



# Improving the CEC Residential Simulation Engine

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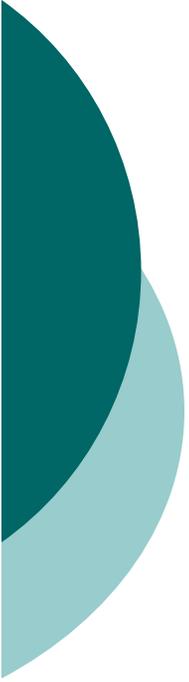


# Improving the Residential Simulation Engine

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## Topics

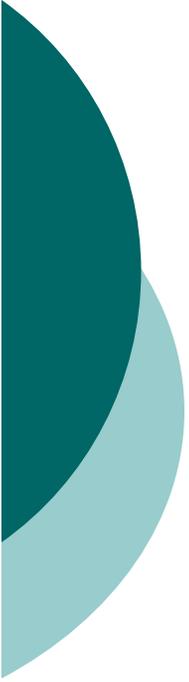
- Roles of simulation in a performance standard
- The important technical challenges
- UZM, an improved roof/attic/duct calculation for the 2008 Standards
- CSE a new California Simulation Engine
- 2011 Standards Research Program



# Standards

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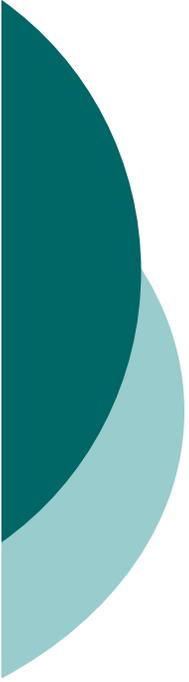
- Prescriptive Standard prescribes the efficiency measures that must be used
- Performance Standard prescribes the performance that must be achieved



# Performance Standard

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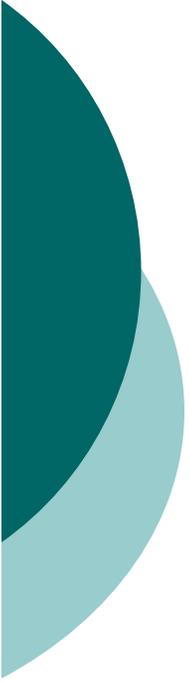
- Performance means “simulated performance” not utility bills
- Prescriptive standard used only to define the performance target
- Builders make a custom package of efficiency measures for each house that meets the performance target



# Performance Standard

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- Performance compliance is used by virtually all (>90%) CA residential builders. Millions of homes in 25 yr.
- Politically allows CEC to include controversial new measures because builders know they don't have to use them if they don't want to.
  - Duct sealing, verified furnace fan Watts verified refrigerant charge etc

