

Revisions to the Residential Standards and ACM Calculations



June 13, 2007
Bruce Wilcox, P.E.

DOCKET	
07-BSTD-1	
DATE	JUN 13 2007
RECD.	APR 29 2008

Topics

- Refrigerant Charge
- Fan Watt Draw and Airflow
- Indoor Air Quality
Ventilation
- New Solar Homes
Partnership

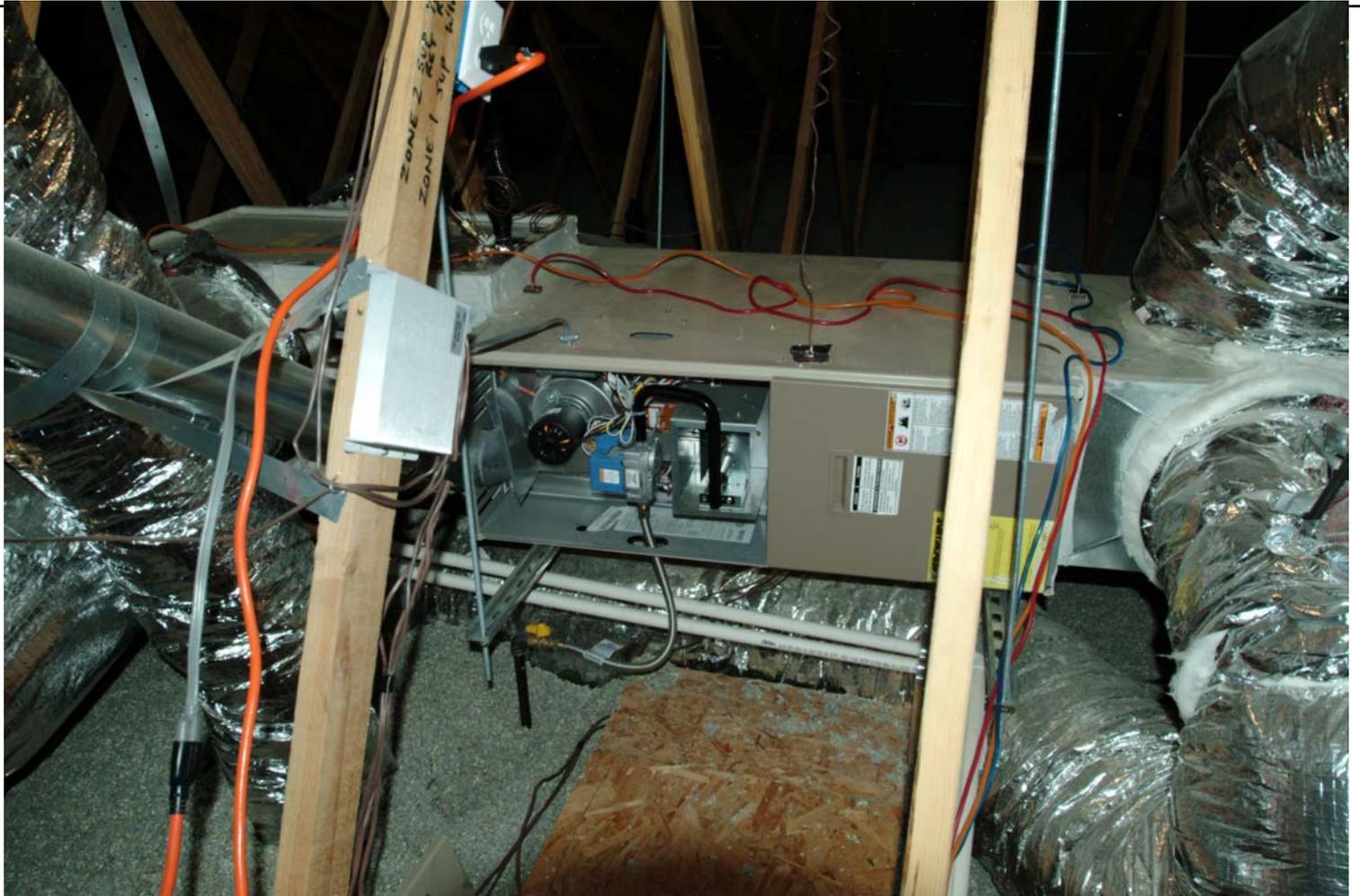
Refrigerant Charge, Charge Indicator Display, and TXVs

