

ICT-based Solutions in Achieving Building Energy Efficiency



Huafen Hu & Geoff Jenks

Dept. of Mechanical Engineering, Portland State University

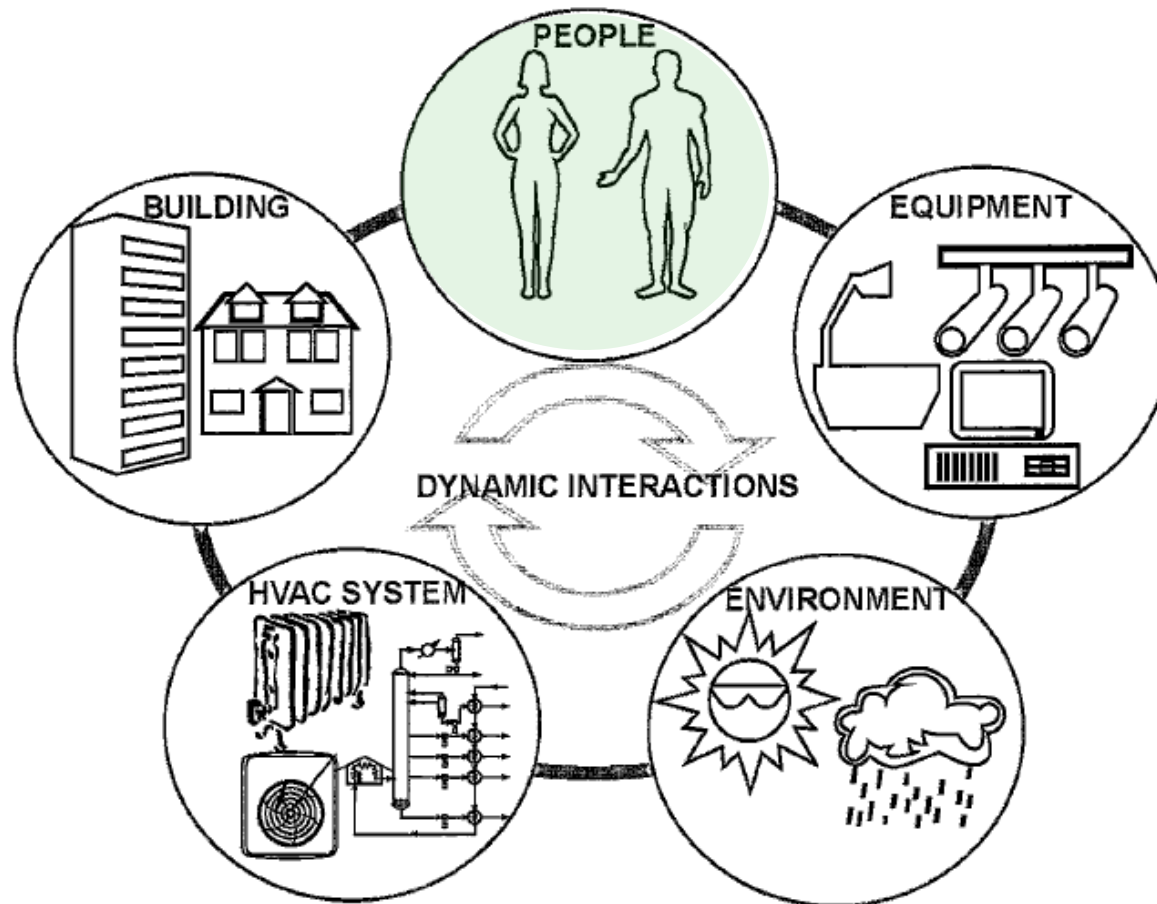
Yonghong Huang, Milan Milencovic, Ulf Hanebutte

