





California 2005 Title 24 Energy Efficiency Standards

Impact on HERS Raters and Multifamily Compliance

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Overview

- Review of the changes to California's Title 24 energy standards taking effect on October 1, 2005
- Impact of change on new construction HERS raters in California with an emphasis on multifamily dwellings.









Introduction

- Charles "Chas" Ehrlich
 - B.A. Architecture, U.C. Berkeley, 1989
 - M.S. Architecture (Building Science), U.C. Berkeley, 2002
 - PG&E, Pacific Energy Center 1992-1995
 - LBNL, Building Technologies Dept., 1995-2001
- Heschong Mahone Group, Inc.
 - Building Energy Efficiency Consultants, but "we don't do buildings"
 - Program Design and Implementation
 - Energy Efficiency Codes and Standards Development
 - Program Measurement and Evaluation (EM&V)
 - Building Energy Efficiency Research (Daylighting Productivity)









2005 Code Enhancement Approach

- Major Philosophy or Strategies:
 Close loopholes
 - Seek efficiency in areas not addressed previously
 - Increase reliance on installation and performance verification
 - Increase importance of peak energy savings









Electricity Usage Trends











Refrigerator Energy Use











Natural Gas Usage Trends



Figure 4: Residential Natural Gas Consumption and Population Growth Trends Source: California Energy Commission









California Compliance Methodology

- Residential vs. Non-Residential Codes
- Mandatory Minimums
- Prescriptive Package D
- Performance Simulation

 MICROPAS (CaIRES) Low-rise Only)
 EnergyPro (CaIRES + DOE 2.1e)
 eQuest under consideration (DOE 2.2)









Code Applicability to Residential Occupancy Types

- Low-rise = 3 stories or less
 - Residential Code entire building
 - Includes non-residential space up to 10% of floor area
- High-rise = 4 stories or more
 - Residential Code for dwelling units and DHW
 - Non-Residential Code for Envelope and HVAC











California Climate Zones









Climate Zones: Heating Dominated











Mild Climate Zones





2001







Intermediate Climate Zones













Cooling-Dominated Climate Zones











Cooling-Dominated Climate Zones











Impact of 2005 Revisions on Energy Budgets

	2001-2005	2001-2005	2001-2005	2001-2005	2001-2005
	Percent	Percent	Percent	Percent	Percent
	HeatTDV	CooITDV	DhwTDV	LightTDV	T o ta IT D V
C lim a te	(%)	(%)	(%)	(%)	(%)
Zone					
1	3 %	24%	14%	23%	14%
2	5 %	23%	1 5 %	23%	15%
3	10%	52%	1 5 %	23%	20%
4	1 3 %	47%	1 5 %	23%	20%
5	4 %	30%	1 5 %	23%	17%
6	17%	46%	20%	23%	24%
7	16%	38%	20%	23%	22%
8	14%	33%	20%	23%	24%
9	20%	34%	21%	23%	25%
10	13%	29%	21%	23%	24%
11	5 %	20%	15%	23%	16%
12	5 %	21%	15%	23%	16%
1 3	5 %	19%	16%	23%	17%
14	7 %	20%	15%	23%	17%
1 5	8 %	20%	18%	23%	20%
16	6 %	27%	14%	23%	14%
avg.	9 %	30%	17%	23%	19%
min.	3 %	19%	14%	23%	14%
max.	20%	52%	21%	23%	2 5 %

Based on research by Ken Nittler of EnerComp. MULTIFAMILY BUILDINGS: HIGH PERFORMANCE DESIGN TRAINING







Origins of HERS Rater Involvement in Code Compliance

- 1998 Standards and Duct Tightness Testing, Blower Door (Building Inspectors complained about these "unfunded mandates")
- California Energy Commission (CEC) recognized HERS Raters as a "special building inspector"
- CEC with support from the Investor-owned Utility Companies established the first HERS Provider registry for new construction









Expansion of HERS Rater Responsibilities

- 2001 Title 24 Energy Efficiency Standards
- Window Performance (Not required—but first impact on Multifamily)
- Thermostatic Expansion Valve (TXV)
- Refrigerant Charge and Air Flow
- Radiant Barrier inspection
- ACCA Manual D Duct Design











