CALIFORNIA ENERGY COMMISSION

2013 Building Energy Efficiency Standards Staff Workshop

Residential Infiltration and Testing

May 31, 2011

Background

- Proposal sponsored by the California Statewide Utilities Codes and Standards Program as a Codes and Standards Enhancement (CASE) study
- CASE study authors Bruce Wilcox,
  Rick Chitwood. John Proctor
- Presented at stakeholder meeting May 13, 2011

Residential Infiltration and Testing

- Summary of current code requirements
- Typical practice
- Summary of code change proposals
- Data/findings
- Specifics of code change proposals

Current Code Requirements

- Prescriptive air sealing
  - Caulk and seal
  - Certification requirements for windows, ceiling cans etc
  - Performance credit for air barrier
- Performance credit for leakage testing
  - Credit for tested air leakage (HERS verified)
  - Credit potentially much larger in 2008 Standards
- Effectively no multi-family testing option
  - Blower door testing of whole building is impractical

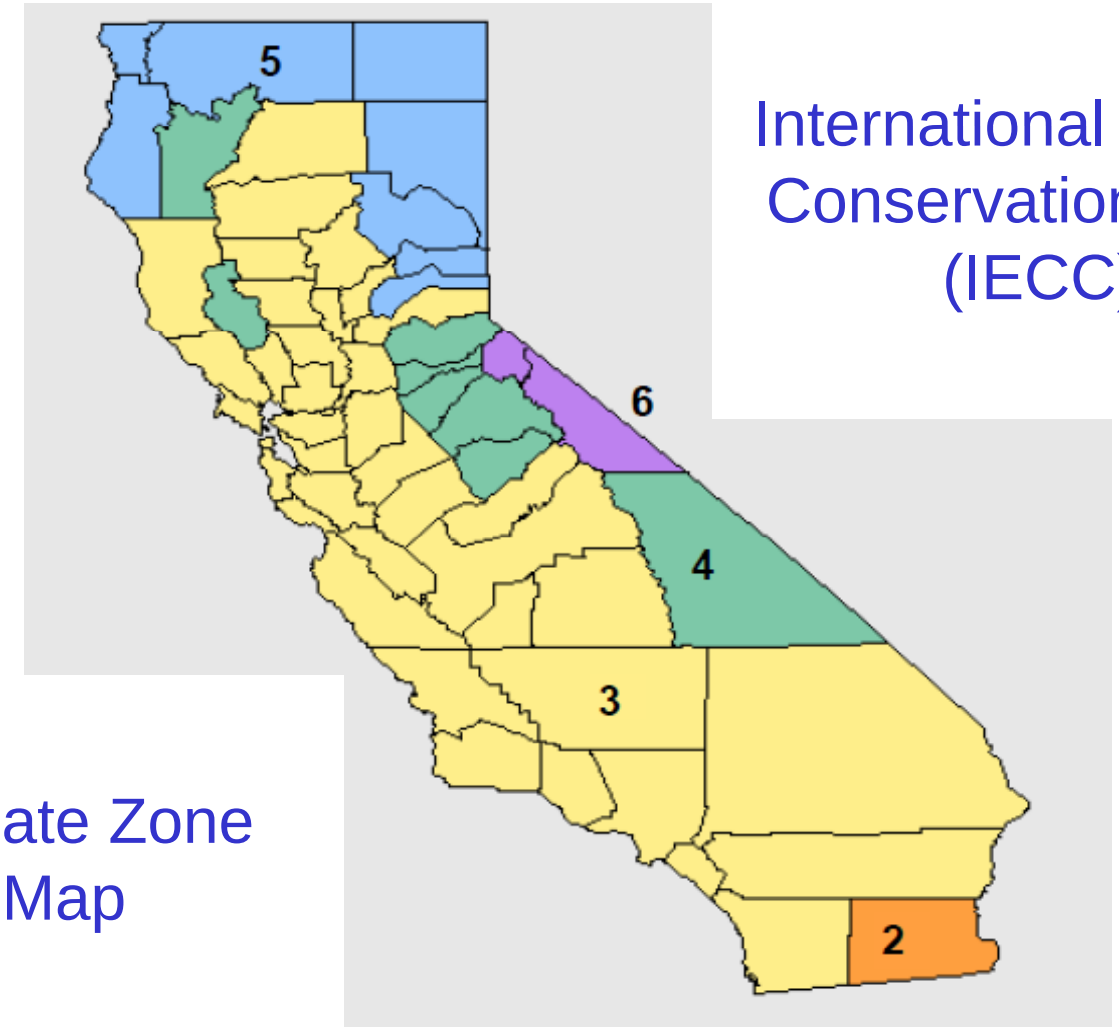
Typical Practice

- Single family
  - Usually default
    - No air sealing measures
    - No credits
  - Some production builders take credit
    - Problem of no air sealing contractor
    - CEC Checklist
    - HERS raters provide testing
    - Much bigger credit in 2008 - mechanical ventilation removes lower limit on air leakage
- Multi-family no action

New IECC Requirement

The International Code Council (ICC) has adopted a new version of the International Energy Conservation Code (2012 IECC) with a minimum airtightness requirement of 3 ACH50 for DOE Climate Zones 3-8

