



2008 Title 24 Standards

Selected Residential and Nonresidential Issues

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*Some slides developed through the support
of Pacific Gas & Electric Company*



Overview

- Shine some light on a few specific issues in the 2008 standards and compliance software
- What you and/or your clients need to know or remember about these
- How the CEC or can fix them under current or 2011 standards
- General topics:
 - Low-rise Residential Standards
 - Nonresidential, High-rise Residential & Hotel/Motel Standards
- Comments and questions are welcome ..
.. but please keep them concise and on point



2008 Low-rise Residential Issues

An eclectic list of issues, tips and reminders from real projects, communication with CABEC members, developing training materials for the utilities, and discussions at building department trainings



2008 Lighting Changes: Relatively Minor ..

Section 150(k): Kitchen Lighting Exception



- 50% of Lighting Wattage must be High Efficacy ([no change from 2005 Standards](#))
- 50 Additional Watts of Low Efficacy allowed if Dwelling Unit < 2,500 sq ft.
- 100 Additional Watts of Low Efficacy allowed if Dwelling Unit > 2,500 sq ft.
- All low efficacy luminaires controlled by vacancy sensor, dimmer, EMCS, or multi-scene programmable control, and
- All luminaires in garages, laundry, closets > 70 sf, utility rooms must be high efficacy AND have a vacancy sensor



.. and the WS-5R Form is Gone

- 2005 Standards required the WS-5R worksheet to demonstrate at permit submittal that Kitchen Lighting requirements were met
- Energy Commission staff had complaints from the industry about a lack of accurate kitchen lighting design specs at permit, and final lighting was not properly inspected
- The decision was to move the kitchen lighting calculation to the installation certificate, CF-6R-LTG-01, under the 2008 standards

CF-6R-LTG-01: Lighting test

Where you see the wattage test that used to be on WS-5R
 (Contractor/Building Inspector Responsibility)

INSTALLATION CERTIFICATE						CF-6R-LTG-01																																																																	
Residential Lighting						(Page 1 of 3)																																																																	
Site Address:				Enforcement Agency:		Permit Number:																																																																	
<p>§150(k)8 Kitchen Lighting must comply with either method (a), (b), or (c) below:</p> <p>(a) All high efficacy luminaires</p> <p><input type="checkbox"/> Yes, complies because only high efficacy luminaires have been installed in the kitchen.</p> <p><input type="checkbox"/> No, complies with method (b) or (c).</p> <p>(b) $\geq 50\%$ watts used by high efficacy luminaires</p> <p><input type="checkbox"/> Yes, complies because at least 50% of the installed watts are from permanently installed high efficacy luminaires as demonstrated in the table below: Total A \geq Total B.</p> <p><input type="checkbox"/> No, complies with method (a) or (c).</p> <p>Fill out the following table if complying with either method (b) or (c).</p> <p>Table (b)</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Luminaire Type</th> <th colspan="2">Efficacy</th> <th rowspan="2">Watts</th> <th rowspan="2">x</th> <th rowspan="2">Quantity</th> <th rowspan="2">=</th> <th rowspan="2">High Efficacy Watts</th> <th rowspan="2">or</th> <th rowspan="2">Low Efficacy Watts</th> </tr> <tr> <th>High</th> <th>Low</th> </tr> </thead> <tbody> <tr> <td></td> <td> </td> <td> </td> <td></td> <td>x</td> <td></td> <td></td> <td></td> <td>or</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td></td> <td>x</td> <td></td> <td>=</td> <td></td> <td>or</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td></td> <td>x</td> <td></td> <td>-</td> <td></td> <td>or</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td></td> <td>x</td> <td></td> <td>=</td> <td></td> <td>or</td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td></td> <td>x</td> <td></td> <td>=</td> <td></td> <td>or</td> <td></td> </tr> </tbody> </table> <p>Complies with method (b) if A \geq B Total: A: \geq B:</p> <p>(c) Additional Kitchen Low Efficacy Lighting</p>										Luminaire Type	Efficacy		Watts	x	Quantity	=	High Efficacy Watts	or	Low Efficacy Watts	High	Low					x				or			<input type="checkbox"/>	<input type="checkbox"/>		x		=		or			<input type="checkbox"/>	<input type="checkbox"/>		x		-		or			<input type="checkbox"/>	<input type="checkbox"/>		x		=		or			<input type="checkbox"/>	<input type="checkbox"/>		x		=		or	
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New Problem

- **Non-compliance with the kitchen lighting requirements may not be uncovered until late in the process, possibly at final inspection**
- Even though no longer a permit requirement, make note of whether there is new kitchen lighting (e.g., in alterations), and discuss with your client
- Recommend and encourage designers complete the CF-6R-LTG-01 at permit stage to be sure the kitchen lighting works
- Some building departments may require the CF-6R-LTG-01 form well before final inspection