Energy & Sustainability Lab, Intel labs

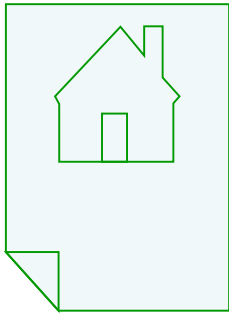


Portland State
UNIVERSITY

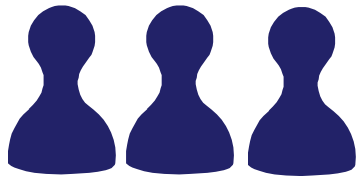
A complex system



Design Challenges



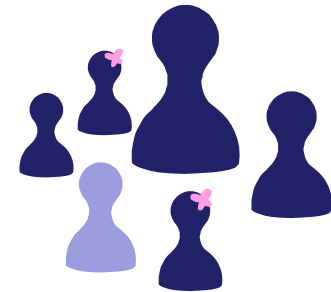
As-designed



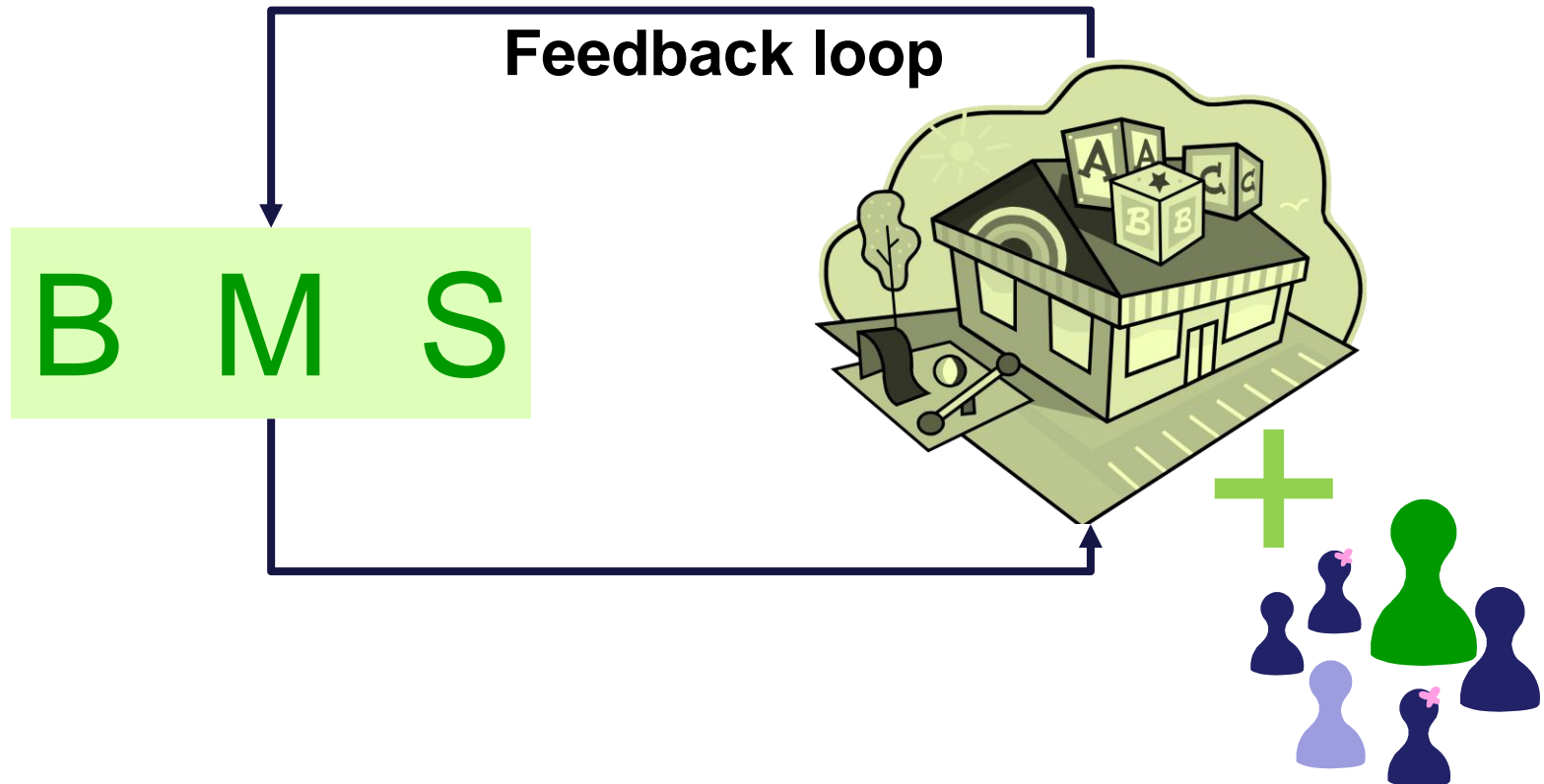
As-built



As-operated



Control Challenges



An ICT-based Solution: POEM

Personal Office Energy Monitor (POEM)

By Energy Sustainability Lab, Intel Labs

IT-infrastructure based sensor system

2-Way Interaction between building and occupants

- Energy Report
- Ambient Report
- Feedback Report



Pilot study 1

An office building in Paris, France

Lasted 73 days, with 23 participants

Diverse participants:

different floor/department/disciplines/zones

Performance matrices:

actual occupancy rate

energy consumption profile

Method



Power sensor: software sensor

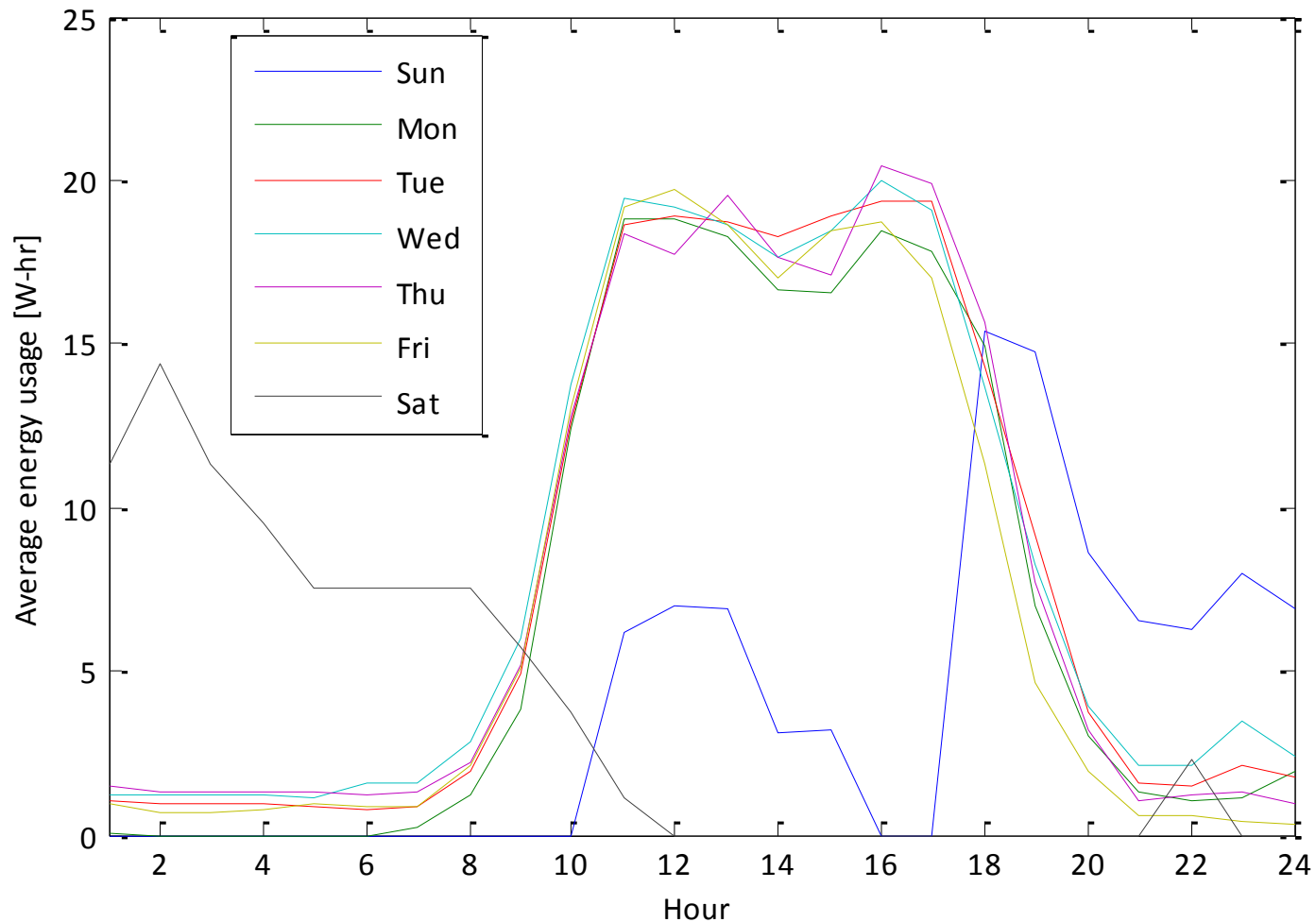


Environment sensors: physical sensors

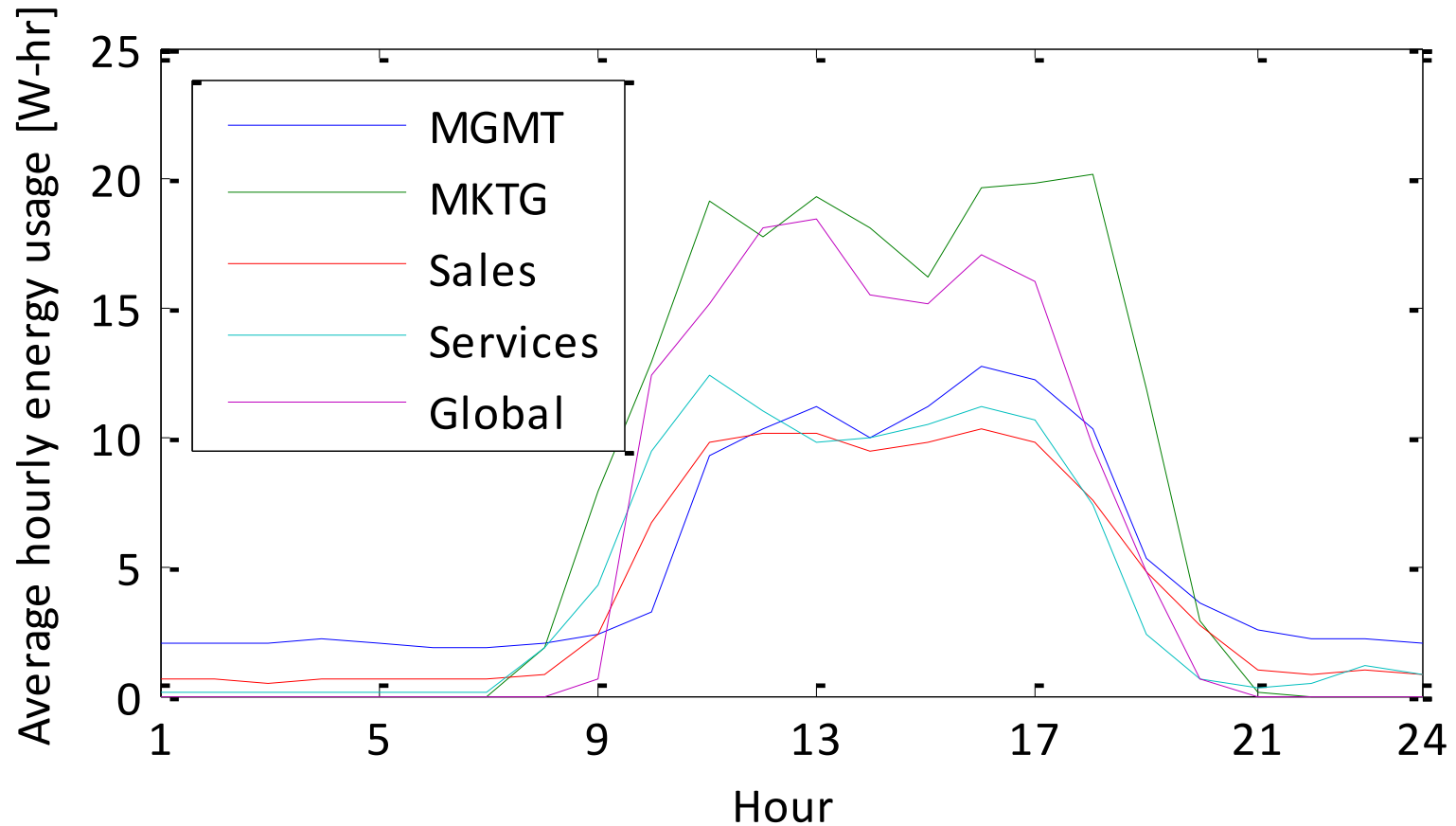
