An Experimental Investigation of Occupancy-Based Control of Commercial Building Climate

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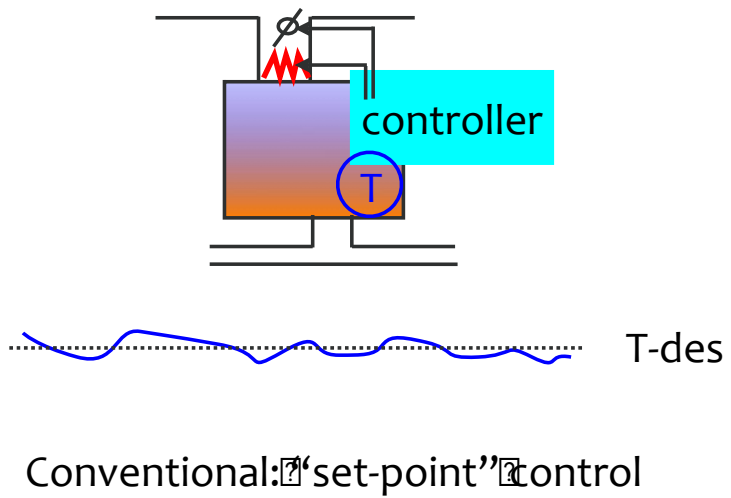**[2] Pacific Northwest National Laboratory**
[3] Lutron Electronics
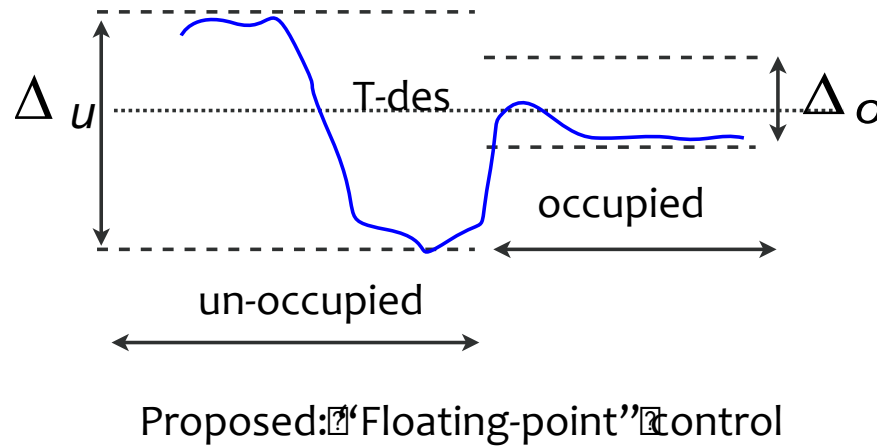**[4] Department of Industrial and Manufacturing Systems Engineering, University of Missouri**

More info: http://humdoi.mae.ufl.edu/~pbarooah/Research/PBResearch_buildings.html

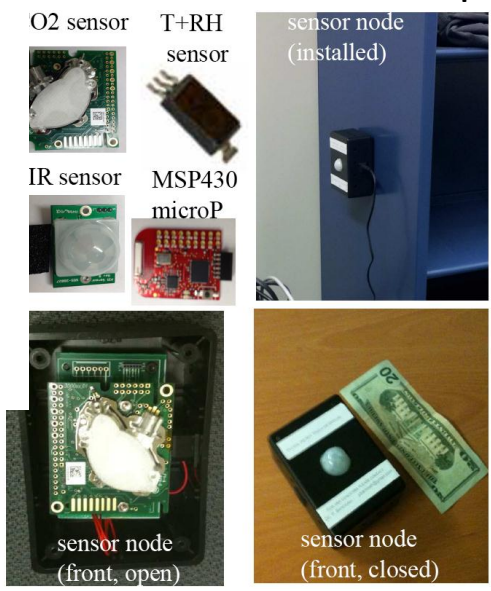# Climate control for occupants, not by the clock

What is done now

controller

T-des

Conventional: "set-point" control

What we propose

Δ_u T-des Δ_c

occupied

un-occupied

Proposed: "Floating-point" control

Requires (1) occupancy sensors + (2) control algorithm

1. UF wireless sensor module

MSP 430 microP + motion detector + [T + RH + CO2] sensors

O2 sensor   T+RH sensor   sensor node (installed)

IR sensor   MSP430 microP

sensor node (front, open)   sensor node (front, closed)

