Residential Night Ventilation
Cooling
Residential Stakeholder Meeting

California Statewide Utility Codes and Standards Program

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Residential Night Ventilation Cooling

Overview

- Summary of current code requirements
- Typical practice
- Summary of code change proposals
- Data/findings
- Analysis
- Issues to be resolved
- Questions
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Current Code Requirements

- Title 24 does not recognize ventilation cooling
  - Current ACM modeling rules do not reflect any benefit for nighttime ventilation cooling
- Title 20 requires whole house fans be listed for airflow and cfm/Watt
# Residential Night Ventilation Cooling

## Current Code Requirements - CEC Listing

<table>
<thead>
<tr>
<th>Manufacturer Name</th>
<th>Brand Name</th>
<th>Model Number</th>
<th>Fan Type</th>
<th>Air Flow CFM</th>
<th>Air Flow Efficiency (CFM/Watts)</th>
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</thead>
<tbody>
<tr>
<td>Air Vent, Inc.</td>
<td>Grainger</td>
<td>WH302BD-HDX</td>
<td>Belt-Drive Single Whole House Fan</td>
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</table>
Typical Practice

- Windows
  - Operable windows provide limited night cooling.
    - LBNL 2006 mail survey: 20% never open windows at night; 50% hardly open windows
    - Closed interior doors and first floor windows (security) significantly reduces any benefit
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Typical Practice

● **Whole House Fans**
  ● Rare in new construction; more common as a retrofit item (~6% PG&E saturation)
  ● Very efficient, but….
    ● Manual control, open/close windows
    ● Dust, noise, allergens, security, infiltration, thermal short to attic,…
    ● Noise means some people use just as a “flush” device– evenings after it cools off, first thing in the AM. Does not pre-cool building mass
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Typical Practice
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Typical Practice

- **Integrated Central Fan Systems**
  - Characterize generally as fixed speed (aka SmartVent) and variable speed (aka NightBreeze)
  - Key Advantages - Fully automated operation in response to outdoor temperature & ventilation setpoint; security; filtered air
  - Disadvantages - More expensive, less efficient in terms of Watts/cfm
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Typical Practice

- Supply Air
- HEAT/COOL COILS
- Blower
- RETURN Air
- Filter
- Damper
- Outside Air Intake
- Relief Air
- Attic Vent Exhaust
Central Fan System Components

- **Common Features**
  - Damper box
  - Outdoor air duct with air filter
  - Outdoor temperature sensor

- **Differences**
  - Ability to vary fan speed
  - Control strategy
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Code Change Proposals

- Develop Compliance Option for three system types
  - WHFs
  - Fixed speed central fan system
  - Variable speed central fan system
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Data/Findings

- WHFs largely installed as a retrofit product
- NightBreeze developed with CIEE and PIER funding (several 100 units installed since ~2003)
  - Monitored under Building America
- SmartVent introduced mid ‘90’s; more than 20,000 systems installed
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Data/Findings

- PG&E monitored six units (3 SV, 3 NB) near Sacramento in 2007 (Matrix)
  - New (2005/2006) homes (2400-3150 ft²)
  - 10% average duct leakage
  - Avg 22 days baseline, 43 days vent cooling
- Projected annual savings vs. 17 SEER AC
  - 48-50% reduction in Noon to 6 PM kWh
  - Annual energy savings: -16% SV, 2% NB
  - Savings for days >92F: 14% SV, 30% NB
Average Demand for Days with 100-105F Peak Outdoor T
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Analysis - CSE Model Development

- Wilcox team revamped ACM model
  - Improved thermal modeling
  - Reduced natural ventilation impacts
  - More reasonable “floating” performance

- Whole house fans
  - Fixed airflow, W/cfm, and target temperature

- Integrated generic vent cooling model
  - Looks for indoor-to-outdoor delta T; fixed target T
  - Fixed speed: Static cfm & W/cfm
  - Variable speed: Daily varying cfm & W/cfm
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Analysis - CSE Model Results CZ12

CZ 12 2,700 ft² Prototype Projected Cooling Energy Use

Annual Energy Use (kWh)

- Night Vent
- AC Fan
- AC

Base
WHF 100%
WHF 50%
WHF 20%
Fixed Default
Fixed Tested
Variable Default
Variable Tested

2,700 ft²

5/5/2011

CA Utilities 2013 Title 24 Stakeholder Meeting for Proposed Code Changes 5/5/2011
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Analysis- WHF Projections by CZ

![Graph showing WHF projections by CZ]

- 100% Airflow
- 50% Airflow
- 20% Airflow
- Standard Budget
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Analysis- “Fixed” Projections by CZ

![Graph showing annual total TDV budget projections for CZ zones.
' Tested' - 350 cfm/ton, 0.58 W/cfm
Default - 300 cfm/ton, 0.80 W/cfm
Standard Budget

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Analysis—“Variable” Projections by CZ

![Graph showing annual total TDV budget projections for CZ1 to CZ16 by tested and default settings.]

- Tested - 350 cfm/ton, 0.58 W/cfm
- Default - 300 cfm/ton, 0.80 W/cfm
- Standard Budget
## Residential Night Ventilation Cooling

### Data/Findings- CSE Model Results

#### Cooling TDV Budget Impact (Positive value = savings)

<table>
<thead>
<tr>
<th></th>
<th>Whole House Fans</th>
<th></th>
<th>Fixed Speed</th>
<th></th>
<th>Variable Speed</th>
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<td>100%</td>
<td>Default</td>
<td>Test</td>
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### Data/Findings - CSE Model Results

#### Total TDV Budget Impact (Positive value = savings)

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</table>
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Issues to be Resolved

● WHFs
  ● Level of credit
  ● Distinguish between lower airflow/more thermally efficient insulated units and traditional barometric WHFs

● Central Fan Systems
  ● Damper failure concerns

● Eligibility criteria for all system types
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QUESTIONS & COMMENTS

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