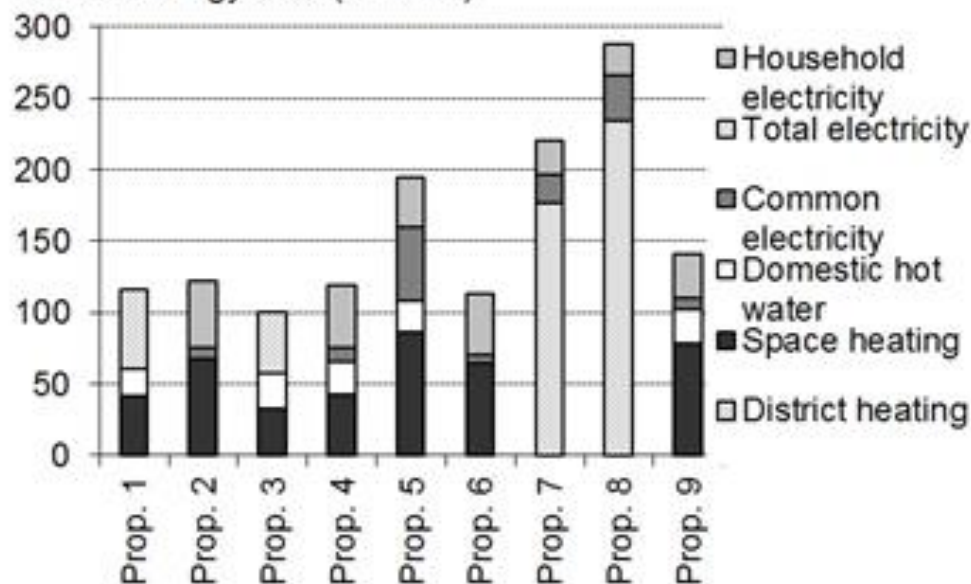
Different technical systems

- Mechanical exhaust air ventilation
- Mechanical supply- and exhaust air ventilation
- Ventilation heat exchanger
- Exhaust air heat pump
- Apartment units
- Under floor heating
- Radiators
- Towel dryers electric/hydronic
- Under floor heating in bathrooms electric/hydronic