- For new construction
- Eliminate TXV credit
- Always verify charge
- Verify TXV performance

New Optional Charge Verification Charge Indicator Light

- Provides a clear indication to the homeowner that the refrigerant charge on the air conditioner is incorrect
- Indication is based on essentially same criteria as installer diagnostic test
 - Superheat
 - Subcooling
 - Temperature Split
- Replaces charge test

Fan Watt Draw and Airflow





Fan Watt Draw and Airflow

- Summary of Revised Proposal
- Furnace Fan W/CFM data
- Comparison with New California Homes
- Life Cycle Cost Analysis

Proposed Prescriptive Standard

- In hot Climate Zones 10-15 only
- Furnace fans shall simultaneously demonstrate, in every zonal control mode, a flow greater than 350 CFM/ton of nominal cooling capacity of the outdoor unit and a watt draw of 0.58 W/CFM (measured) or less
- Permanent static pressure probes must be installed
- Performance verified by post construction test
- Not mandatory, can be traded against other efficiency measures

Proposed Prescriptive Standard Advantages

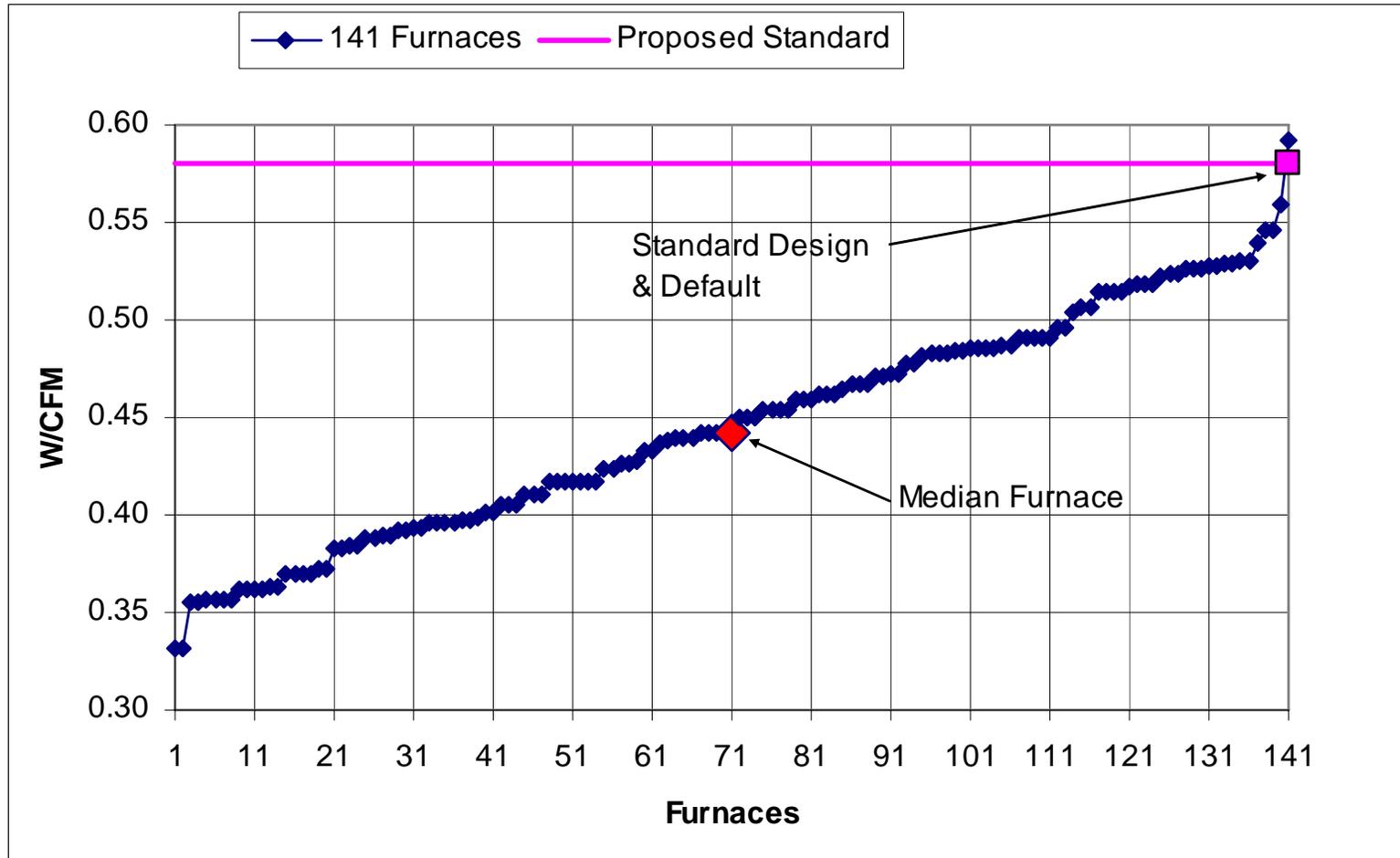
- Offers Flexibility for Builders
 - Comply with good ducts (0.5 IWC external)
 - Comply with better furnace
- Nearly all furnaces comply at 0.5 IWG external
- Real performance field verified by testing
- Deals with multi-zone air flow and ventilation issues
- Provides path to greater demand and kWh savings for incentive programs