HERS Rater Involvement in Utility Incentive Programs

- California Energy Star New Homes
- Single-family
- Multifamily
- Verification of window performance (NFRC labels required)
- Insulation inspection
- HVAC Equipment Performance verification
- Domestic Hot Water Equipment verification









Energy Efficiency Enhancements

- Mandatory Measures
 - Adopted Federal Appliance Standards
 - Lighting
- Prescriptive Requirements
 - Building Envelope
 - HVAC
- Performance Calculation
 - Domestic Hot Water
 - Time Dependent Valuation (TDV)









Mandatory Measures

- Federal NAECA standards → CA Title 20 Appliance Standards
- SEER 10→ SEER 12 (Oct. 15, 2005)
- SEER 12 → SEER 13 (Jan. 23, 2006)
- 0.54 EF → 0.575 Energy Factor Gas Storage Water Heater
- NFRC Window Efficiency Labeling









Lighting (Mandatory Measure)

- Stepped definition of "high efficacy"
- 50% of Installed Wattage in Kitchens
- "High-efficacy" lighting or use controls in other rooms
- Parking lots and garages for 8 or more vehicles
- Other outdoor lighting reqts (lighting zones) may require full cut-off luminaries









Terminology

2005 CEC Definition of "High Efficacy" No screw-based fixtures meet the definition Must have electronic ballasts if > 13 watts

TABLE 150-C HIGH EFFICACY LAMP REQUIREMENTS				
Lamp Power Rating Minimum Lamp Efficacy				
15 watts or less	40 lumens per watt			
over 15 watts to 40 watts	50 lumens per watt			
over 40 watts	60 lumens per watt			









Building Envelope

- Multifamily Glass Area Loophole –closed–
 - Allowable area varies with proposed, less area not a credit
 - Max. Glazing Area is 20% of floor area
- West-facing glass assumed to be 5% of floor area (Climate Zones 2,4,8-15)
- Degraded performance of standard wall construction assemblies
- Simplified wall construction assembly choices (Joint Appendix IV)
- Radiant Barrier (unchanged)









HVAC

- Duct Insulation
 - R-4.2 unchanged for CZ 6-8 (coastal)
 - R-4.2 → R-6 (CZ 1-5 and 9-13)
 - R-4.2 → R-8 (CZ 14-15-16)
- Tight Ducts (unchanged since 2001)
- TXV or Refrigerant Charge and Air Flow

 Required Field Verification by HERS Rater (unchanged)









Domestic Hot Water

- No Prescriptive Compliance for Domestic Hot Water
 - Hourly simulation model
- Water heater "blanket" credit eliminated
- Water heating system type matches proposed
 - Individual water heaters is NOT baseline
 - If Central System proposed, also baseline
- Improved modeling of recirculation loop losses and controls for multifamily









Distribution Losses

Project No.	CZ03	CZ07	CZ09	CZ12
#2	16.9%	15.4%	15.0%	15.5%
#11	15.0%	14.1%	13.5%	13.4%
#13	25.0%	23.6%	22.4%	22.8%

 ... as a percentage of total building energy use.

Project No.	CZ03	CZ07	CZ09	CZ12
#2	28.8%	29.5%	29.8%	29.2%
#11	26.8%	27.4%	27.7%	27.1%
#13	38.6%	39.2%	39.4%	38.9%

... as a percentage of DHW energy use.









Performance Calculation

- Time Dependent Valuation (TDV) energy
 Site vs. Source energy factor varies over time
 - Places emphasis on efficiency strategies that save energy at peak demand times
- Revised cooling thermostat schedule
- Slab thermal mass modeling
 - Temp varies with regional ground temps
 - Slab edge modeling improved









TDV Energy











Existing Construction Modifications

- Alterations and Additions—2005 first involvement of HERS Raters
- Compressor change-out requires duct tightness test
- No requirement if HVAC equipment not changed









Title 24 Measures Requiring HERS Rater

- Quality Installation of Insulation
- High Efficiency Air Conditioner Verification
- Proper Equipment Sizing
- Duct Design
- Buried Ducts









Building Envelope

- Field studies show 20% framing factor more typical (currently assumes 15%)
 - Degraded performance of standard wall construction assemblies (see next slide)
- Quality Insulation Installation
- Requires field verification by HERS Rater to get credit
- Building Leakage Testing
- Min and Max specific leakage area









Current Assumptions 15% Framing – 16" on center studs











Realistic Basis for a Framing Factor













Quality Installation?