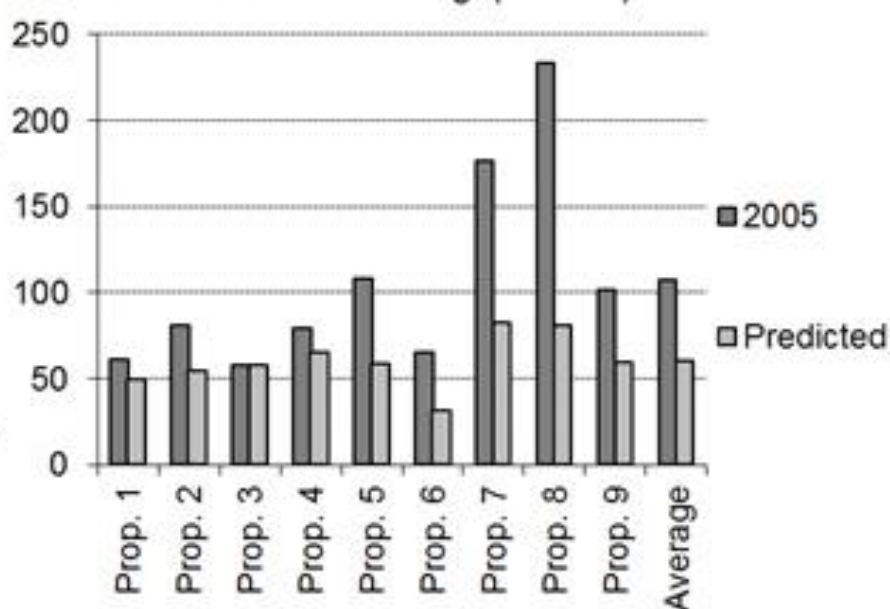




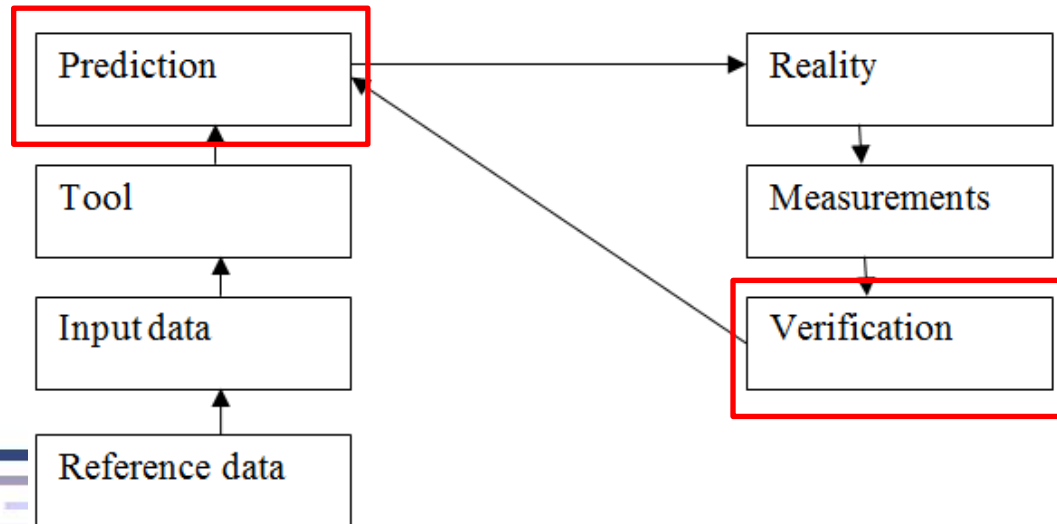
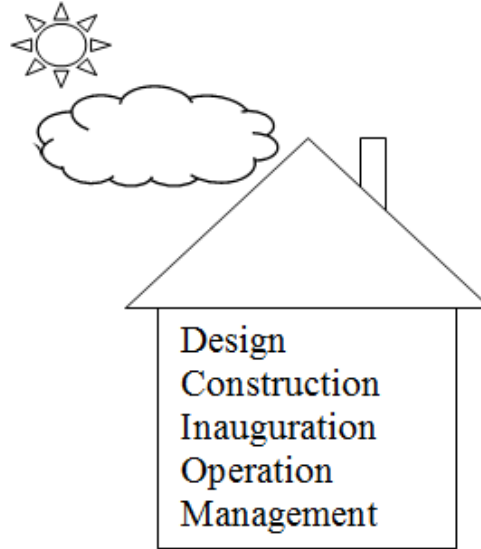
Annual Energy Use/ (kWh/m²)

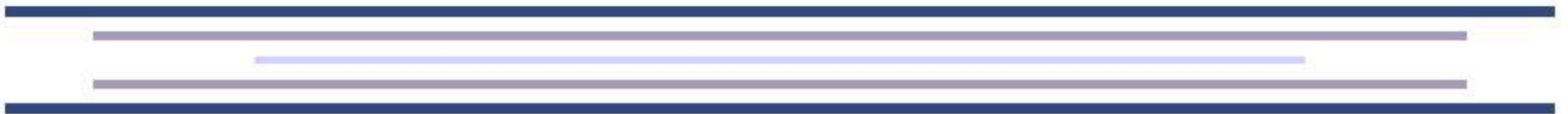
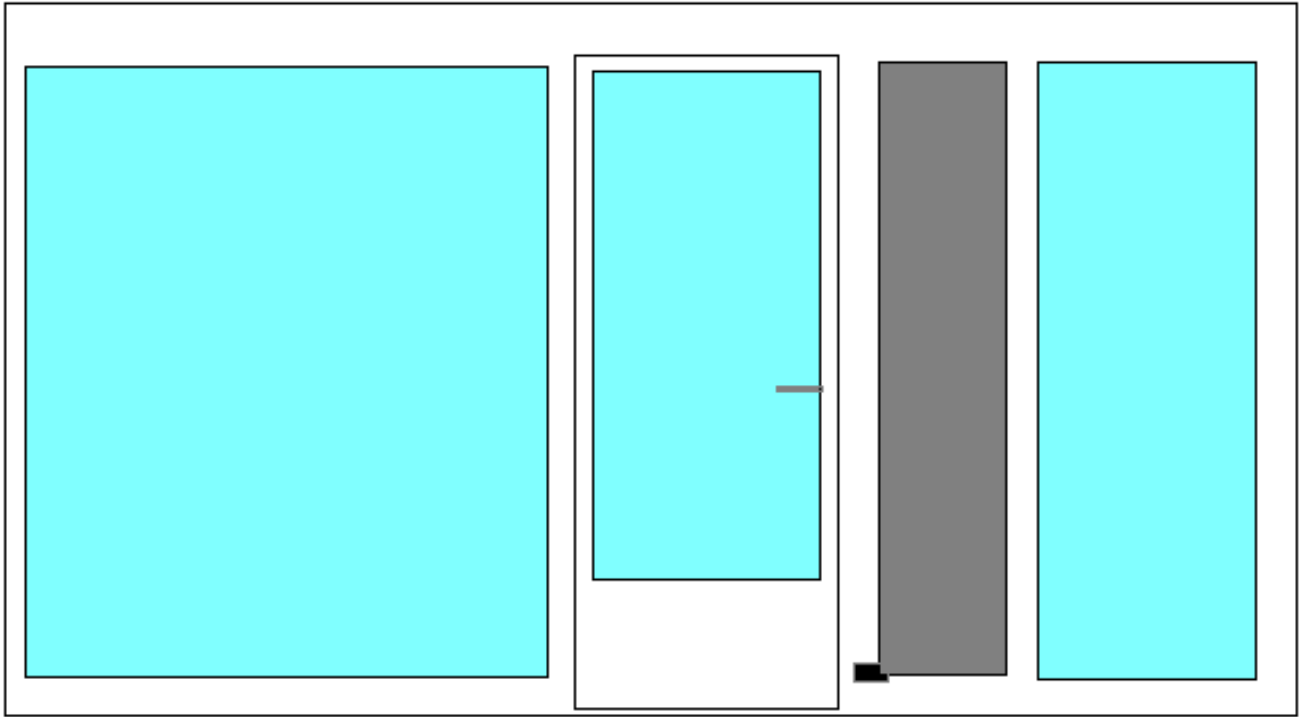