Definitions & Methods Have Not Changed

- “ADDITION is any change to a building that increases conditioned floor area and conditioned volume.” [Section 101\(b\)](#)
- “ALTERATION is any change to building’s water heating system, space-conditioning system, lighting system, or envelope that is not an addition.” [Section 101\(b\)](#)
- Alterations always must meet all applicable mandatory measures (new MF-1R form); and usually must show energy compliance (new CF-1R)
- “Existing + Addition + Alteration” compliance can only be done with the Performance Approach



Prescriptive Alterations & Additions \leq 1,000 sf

New Certificates of Compliance: Prescriptive CF-1R-ALT and CF-1R-ADD forms

- Can be used as a simple guide and/or reference
 - How to meet the applicable requirements for prescriptive alterations and additions \leq 1000 sf
 - Quick checklist in assessing whether an alteration or addition includes the correct prescriptive measures
- Very useful for Additions \leq 100 sf
- New CEC “fillable” version of the *.pdf form
- http://www.energy.ca.gov/title24/2008standards/residential_manual.html



CF-1R-ALT: now a fillable *.pdf form

Prescriptive Certificate of Compliance: Residential		CF-1R-ALT
<i>Residential Alterations</i>		(Page 1 of 5)
Project Name:	Climate Zone #	# of Stories

General Information		
Site Address:	Enforcement Agency:	Date:
Building Type <input type="checkbox"/> Single Family <input type="checkbox"/> Multi Family	Circle the Front Orientation: N, E, S, W, or degrees _____	
Conditioned Floor Area (CFA): _____	Project Type: <input type="checkbox"/> Alterations <input type="checkbox"/> Envelope <input type="checkbox"/> Fenestration <input type="checkbox"/> Roof <input type="checkbox"/> HVAC Replacement or Change Out <input type="checkbox"/> Duct Replacement <input type="checkbox"/> Water Heater	
NOTE: This form is not to be used for Newly Constructed Buildings or Additions		
<i>Insulation Values For Opaque Surfaces (for Furring use the Mass and Furring Strips Construction table below)</i>		
Assembly Alteration		
<input type="checkbox"/> Opening of framed cavity alone Alterations that involve the opening of the framed cavity of a wall, ceiling, or floor must install the mandatory minimum insulation value per §150 for the altered assembly. Fill in Columns A - C and enter mandatory insulation value in Column II.		
<input type="checkbox"/> Replacement of entire assembly Replacement of an entire wall, ceiling, or floor assembly requires the installation of Component Package- D insulation values in Table 151-C. Fill in Columns A - J.		

Opaque Surface Details For the furred portioned of Mass Walls see Furring Strips Construction Table below.									
A	B	C	D	E	F	G	H	I	J
Proposed <small>See Note</small>				Standard	Values From JA4 Table				
Tag/ ID ¹	Assembly Name or Type ²	Framing Material and Size ²	Thickness, Spacing, or Other ³	U- factor ⁴	JA4 Table Number ⁵	Framed Cavity R-value ⁶	Continuous Insulation R-Value ⁷	JA4 Assembly Cell Value ⁸	Proposed Assembly U-factor ⁹
<small>Note: For furred assemblies, accounting for Continuous Insulation R-value, see Page JA4-3 and Equation 4-1. For calculating furred walls use the Mass and Furring Construction table below.</small>									



CF-1R-ADD: now a fillable *.pdf form

Prescriptive Certificate of Compliance:						CF-1R ADD
Residential Additions						(Page 1 of 5)
Site Address:			Enforcement Agency:		Date:	

General Information										
Project Name				Climate Zone #		# of Stories				
Building Type <input type="checkbox"/> Single Family <input type="checkbox"/> Multi Family			Circle the Front Orientation: N, E, S, W or Degrees _____							
Conditioned Floor Area of Addition (CFA):		New Addition Size: <input type="checkbox"/> Less than or equal to 100 ft ² <input type="checkbox"/> Less than or equal to 1000 ft ² <i>(Do not use this form for additions greater than 1000 ft²)</i>								
<i>NOTE: For Alterations to an existing home, submit a completed CF-1R-ALT Form. Exception: Existing HVAC systems that are replaced or altered to serve the addition may be included on the CF-1R -ADD Form.</i>										
PRESCRIPTIVE ENVELOPE REQUIREMENTS FOR ADDITIONS										
For <u>standard wood and assemblies meeting the Cavity R-value only.</u>										
<ul style="list-style-type: none"> For 100 ft² additions; the Proposed values must be equal or greater than the Standard column or when indicated when using Package D, "Pkg D". Enter values in the shaded Proposed Columns. For less than 1,000 ft² additions must comply with "Pkg D" requirements unless indicated in the Standard Column. To meet "Pkg D" minimum energy compliance requirements, see RCM Appendix B, Table 151-C or §152(b) in the RCM. Enter values in the shaded Proposed Columns. 										
Size of Addition	100 ft² or less			Less than 1,000 ft²						
Component	Standard	Proposed		Comment	Standard	Proposed	Comment			
Ceiling Insulation	R-19			Minimum	Pkg D		Table 151-C			
Wall Insulation	R-13			Minimum	R-13		Minimum			
Floor Insulation	R-13			Minimum	Pkg D		Table 151-C			
Fenestration	U-factor	SHGC	U-factor	SHGC	Enter Values From "Fenestration Proposed Areas" Page 2 of 5	U-factor	SHGC	U-factor	SHGC	Enter Values From "Fenestration Proposed Areas" Page 2 of 5
	0.40	Pkg D				0.40	Pkg D			
Maximum Glazing Area	50 ft ²	≥	ft ²		"Fenestration Proposed Areas" Page 2 of 5	Addition Alone ¹	ft ²		Enter Values From "Addition Allowed Fenestration Areas" Page 3 of 5	
						For West-Facing Orientation ^{2,3}	ft ²			
Radiant Barrier	N/A					Pkg D	Table 151-C			
Roofing	N/A		See Roofing Products Below			Pkg D	See Roofing Products Below			