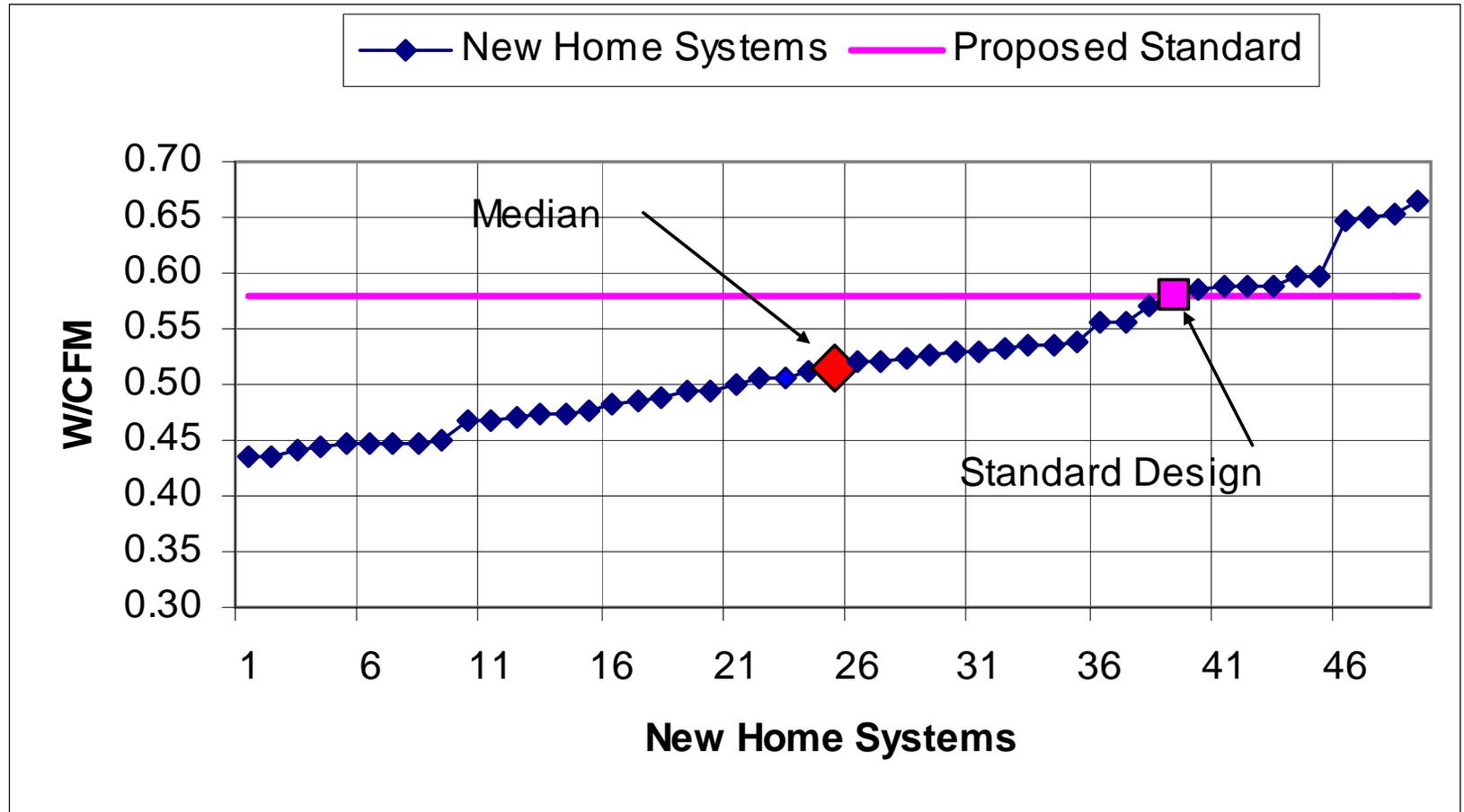
Based on Manufacturers' Furnace Data

- Compiled by LBNL
- Data from Manufacturers' website or directly
- 141 unique PSC models that had blower power information
- W/CFM for cooling at high speed setting

