Residential Energy Management

HVAC Control with Distributed Wireless Sensing

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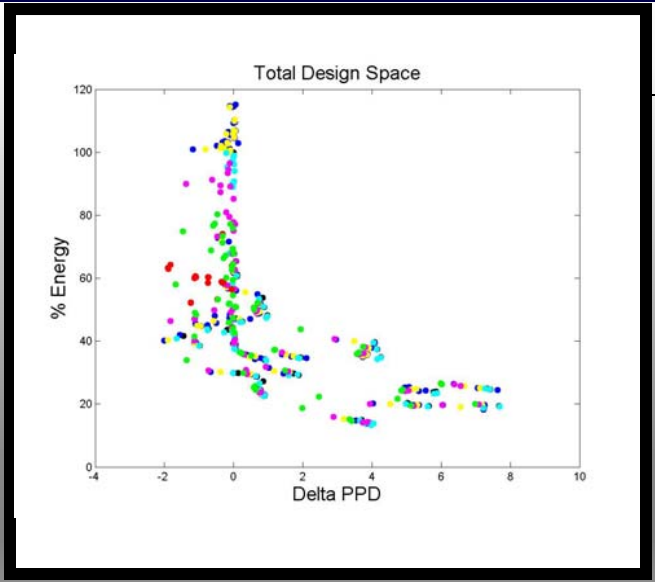


Vision

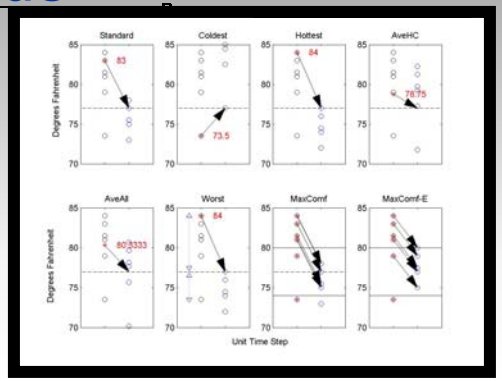
Challenge: California's peak demand exceeding supply.
Challenge: National base demand encroaching supply.
Objective: Simultaneous reductions in base and peak load are needed to resolve the problem.
Vision: A wireless sensor network enabled residential HVAC that reliably balances occupant comfort with automatic, reactive short-duration load shedding and long-term energy reduction for 10 years without maintenance.

Research Questions

Residential HVAC Problems:
Assumes single point is representative
On-off systems inherently oscillate about a set-point or deadband
Hypothesis: Distributed temperature sensing will reduce energy consumption by valuing all rooms rather than a single room, resulting in fewer actuations.

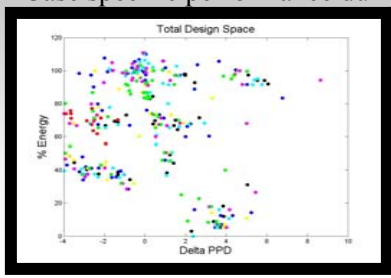
Methods

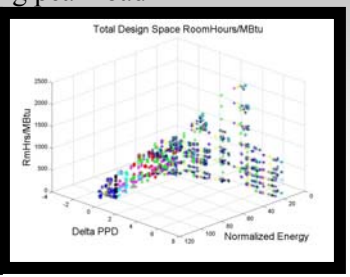
CNE simulation engine
4 house profiles (1728 sq. ft.)
12 month simulation.
2 thermostat setting policies.
Automatic, Manual (by season).
2 weather profiles (TMY2001 data)
Sacramento and Lake Havasu
Peak load times
51 hours/year, 3 hour periods.
Assumptions:
One sensor in each room.
No data loss from sensors/network.
Precise temperature measurement.
No thermal variation within room.



Findings

- Reducing energy requires trading PPD when control deadband encapsulates inter-room temperature distribution
- MaxComf highly improbable to increase mean PPD
- Case specific performance during peak load





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