2. UF-developed control algorithm: MOBS (measured occupancy-based setback) control

Siddharth Goyal and Herbert Ingley and Prabir Barooah, **Occupancy-Based Zone Climate Control for Energy Efficient Buildings: Complexity vs. Performance**, *Applied Energy*, 106 (3), pp. 209-221, June, 2013,
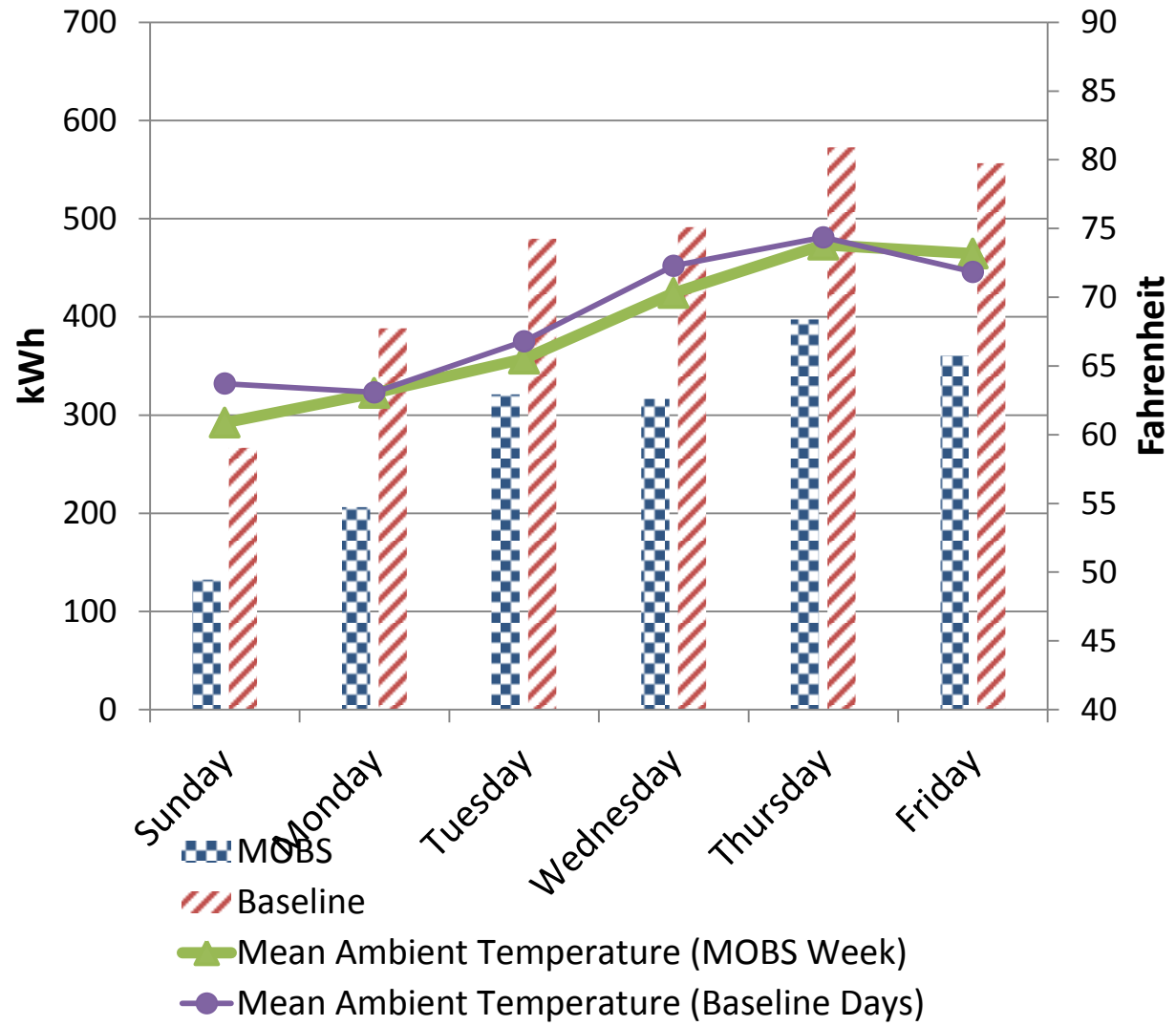
Experimental Results: 12 zones in Pugh Hall, April '13