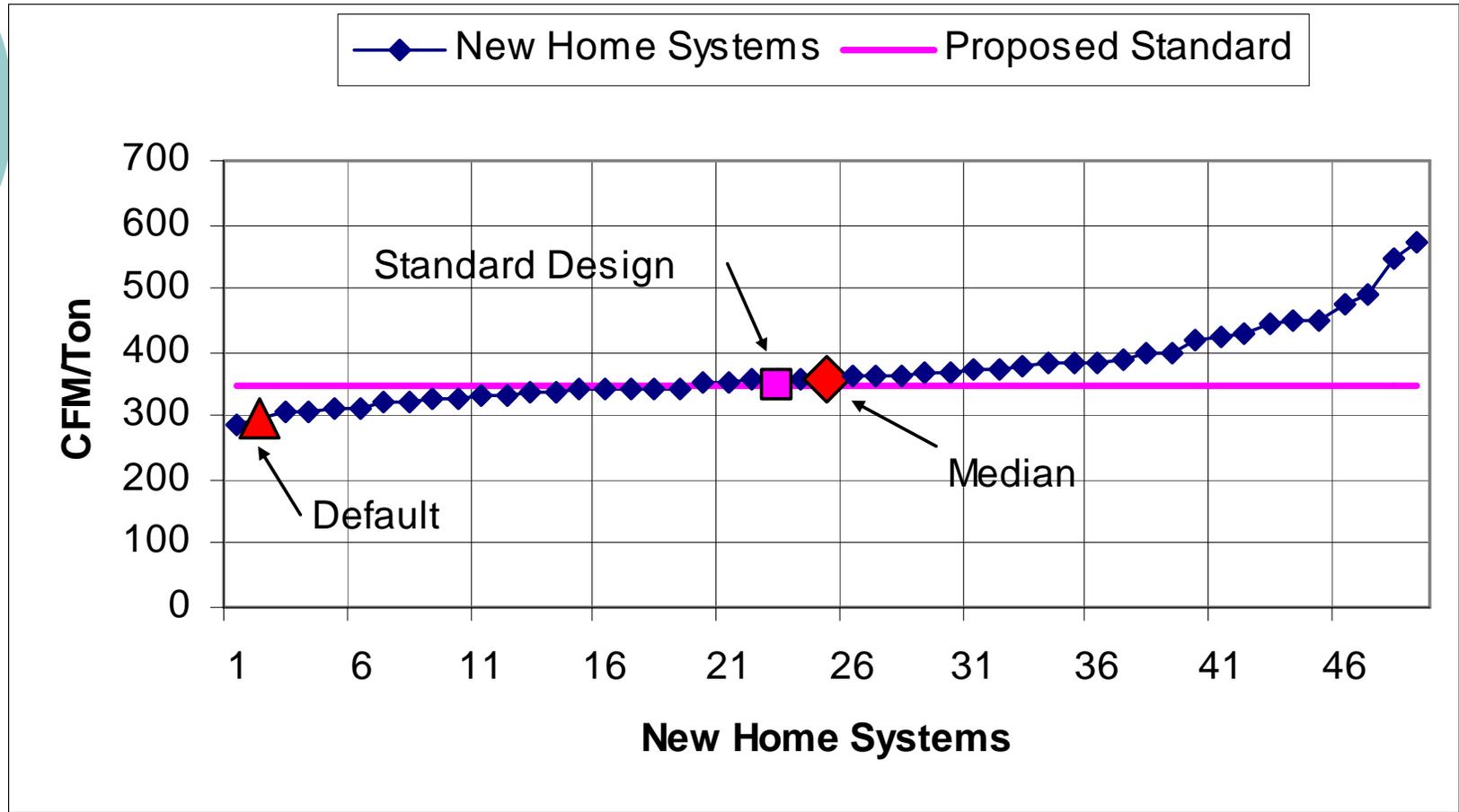
Manufacturers Furnace Data Compared to Proposed W/CFM Standard