International Energy Conservation Code (IECC)



Climate Zone Map

Code Change Proposal Summary

- Base code prescriptive maximum air leakage rate of 3 ACH50 for single family homes in 13 CEC Climate Zones
- No multi-family requirements
- Use new Resnet Draft Standard 802 test protocol
- Eliminate current air barrier credit

2009 ECO Survey*

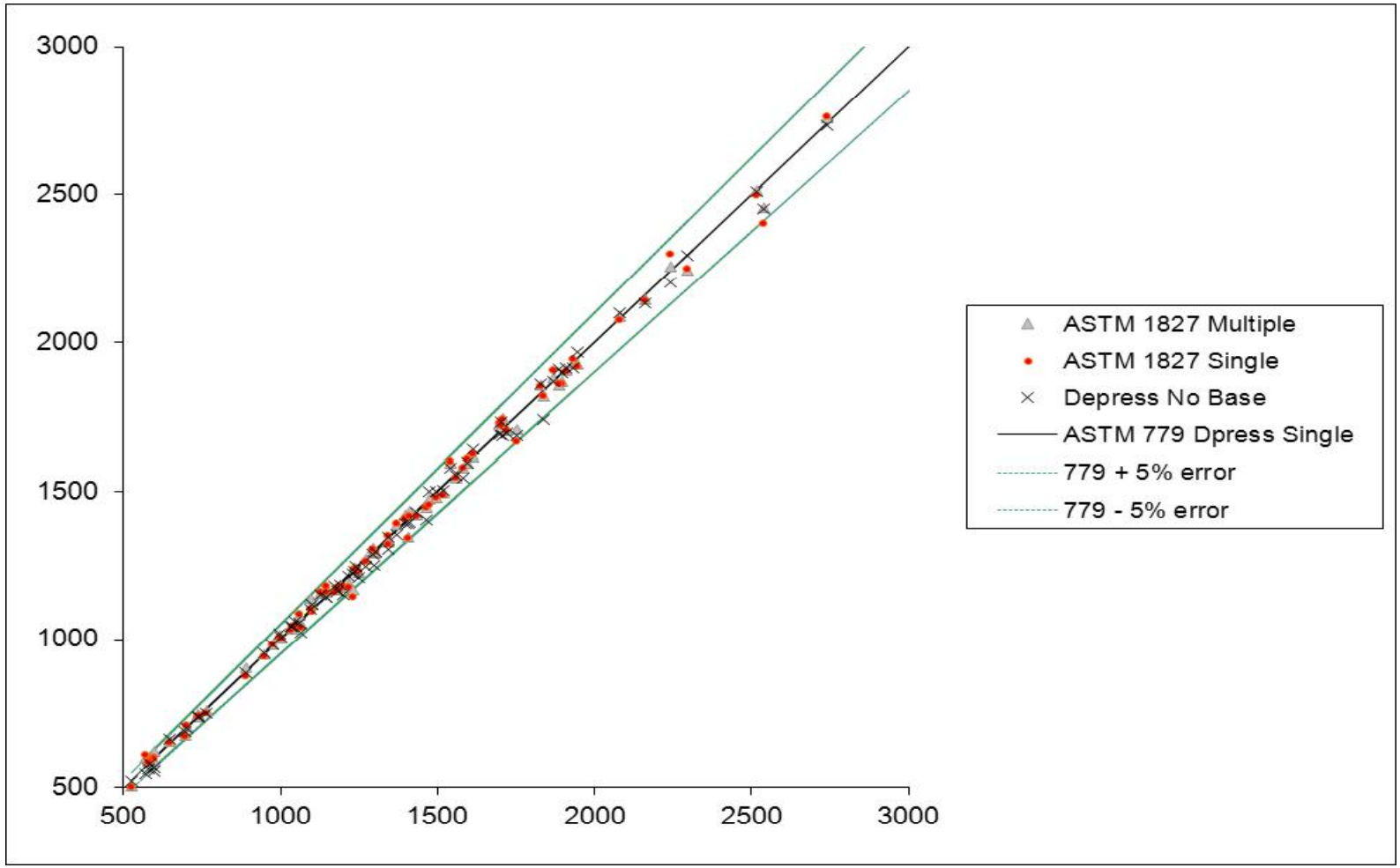
- 40 Single family and 40 Multi-family
- Sample drawn from electric customers of SCE, PG&E and SDG&E
- New homes 1st connected in 2007, probably 2005 Stds
- Occupied for 2 years
- Geographic distribution of surveys matched to sample at 3 digit zip level
- Mailed invitation letter with prepaid reply letter, web site and 800 number for responses. Recruited by phone from responders.
- Occupants received $100 for participation

* Efficiency Characteristics and Opportunities for New California Homes (ECO) http://www.h-m-g.com/T24/Res_Topics/Efficiency_Characteristics_and_Opportunities_for_New_California_Homes_Wilcox_PIER_2011.pdf