Dock Station



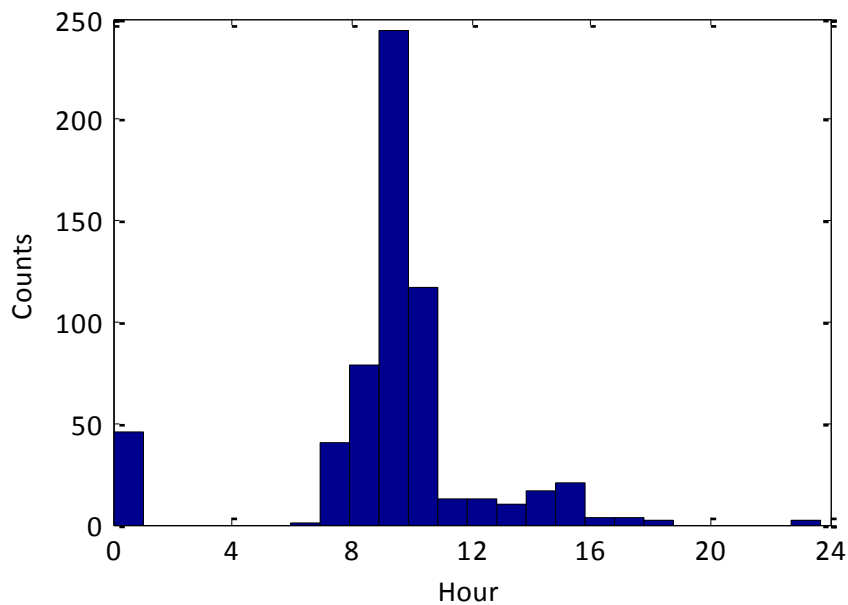
Average energy usage profile



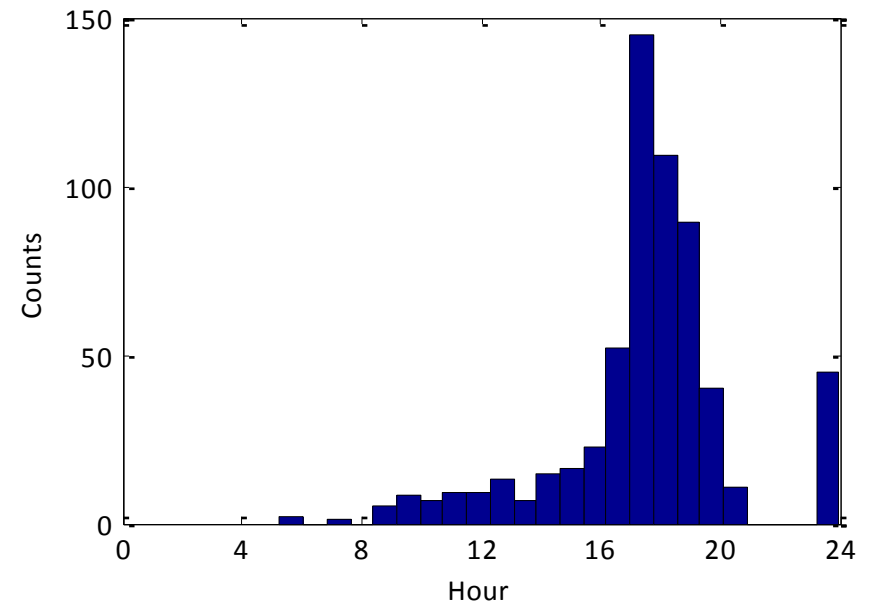
Average energy usage profile



Average occupancy profile