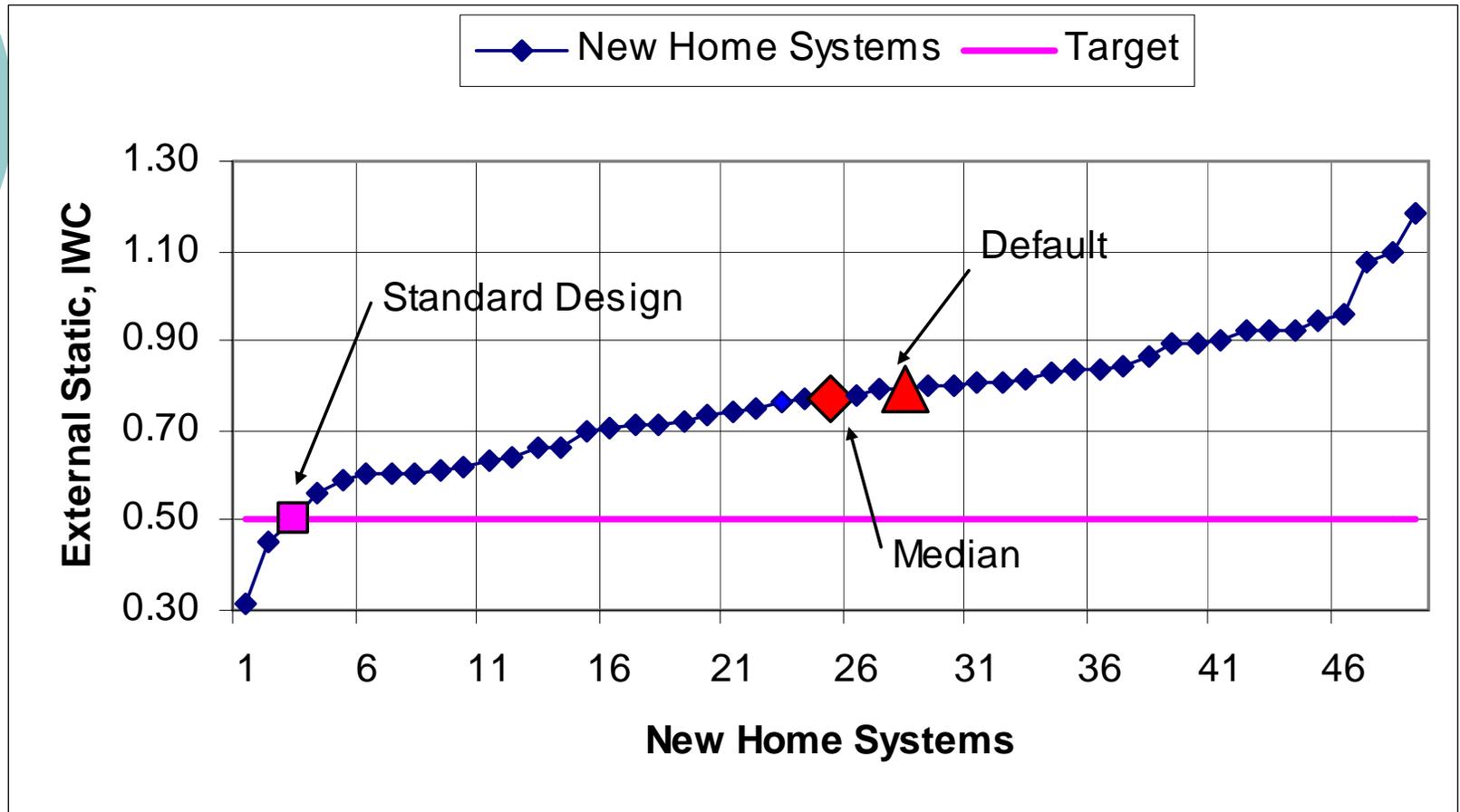
2005 CA New Homes Compared to Proposed W/CFM Standard



2005 CA New Homes Compared to Proposed CFM/Ton Standard



2005 CA New Homes Compared to Target External Static Pressure



Permanent Static Pressure Probes

- Must be permanently installed to meet prescriptive requirement.
- Allow contractor to easily and accurately verify duct system return and supply static pressure
- Allow contractor and HERS rater to accurately and repeatably measure air flow without drilling holes in the system

Example Approach to Reduce External Static Pressure to 0.5 IWG

Component	Survey Median	Target
Supply Duct	0.18	0.18
Cooling Coil	0.27	0.20
Return Duct	0.15	0.05
Filter	0.15	0.07
Total	0.75	0.50

Cost of Reducing External Static to 0.5 IWG for Example 3.5 ton System is \$123

Component	Modification	Cost increase		
	Strategy	Labor	Material	Total
Supply Duct	No Change			
Cooling Coil	5 ton coil		40.00	40
Return Duct	Increase diameter	11.76	20.75	32
Filter	25% Larger area		15.00	15
Overhead and profit	30%			37
Total				123

Life Cycle Savings from Reducing 0.8 IWG External Static Pressure to 0.5 IWG

~30% reduction in fan power at same efficiency

0.45 W/CFM at 0.5 IWG

0.63 W/CFM at 0.8 IWG

- Life Cycle Cost savings in 1761 ft² prototype:

Zone	LCC \$ Saved
10	931
11	1193
12	785
13	1275
14	1292
15	2335

The Value of Reducing 0.8 IWG External Static Pressure to 0.5 IWG

In a 5 ton system with 1750 CFM

0.63 W/CFM = 1102 Watts

0.45 W/CFM = 787 Watts

Savings 315 Watts

- On peak electrical demand
- PV to supply this costs ~\$2500

Performance Path

Standard Design and Defaults

Case	CFM/Ton	W/CFM
Standard Design	350	0.58
Default	300	0.8



New Mandatory Requirements for Indoor Air Quality Ventilation

- Summary of requirements
- Air Distribution Systems

Ventilation Rate

- Whole-house Mechanical exhaust, supply or balanced ventilation equal to 1 cfm/100 sq. ft. plus 7.5 cfm * (number of bedrooms + 1).