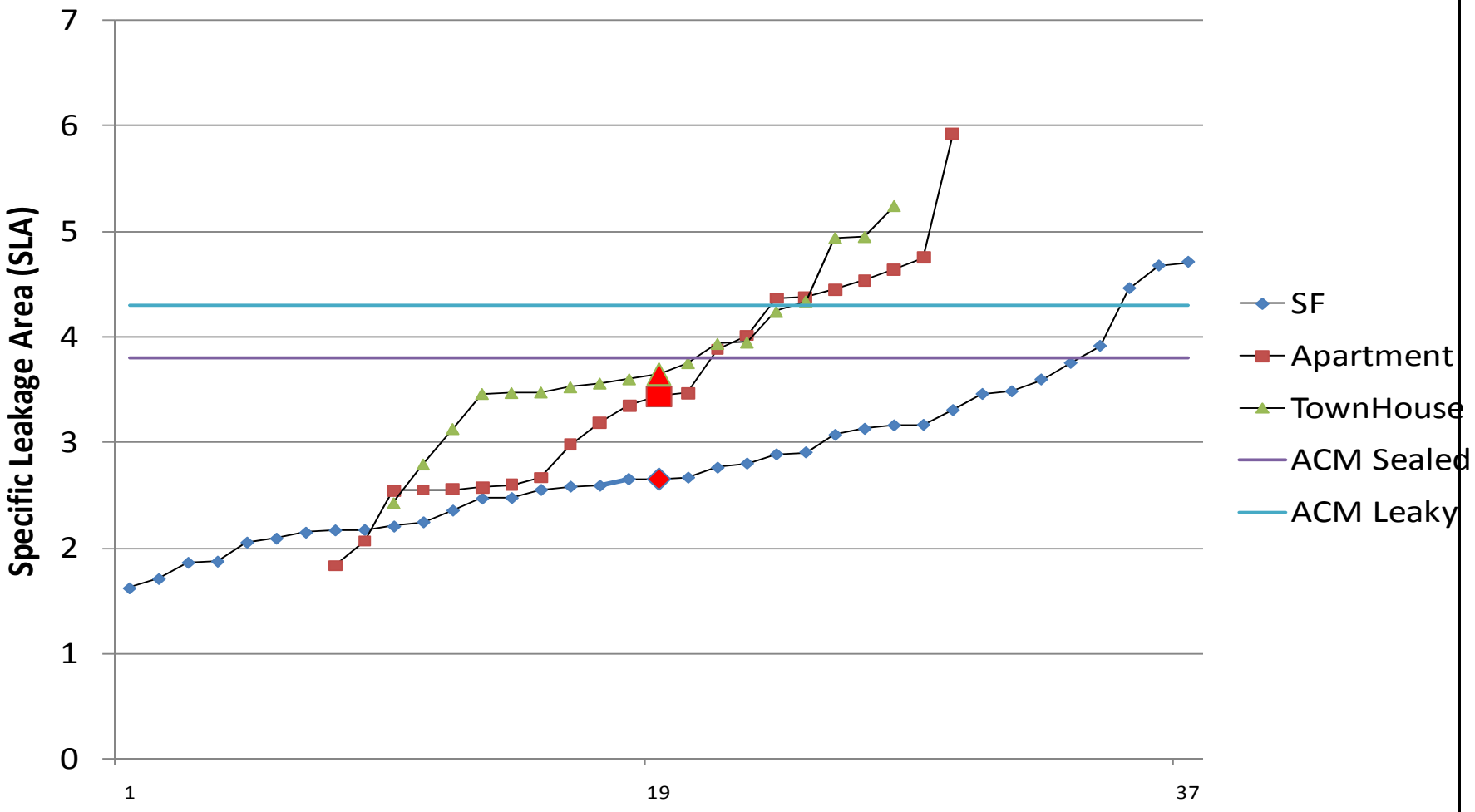
Survey Air Leakage Measurements

- Simple Single Point Blower Door (CFM & ACH50)
  - Single point, no baseline
  - Air flow at 50 Pa (CFM50 or ACH50) Pressure and depressure
- ASTM E1827-02 Air Leakage at 50 Pa
  - Repeated measurements with baseline
  - Air flow at 50 Pa (CFM50 or ACH50) Pressure and depressure
  - Series measurements for leakage to attic and garage]
- E779-03 Air Leakage
  - Effective Leakage Area (ELA/SLA) pressure and depressure
- Fireplace Leakage

