

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.

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

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.