Ventilation Rate

Floor Area (ft²)	Bedrooms				
	0-1	2-3	4-5	6-7	>7
<1500	30	45	60	75	90
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150
>7500	105	120	135	150	165

Fan Power

- If performance approach is not used, the total fan power of a separate IAQ ventilation system used to meet this requirement shall not exceed 1.2 W/cfm of ventilation air. If performance approach is used, total fan power in the standard design is equal to the proposed house but not greater than 1.2 W/cfm of ventilation air.

Control and Exhaust

- Control must be provided to allow occupant use and to determine minimum and maximum operating times.
- Exhaust ventilation (to outside) of at least 50 cfm intermittent or 20 cfm continuous in each bathroom.
- Exhaust ventilation (to outside) of at least 100 cfm intermittent with a vented range hood or 5 ACH in each kitchen.

Sound and Verification

- Air moving equipment must meet requirements for sound of 1 sone for continuous use or 3 sones for intermittent use.
- Air moving equipment must meet requirements for air flow rating either by ASHRAE 62.2 field verification or using a prescriptive table.

Other Requirements

- MERV 6 (or better) particle filtration must be used for any air handling components with at least 10 ft of ducting.
- Naturally aspirated combustion equipment may not be used inside the pressure boundary when exhaust flow exceeds specified limits.
- Clothes dryers must be vented outdoors.
- Other requirements involving location of intakes, dampers, ventilation openings etc.

Air Distribution Systems

- Central AC fan runs on schedule to distribute ventilation air
- Prescriptive Requirement that air distribution mode fan Watt draw must be less than or equal to 0.58 W/CFM in all climates. (Standard Design)
- Performance assumes Standard Design fan runs on schedule.
- Proposed has default fan or actual fan if tested