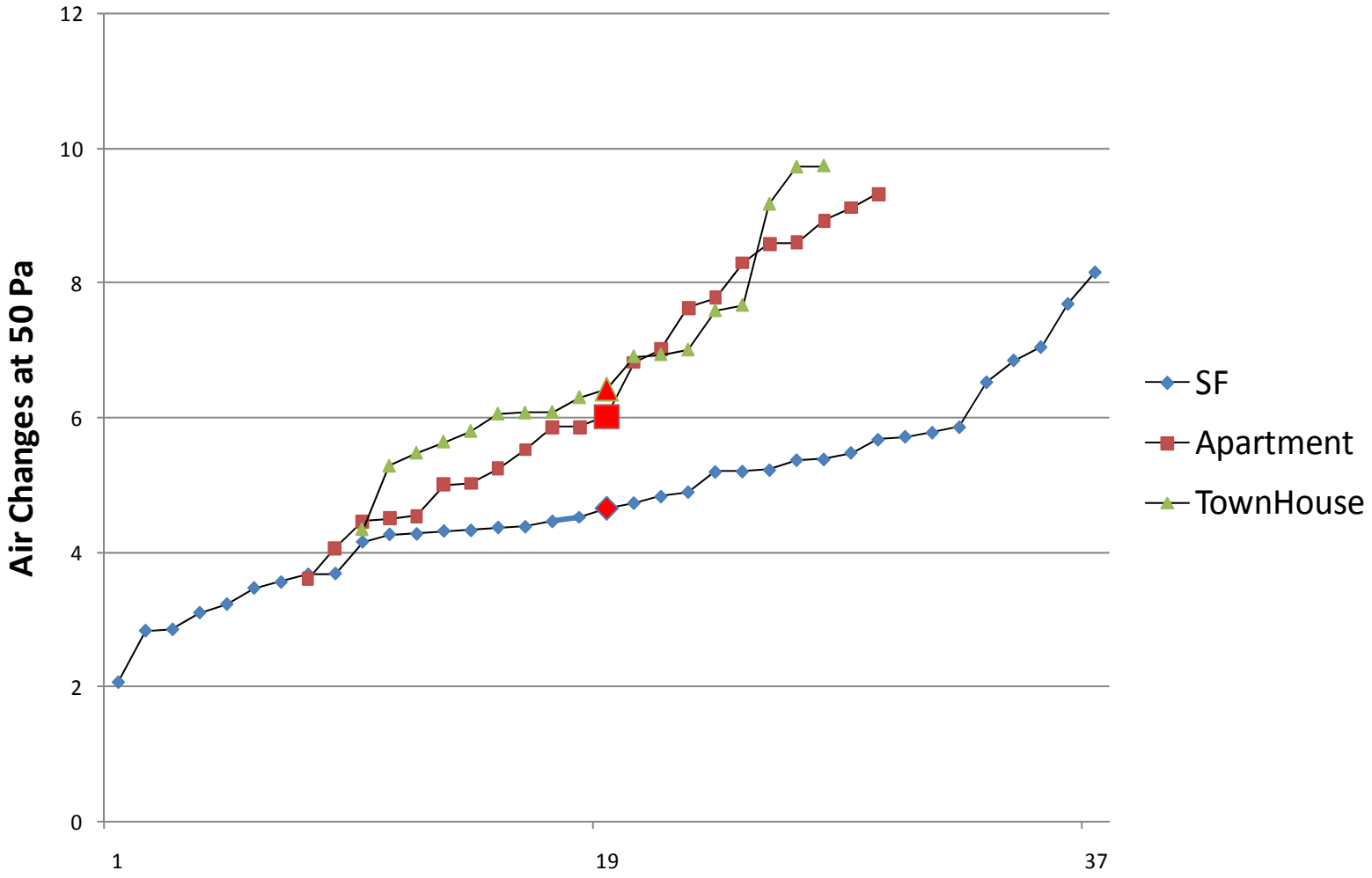
Comparison of Measurements



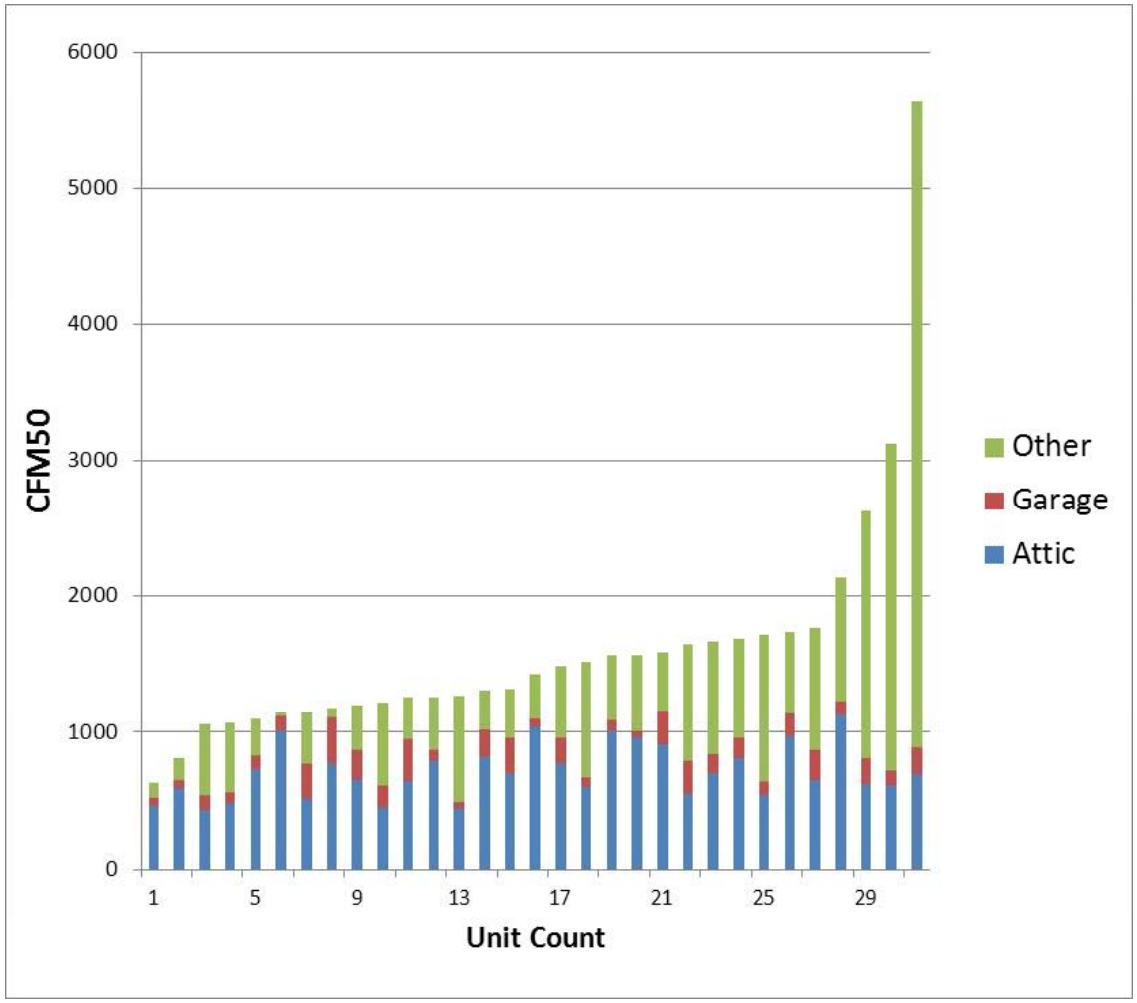
SLA (Specific Leakage Area)