Energy Consumption: MOBS* vs. Baseline: ~ 40% reduction

***M**easured
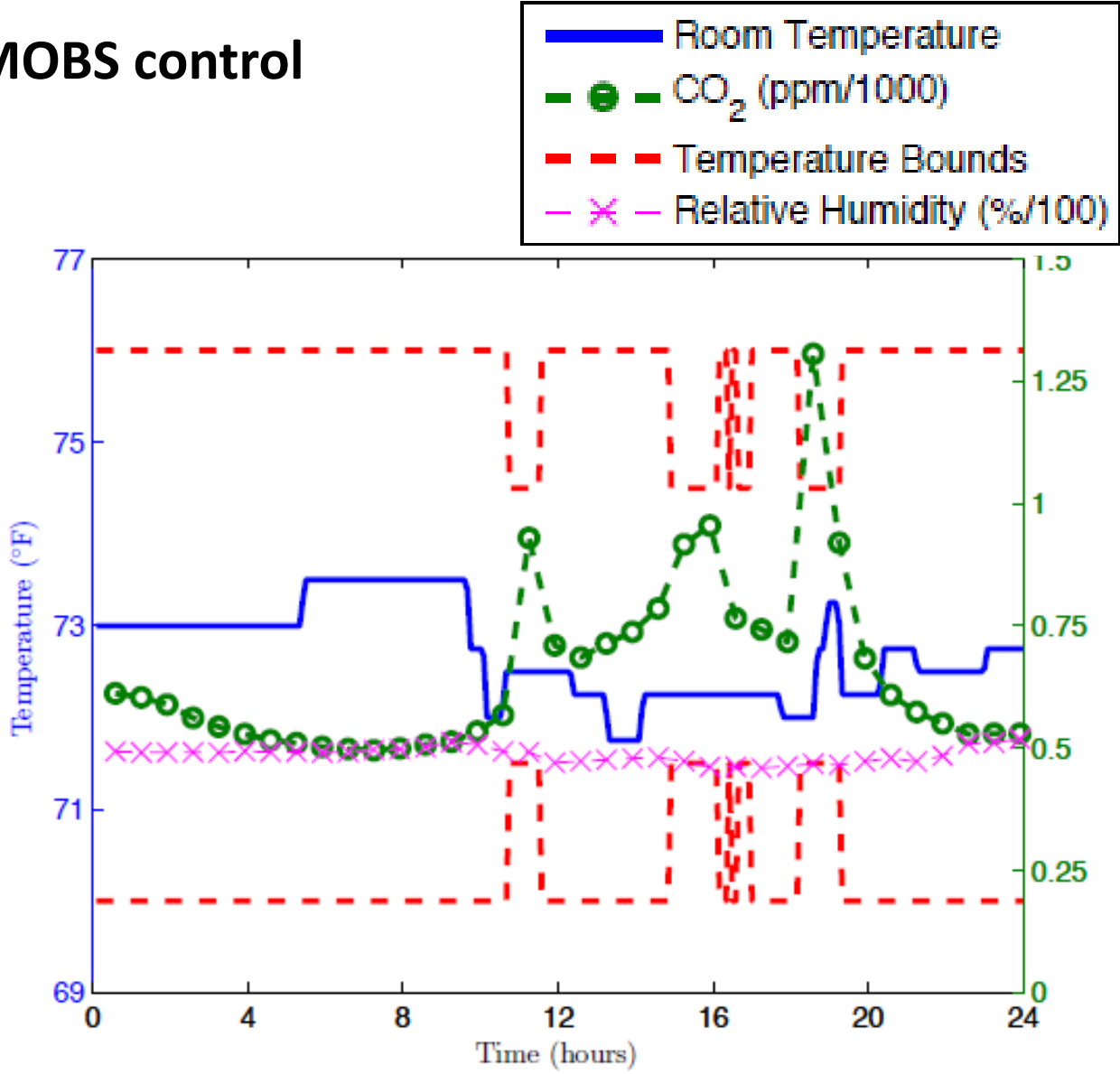**O**ccupancy-**B**ased
Setback control

Pugh Hall, LEED silver

Room climate under MOBS control

Pugh Hall, LEED silver

Conclusions

❖ **Real-time occupancy-based control can reduce energy consumption.**

  ➢ Even with binary measurements (presence/absence)

❖ **No reduction in indoor air quality and comfort**

❖ **Low-cost, payback period less than 2 years**

  ➢ low cost sensors, easy retrofit of existing buildings, no equipment change required, only software add-on to existing HVAC system

Ongoing extensions

Much higher savings with

❖ "number of occupants" measurements (optical or thermal camera + algorithms)

❖ Whole-building optimal control

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