Annual Use of District Heating/ (kWh/m²)



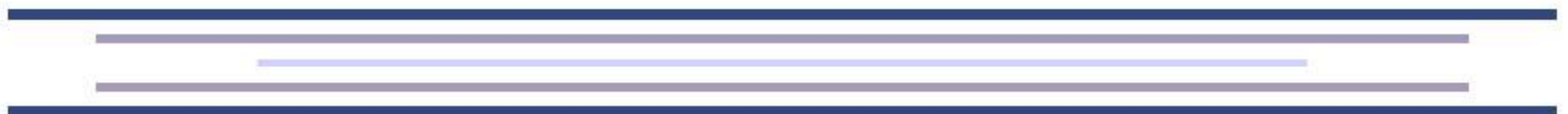
Prediction \neq Verification





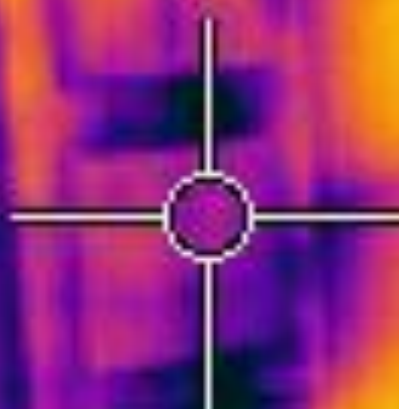
Cold

Hot



FLIR

+ 14.2°C



20



11

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District Heating

- Lowest: 58 kWh/m²
- Highest: 234 kWh/m²
- Mean: 111 kWh/m²
- Floor heating: 173 kWh/m²
- No floor heating: 70 kWh/m²
- Heat recovery: 72 kWh/m²
- No heat recovery: 145 kWh/m²

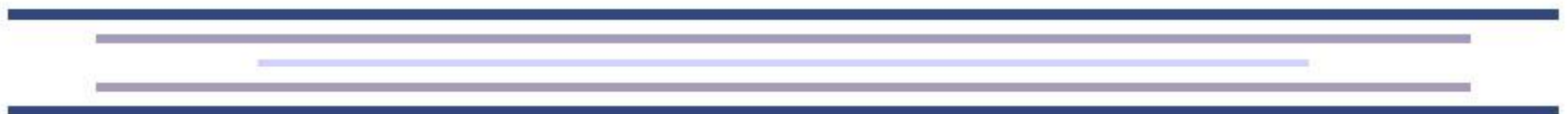


- Floor Heating
- Large Windows
- No Heatrecovery



Annual Household Electricity

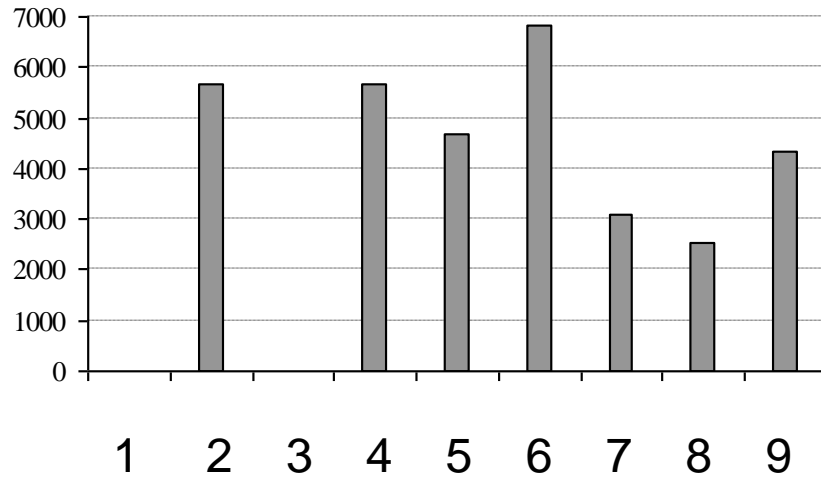
- Household electricity: 2800 kWh
- Electrical heaters in bath: 4900 kWh
- Apartment unit: 6200 kWh