Faming Factor

Insulation Framing Factor Performance Degradation					
Frame	Cavity	2001	2005	2005	Percent
Туре	R-Value	U-factor	U-factor	R-Value	Change
Wood	R-11	0.092	0.110	R-9.09	-16.4%
Wood	R-13	0.088	0.121	R-8.26	-27.3%
Wood	R-13 QI	0.088	0.102	R-9.8	-13.7%
Metal	R-11	0.189	0.268	R-3.73	-29.5%









High Efficiency Air Conditioning

- SEER improvement does not indicate EER improvement
 - Credit for High EER Cooling compressor
- Credit Gas Absorption Cooling
- Credit Efficient AC fan motors
- Credit for thermal storage and off-peak cooling









$\mathsf{SEER} \to \mathsf{EER}$











High EER Compressor

- FREUS[™] is a water-cooled split system condenser
- Utilizing direct evaporative-cooled condensing coil, FREUS achieves a very high cooling efficiency
- EER as high 16! (SEER rating as high as 20)











Thermal Storage System

- Ice Bear[™]: Low cost, off the shelf Distributed Energy System for ACs with up to 10KW on-peak electrical demand
- Cuts energy costs by shifting consumption to off-peak lower priced hours
- Slashes daytime air conditioning peak demand charges by 90% without sacrificing comfort.



Ice Bear™ Distributed Energy Storage Module









Equipment Sizing

- Equipment operates much less efficiently at part load
- Credit for properly sized for cooling equipment
- Requires field verification of <6% duct leakage, adequate airflow, and TXV or refrigerant charge
- Credit for Reduced Fan Power credit









Duct Design

- Ducts in attic continues to be serious energy looser
- Credits for:
 - Tight ducts continues to be a prescriptive package D requirement
 - Measured Duct Surface Area
 - ACCA Manual D duct design
 - Less than 12 feet of duct in unconditioned space
 - Buried Ducts—under attic insulation
- All Require Field Verification by a HERS Rater









Alterations and Additions

- Altered HVAC system components must meet Mandatory Measures
- **Existing** ducts must be **sealed** if HVAC is altered:
- An air handler is installed or replaced
- An outdoor condensing unit of a split system air conditioner or heat pump is installed or replaced
- A cooling or heating coil is installed or replaced
- A furnace heat exchanger is installed or replaced
- When more than 40 ft of new or replacement ducts are installed in unconditioned space the ducts must also meet the duct insulation requirements of Package D









High-rise Mechanical

- Acceptance Certificates
- All duct systems shall be sealed to a leakage rate not to exceed 6% of the fan flow if the duct system:
- 1. Is connected to a constant volume, single zone, air conditioners, heat pumps or furnaces, and
- 2. Serving less than 5,000 square feet of floor area; and
- 3. Having more than 25% duct surface area located in one or more of the following spaces:
- A. Outdoors, or
- B. In a space directly under a roof where the U-factor of the roof is greater than the U-factor of the ceiling, or
- C. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces, or
- D. In an unconditioned crawlspace; or
- E. In other unconditioned spaces.









High-Rise Envelope

Cool Roof

- Part of Non-Res prescriptive package
- Product must be labeled by Cool Roof Rating Council (CRRC)
- Skylights
 - Treated as west-facing glass









Conclusions

- 2005 Code is about 25% more stringent than 2001 code.
- Field Verification of Energy Efficiency Measures will play an increasingly important role for improving the energy efficiency of California Homes
- Substantial business opportunities exist in the state starting immediately.









Relevant Web Site URLs

- www.sce.com
- www.pge.com
- www.EnergyDesignWorkshops.com
- www.h-m-g.com
- www.DesignedForComfort.com

More URLs in the resource list on your CD.









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