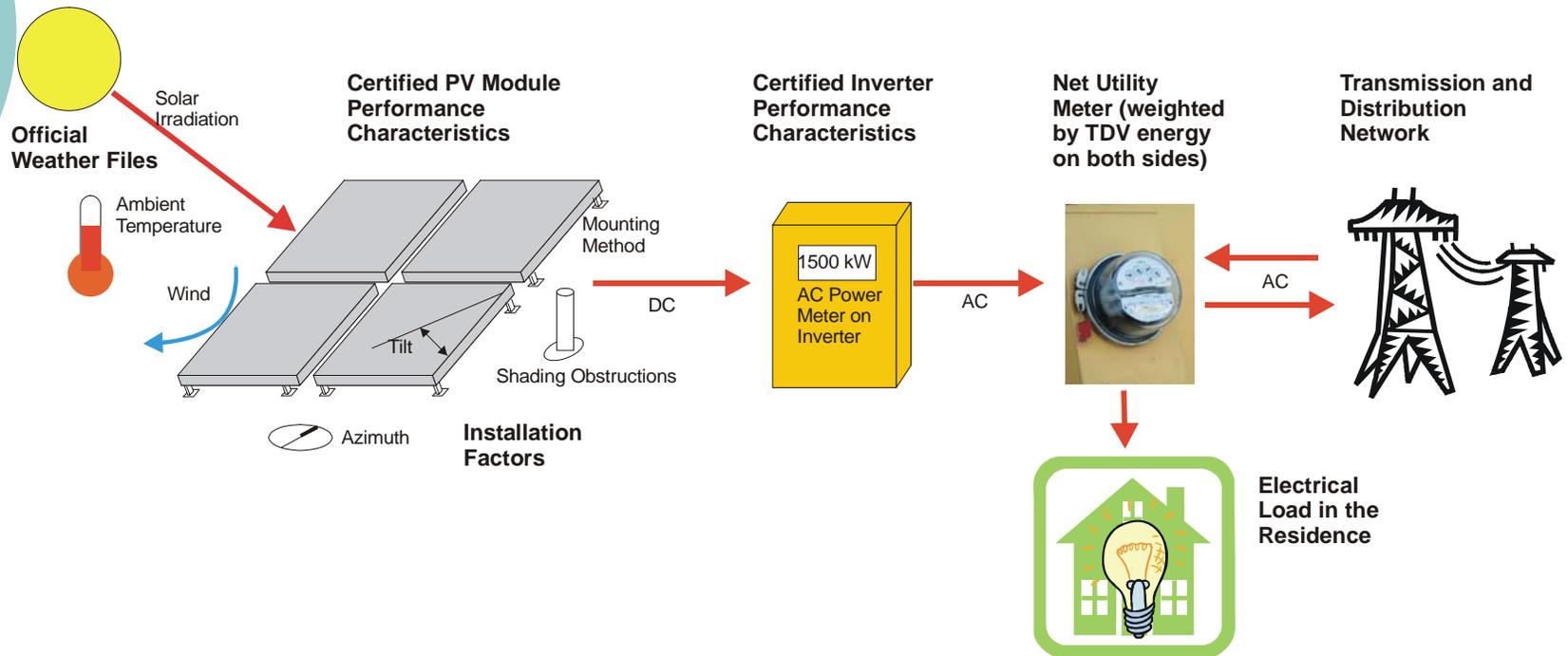
New Solar Homes Partnership (NSHP)



New Solar Homes Partnership (NSHP)

- CEC's photovoltaic system subsidy for new low rise residential buildings
- Combination of energy efficiency and solar is required
- Performance calculations using CECPV simulation
- Field verification of solar system installation and performance
- Emphasis on site shading and orientation

The NSHP PV system



NSHP Energy Efficiency

- Tier I – Minimum Condition of Participation
 - 15% Savings Beyond T-24 Total Energy Budget
- Tier II – Commission Preferred Level
 - 35% Savings Beyond T-24 Total Energy Budget
 - 40% Savings Beyond T-24 Space Cooling Budget
 - Moves Towards Zero Energy New Homes
 - Achieved by Current Building America Homes in California
 - Commission Seeks CPUC/Utility Support for New Construction Program Incentives for Tier II
- Both Tiers: High Efficacy Lighting and Energy Star Appliances

CECPV Performance Calculator

- PV Simulation program
 - Algorithms developed by Dr. William Beckman, University of Wisconsin-Madison Solar Energy Lab (originator of F-Chart)
 - Public Domain Model Published in *Solar Energy*,
 - Uses readily available performance tests as inputs
 - Hourly performance calculation that enables TDV
 - Uses Commission weather data and climate zones
 - Uses Certified Module and Inverter data from CEC database
- Incentives are based on predicted PV performance

NSHP Field Verification

- Visual Inspection
 - Verify the installed equipment
 - Verify the site-specific installation details
- Shading Evaluation
 - Check for shading obstructions
 - Check for trees that will shade modules at maturity
- Performance Verification
 - Measure solar irradiance and ambient temperature
 - Verify AC output displayed on the inverter is as expected
- Installer Checks 100%; HERS Rater Uses Sampling

New Solar Homes Partnership Alternative Compliance

- **EXCEPTION to Section 10-103(e):** For buildings that meet the requirements of the New Solar Homes Partnership (NSHP) as specified in the NSHP Guidebook, the enforcement agency may waive the plan check and inspection of all measures other than the mandatory measures in the building.