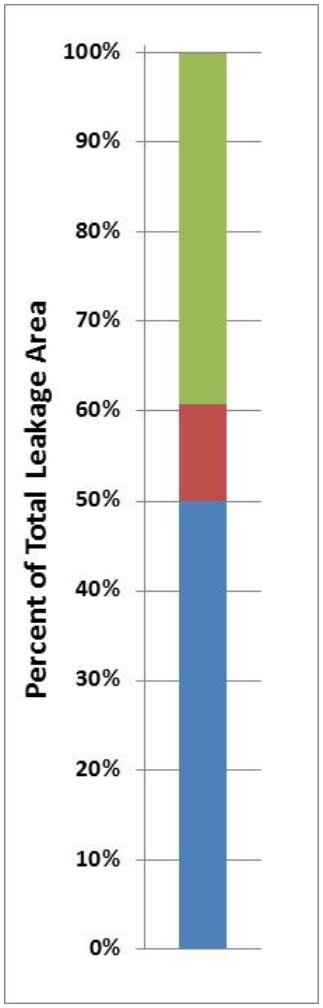


ACH50 (Air Changes @ 50 Pa.)



Most Air Leaks Are in the Ceiling

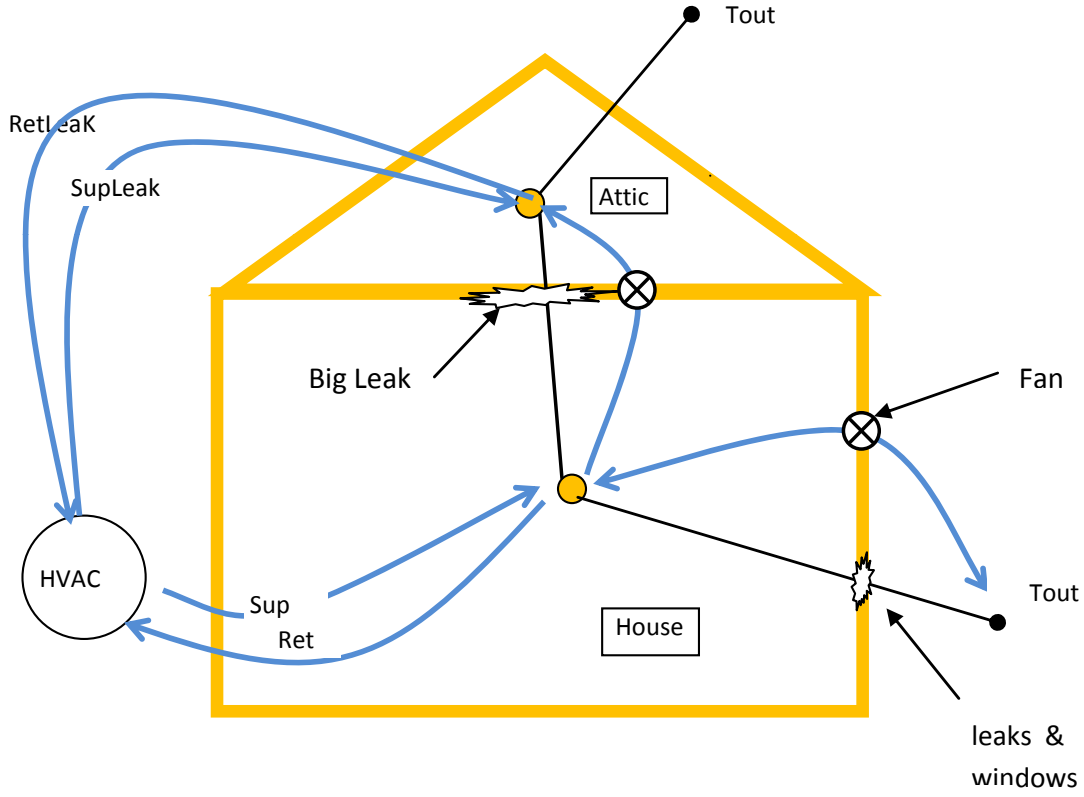




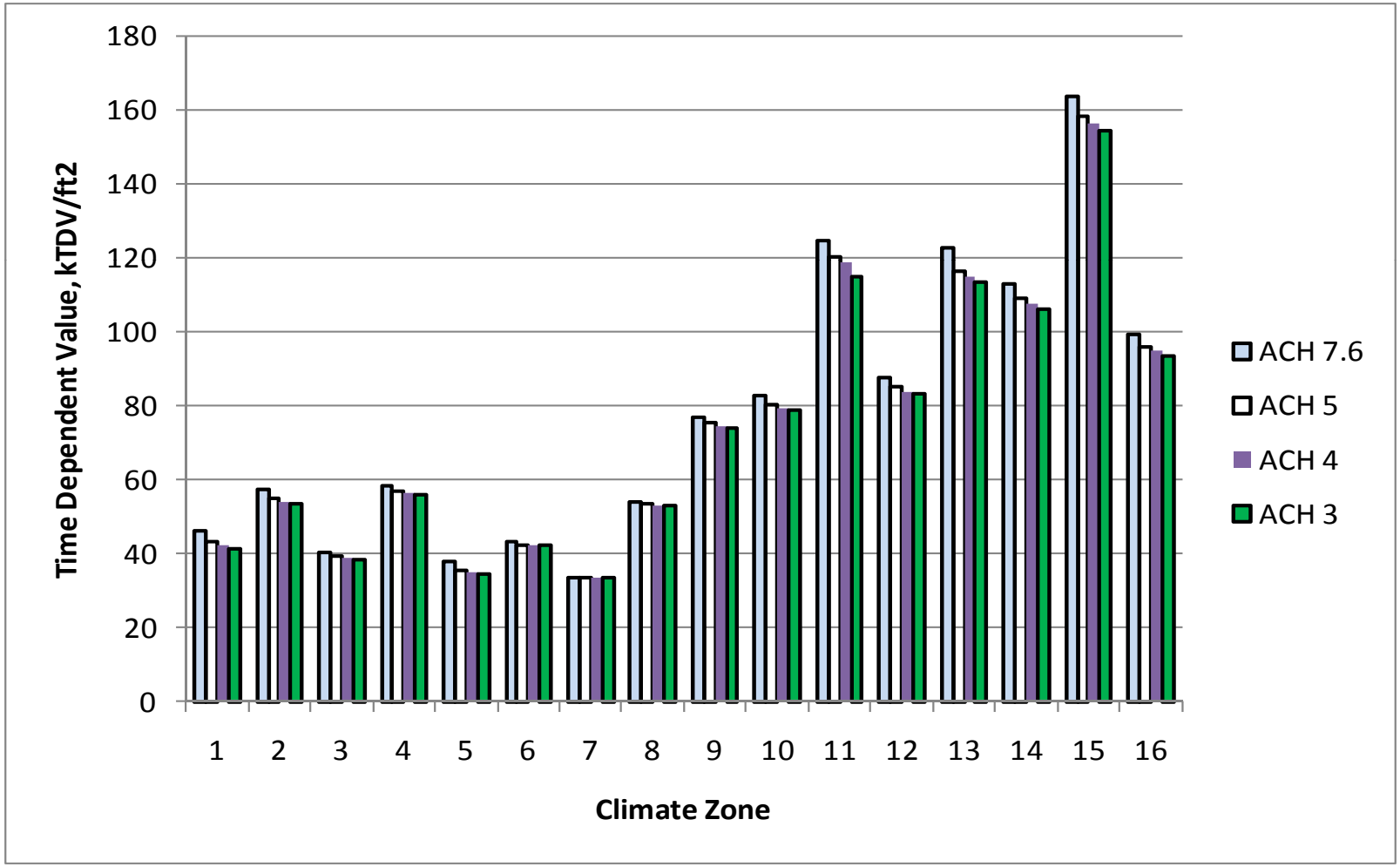
Survey Envelope Air Leakage

- Single Family homes are very tight
- Multi – family homes are much leakier
- Homes with attics and attached garages:
  - 51% of the total leakage area is from/to the attic
  - 11% of the total leakage area is from/to the garage