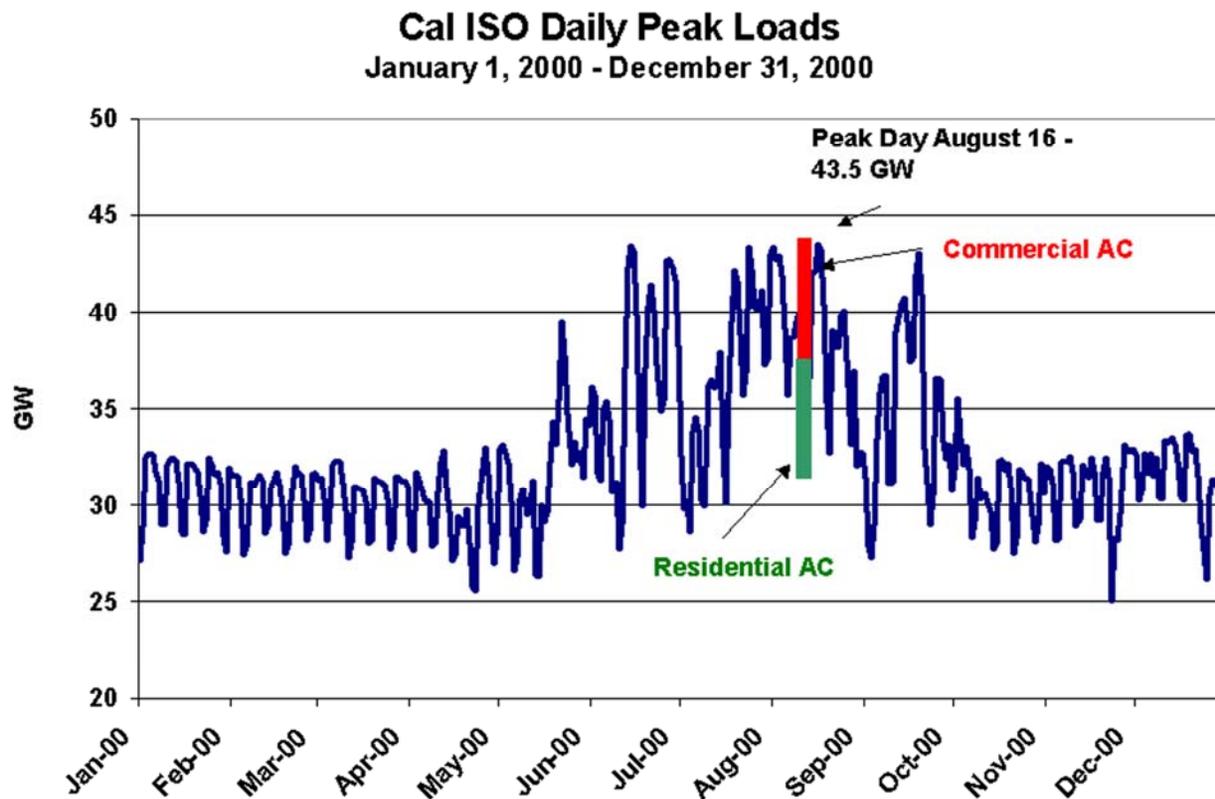


# Role of Simulation

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- Developing the standards
  - Exploring efficiency measure options
  - Proving life cycle cost effectiveness
- Complying
  - The builders own custom package of efficiency measures for each house

# The Important Technical Challenge for the Residential Standards is Cooling



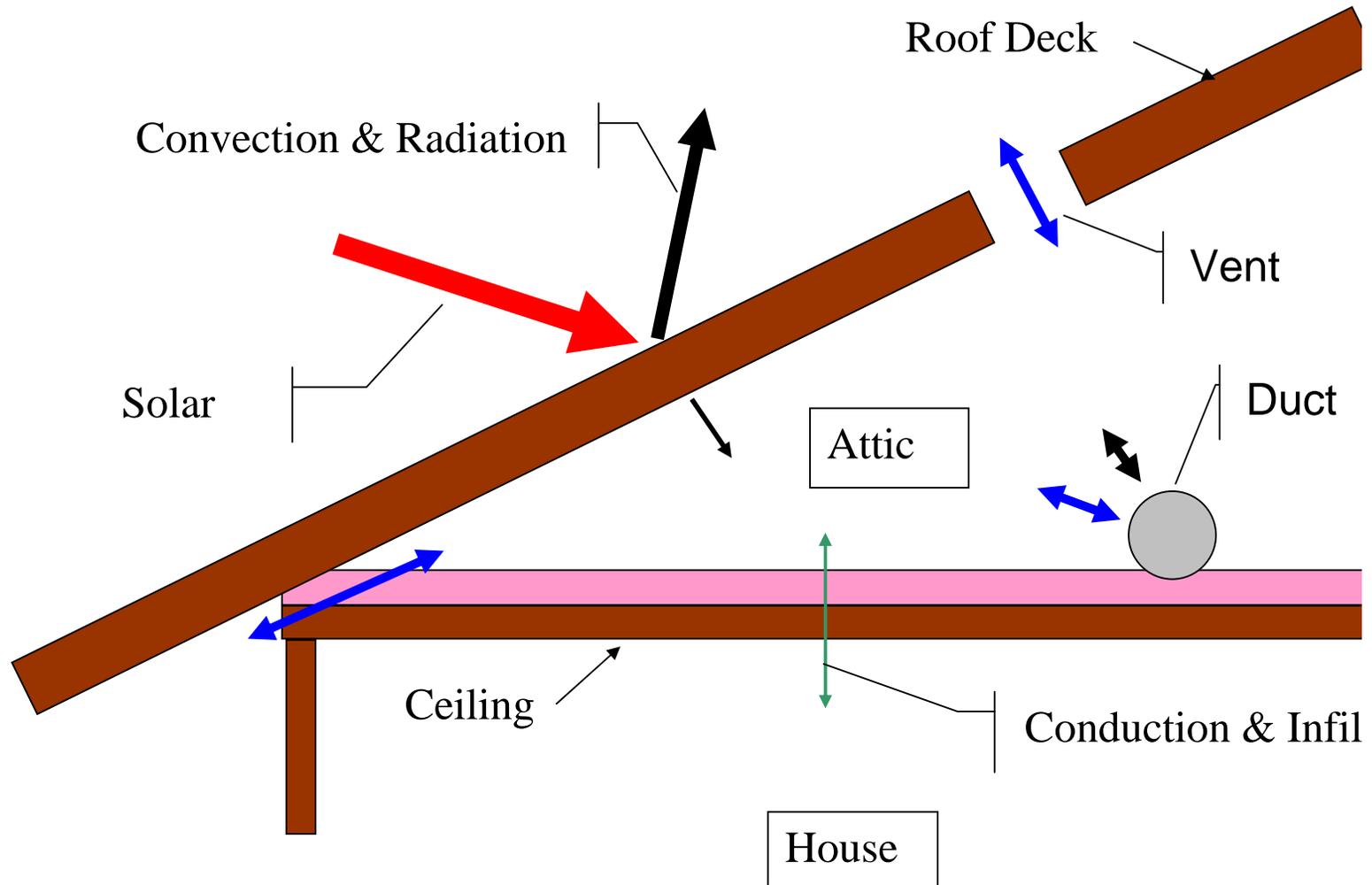
# AC Systems built on Monday try to operate in HOT Attics