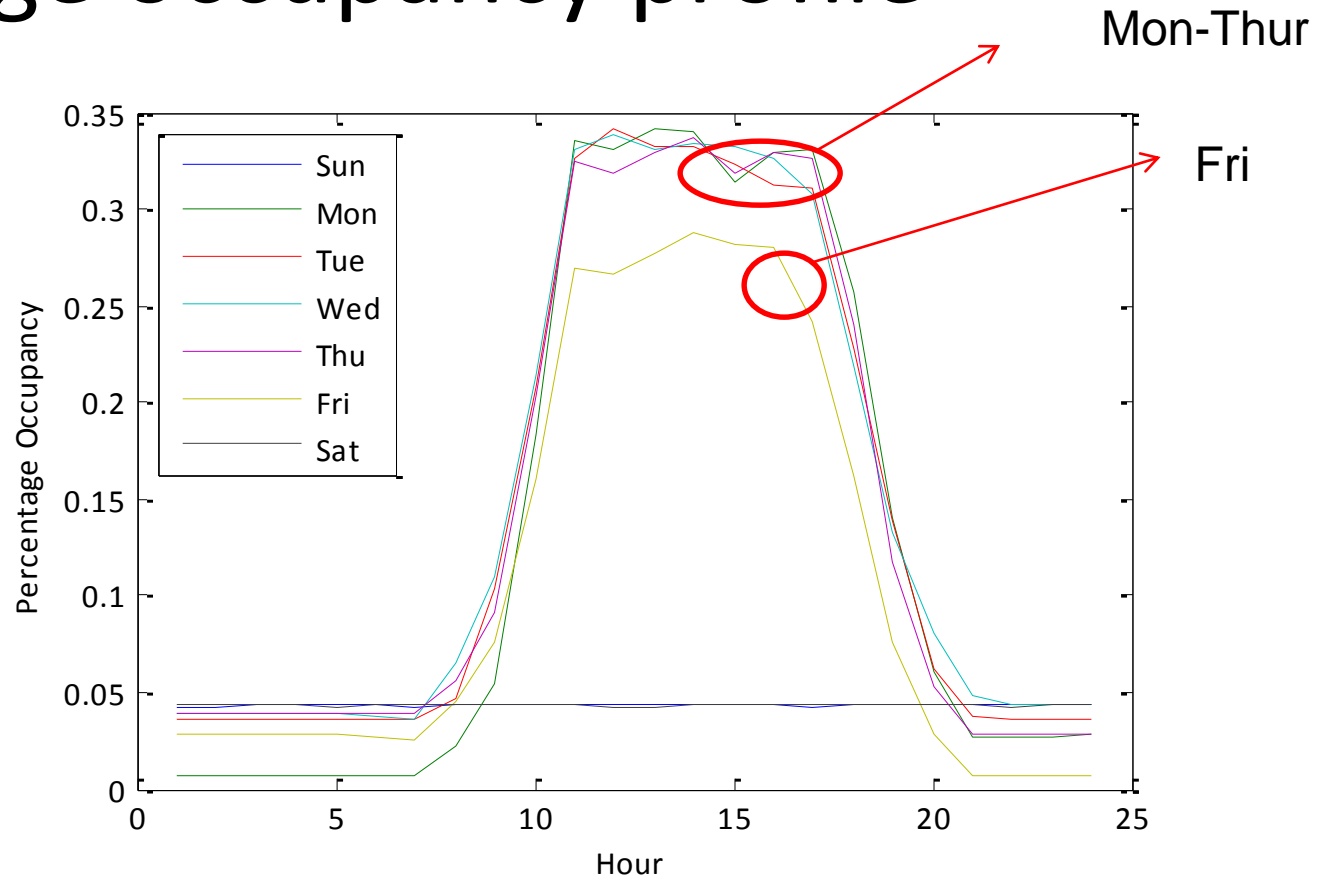


Starting time



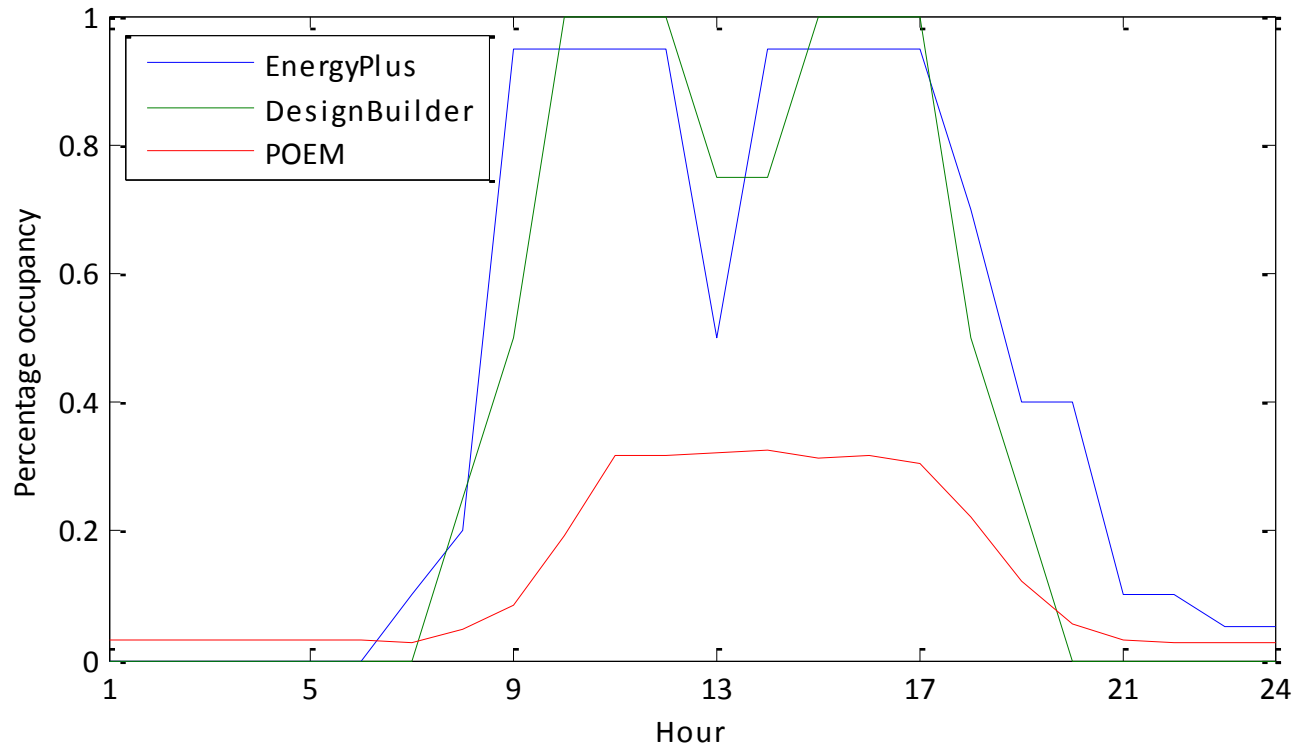
Leaving time

Average occupancy profile



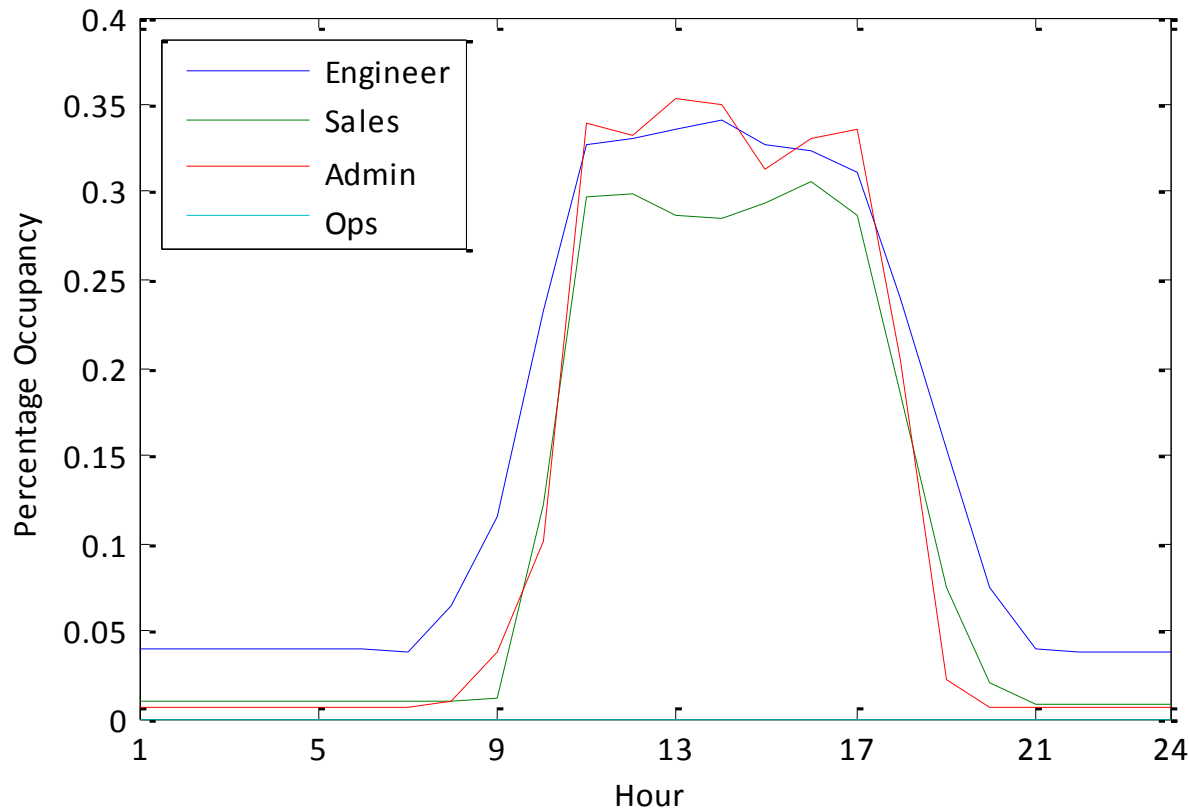
The peak occupancy in averaged occupancy rate is less than 35%

Average occupancy profile



The observed average occupancy rate is considerably lower than what has been assumed in most building energy studies

Average occupancy profile



Occupancy rate varies among employees from different disciplines

Conclusions

- On average, only around 40% people present in the pilot office space at regular work hours.
- Actual occupancy rate varies with day of the week, and occupants' department and profession.
- More realistic occupancy rate/profile needs to be updated and provided to design professionals; and ICT-based sensors could be used to do large-scale field data collection