New CSE Infiltration Algorithm



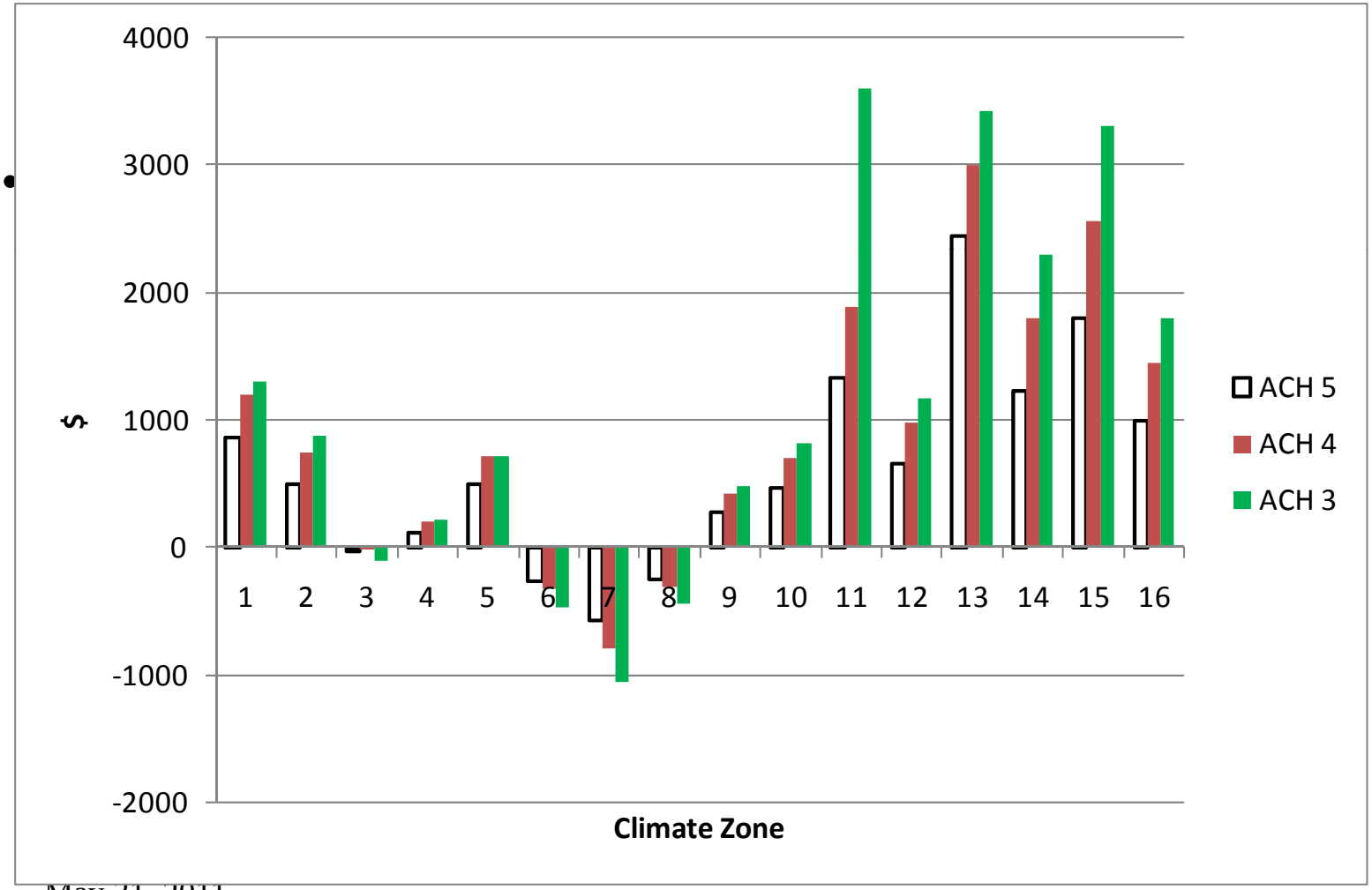
TDV Energy vs Air Tightness



Cost for Air Sealing 2200 ft2 Home

		3 ACH50
Labor		100
Materials		118
Sub Overhead and profit		218
Subcontractor Invoice to builder		436
HERS verification		130
Total cost to builder		566
Builder Markup 30%		170
Total cost to Home buyer		736
$/cfa	$	0.33

Life Cycle Cost Savings



Code Change Proposals

- Base prescriptive maximum air leakage
  - 3 ACH50 criteria with 7.6 default
  - All new single family homes in 13 climates
  - Post construction blower door test
  - HERS verification
  - Not mandatory

No Action in Multi-family

- Unit by unit tests show big leakage, but
  - Some unknown fraction of the leakage is to other units. Sealing improves IAQ, but energy savings unknown.
  - Testing whole building is not practical, but whole building compliance is normal for CA Standards.
- More research is needed (PIER?)
  - Energy savings from unit by unit air sealing
  - Test standard for multi-family ACH50

New Definition in Section 101

ACH50 Air Changes at 50 Pascals. Air leakage rate of a building envelope at 50 Pascals pressure difference between inside and outside, expressed in house volumes per hour, when tested using the procedure defined in Reference Appendix RA6

New Base Code Language in Section 151

(f) **Prescriptive Standards/Alternative Component Packages (Component Packages)**.