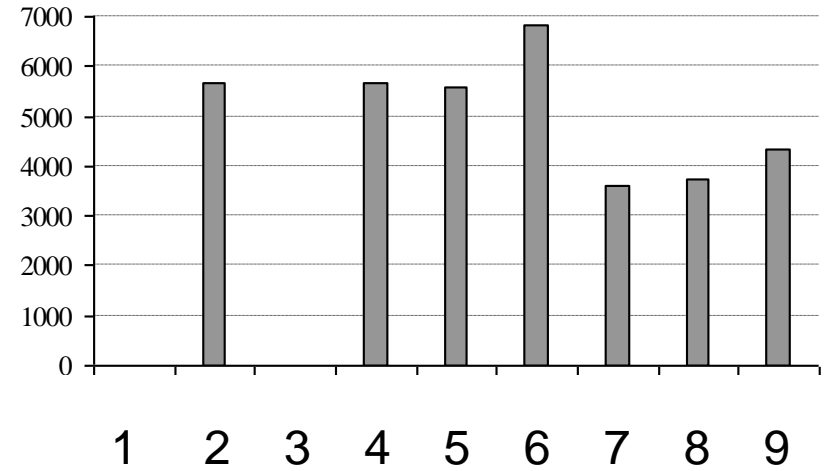
Which Property was most energy efficient?



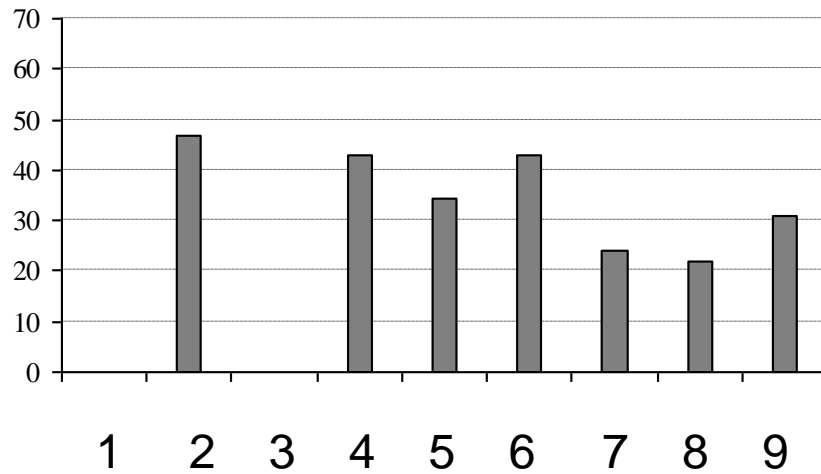
Annual household electricity use/ (kWh/apartment)



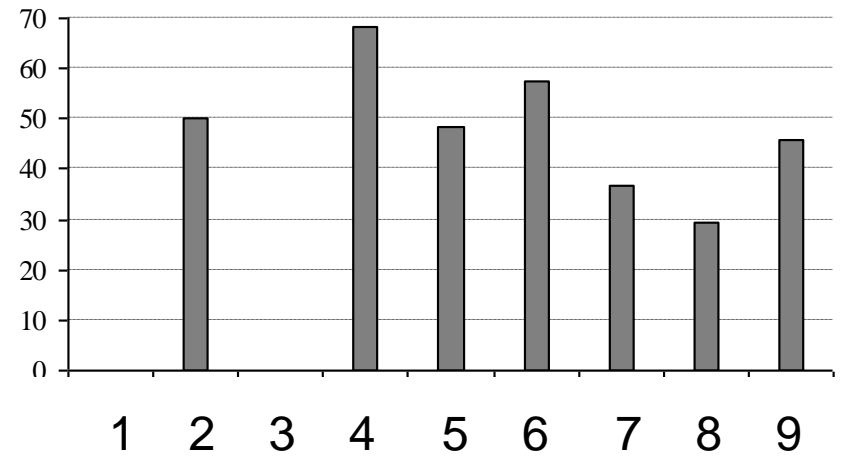
Annual use of household electricity/ (kWh/apartment)



Annual use of household electricity/ (kWh/m²)



Annual use of household electricity/ (kWh/m²)



Conclusions



Questions?

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