13 tons AC on a 3763 ft<sup>2</sup> Palm Springs house  
282 ft<sup>2</sup>/ton - > 10 kW AC, 2.2 kW fans

# 2008 PIER Supported UZM Attic Simulation

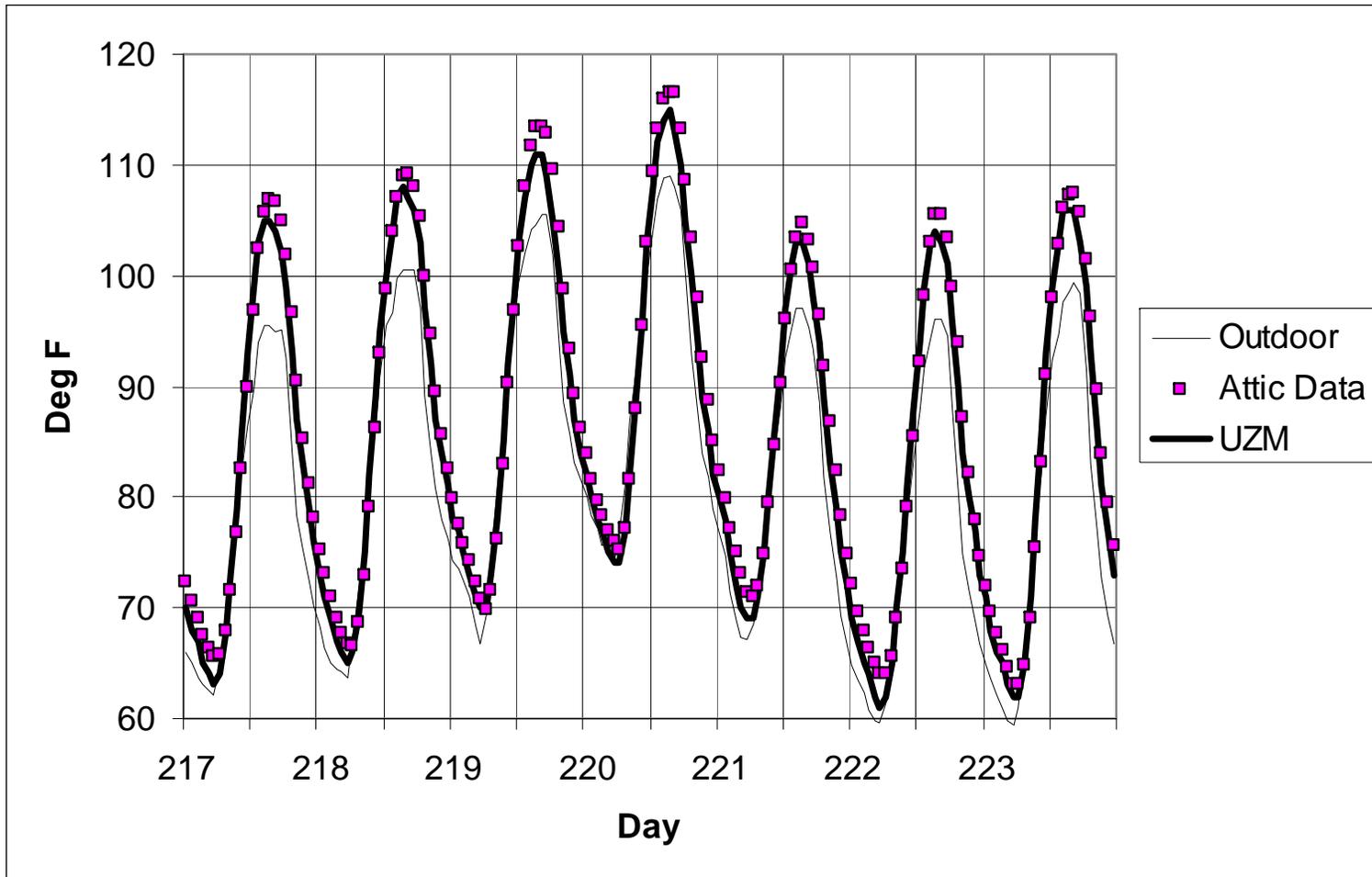


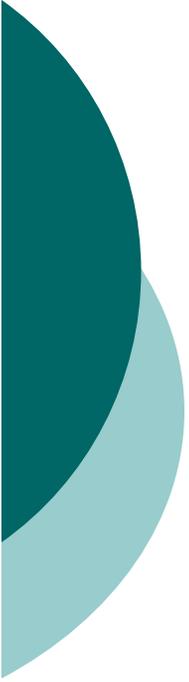
# Using Data to Develop and Verify Simulation Models



- One year of measured attic temperature data for Cardinal Glass research house in Roseville
- Unoccupied, instrumented, ACM occupancy
- Tile roof with high/low ventilation, sealed ducts in attic, ceiling construction defects, all modeled using proposed approach

# UZM matches attic temperature pattern for week including highest attic temperature of the year





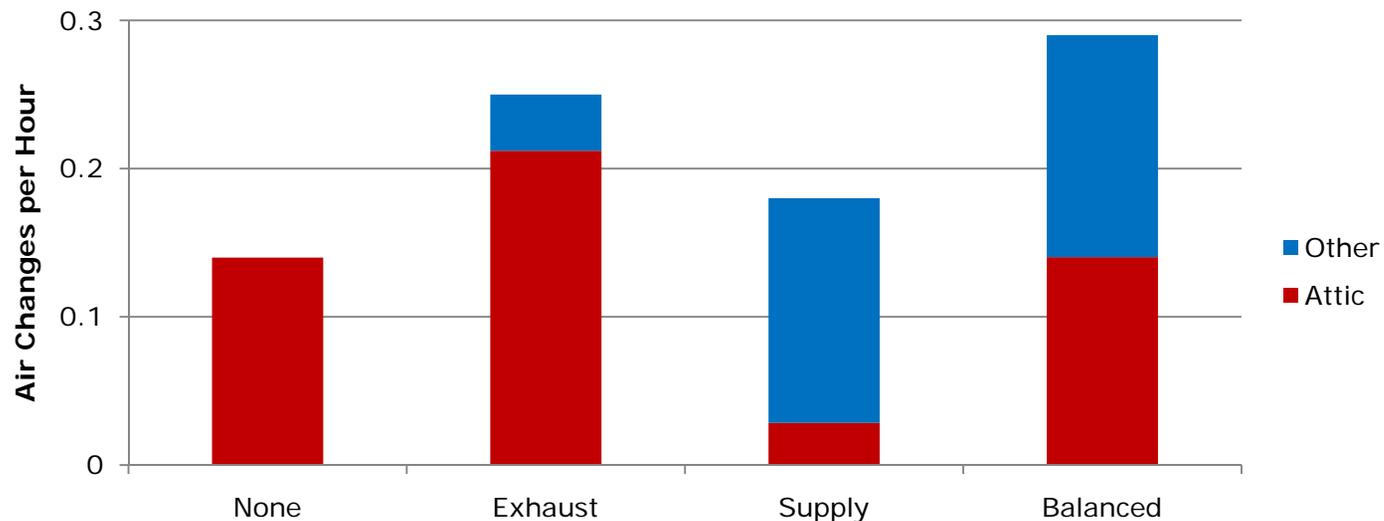
# CSE a new Public Domain California Simulation Engine

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- Supported by the IOUs and the CEC
- Build on the UZM model and field data
- Accurately estimate
  - solar gain impact on cooling energy and peak load
  - building shell and interior mass on cooling loads and indoor temperature variation
  - ventilation interaction with building mass and its impact on cooling energy and peak load
  - Add new capabilities for comfort analysis, mechanical ventilation, evaporative cooling

# New capabilities include a multizone air flow network calculation

Peak summer hour outdoor air ventilation and source of air by IAQ ventilation type



- Interactive effects of envelope, infiltration, natural ventilation, mechanical ventilation, and duct leakage on loads



## 2011 Standards Research Tool

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- Approach used for 2008 Standards
- Supported by the IOUs and the CEC
- Integrated CSE and UZM
- Current Micropas/CALRES User Interface, not public domain
  - Use by CEC, CASE, stakeholders for exploration of measures and ACM rules
  - New weather files
  - Life Cycle Cost using new TDV
- First release in a few days