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13. Maximum Envelope Air Leakage**.**

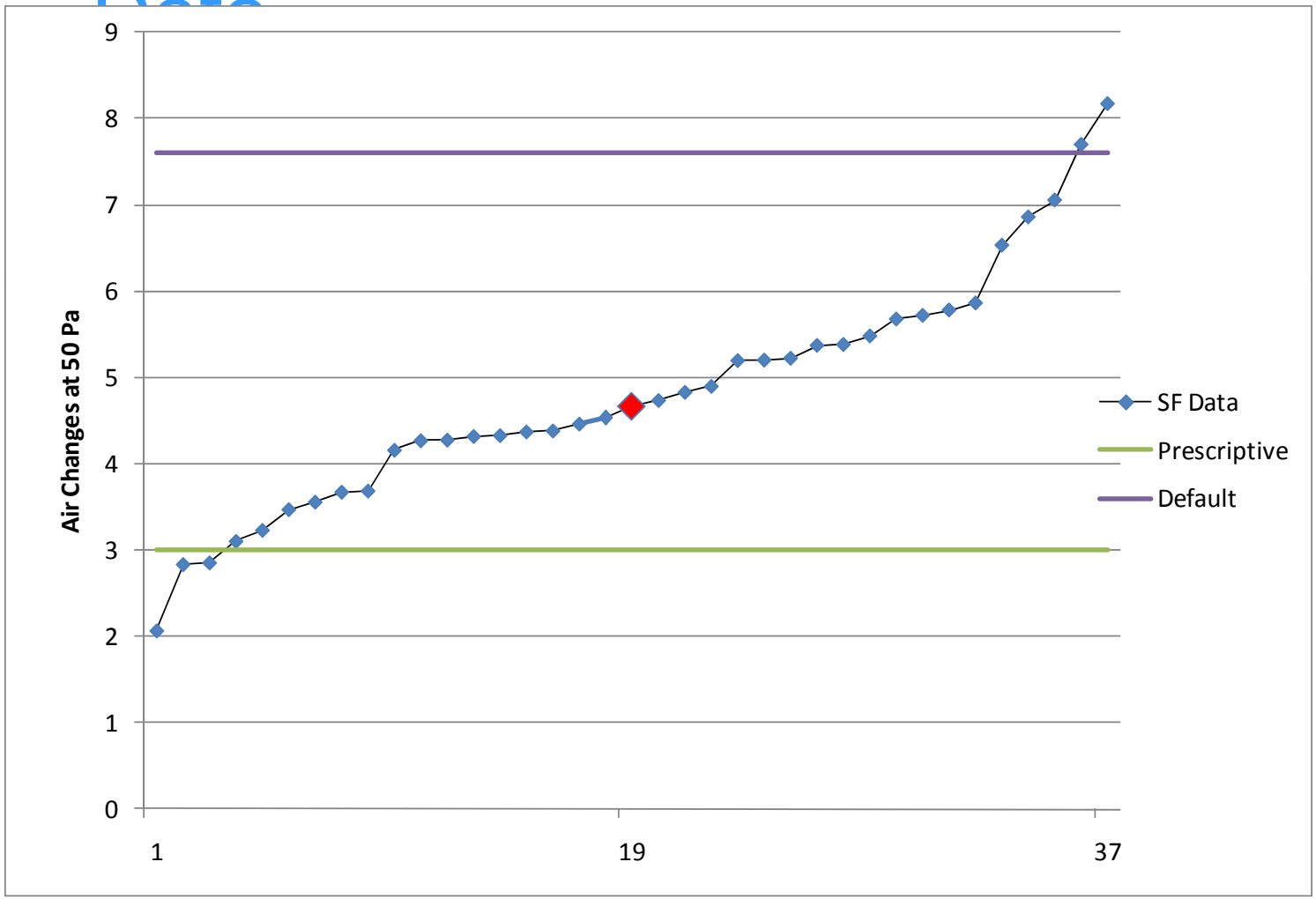
A. The exterior pressure envelope of the home shall be sealed to achieve a tested air leakage less than or equal to the criteria in TABLE 151-C COMPONENT PACKAGE D using the criteria in Reference Appendix RA6.

EXCEPTION to Section 151 (f) 13 A: Multi-family buildings are exempt.

TABLE 151-C COMPONENT PACKAGE D

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
BUILDING ENVELOPE																
Maximum Envelope Air Leakage																
ACH50	3	3	3	3	3	NR	NR	NR	3	3	3	3	3	3	3	3

Proposed Standard vs. Survey Data



RACM Changes

- Air leakage calculations
  - Convert SLA to ACH50 everywhere
  - Untested default 7.6 ACH50 (SLA ~3.8)
  - Eliminate current air barrier credit
  - 51% of leakage between house and attic
  - New CSE integrated air flow network
- Air leakage testing and verification
  - Reference/copy Resnet Draft Standard 802:

PROCEDURES FOR BUILDING ENCLOSURE AIRTIGHTNESS TESTING

www1.resnet.us/comments/amendments/2011-02/Standards_for_Performance_Testing-Chapter8.pdf/

2013 Standards Update

Send related comments by June 30, 2011 to:

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