Prescriptive Fillable *.pdf Forms

- Can refer selected clients (e.g., architects, building contractors) to fill these out for themselves
- Note: projects permitted starting October 1, 2010 which require any HERS measures must be registered online with a HERS provider (*addressed in the “HERS Registry” session on Friday at 1:30 pm*)





CF-1R-ALT: starting 10/1/10 if HERS Measures

Note: For furred assemblies, accounting for Continuous Insulation R-value, see Page JA4-3 and Equation 4-1. For calculating furred walls use the Mass and Furring Construction table below.

1. For Tag/ID indicate the identification name that matches the building plans.
2. Indicate the Assembly Name or type: Roof/Ceiling, Walls, Floors, Slabs, Crawl Space, Doors and etc...Indicate in column G the Frame material and Size: For Wood, Metal, Metal Buildings, Mass, enter 2x4, 2x6, or etc... see JA4 for other possible frame type assemblies.
3. Enter the thickness for mass in inches or Spacing between framing members enter; 16" or 24" OC; or Other for all other assembly description such as Concrete Sandwich Panel, Spandrel Panel, Logs, Straw Bale Panel and etc....
4. Based on the Climate Zone; enter the equivalent U factor found in JA4 Table based on the R Value from Table 151 B, C, or D
5. Enter the Table number that closely resembles the proposed assembly.
6. Enter the R-value that is being installed in the wall cavity or between the framing; otherwise, enter "0".
7. Enter the Continuous Insulation R value for the proposed assembly; otherwise, enter "0".
8. Enter the row and column of the U-factor value based on Column F Table Number and enter the Assembly U-factor in Column J
9. The **Proposed Assembly U-factor, Column J**, must be equal to or less than the **Standard U-factor in Column F** to comply.

Furring Strips Construction Table for Mass Walls Only												L	M
A	B	C	D	E	F	G	H	I	J	K		L	M
Proposed Properties of Masonry and Concrete Walls From Reference Joint Appendix Table 4.3.5, 4.3.6, 4.3.7					Added Interior or Exterior Insulation in Furring Space from Reference Joint Appendix Table 4.3.13								
Mass Thickness ¹	Assembly Name or Type ²	JA4 Table Number ³	JA4-Mass Cell Value ⁴	Mass U-Factor ⁵	Interior or Exterior of Insulation Layer	Frame Thickness	Frame Type Wood or Metal	Furring Cavity R-value ⁶	JA4-Mass Cell Value ⁴	Effective R-value ⁵		Final Assembly U-factor ^{6,7}	Comment

Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____



Prescriptive HVAC Alterations (Change-outs)

New: Simplified Prescriptive Certificate of Compliance, CF-1R-ALT-HVAC

- http://www.energy.ca.gov/title24/2008standards/residential_manual.html
- Two-page form for “2008 Residential HVAC Alterations”
- Building departments can give them out at the counter; HVAC contractors can complete it on their own
- Five versions of the form to cover:
 - Climate Zones 1 and 3 through 7
 - Climate Zones 2, 9
 - Climate Zones 8
 - Climate Zones 10 to 15
 - Climate Zones 16



CF-1R-ALT-HVAC: Page 1 Q&A Summary

2008 Building Energy Efficiency Standards Residential HVAC Alterations Climate Zones 10 to 15

BUSINESS AND PROFESSIONS CODE, SECTION 7110

Willful or deliberate disregard and violation of the building laws, including the California Building Code, and local permit requirements constitutes a cause for disciplinary action from the Contractors State License Board working in conjunction with the local building department. This action may consist of fines up to \$5,000 per violation or suspension/revocation of a contractor's license.

WHEN IS A PERMIT REQUIRED?

A written construction permit shall be obtained from the enforcement agency prior to the erection, construction, reconstruction, installation, relocation, or alteration of any mechanical system, except as permitted in Appendix Chapter 1, Section 112.2 of the 2007 California Mechanical Code. Projects requiring permits include, but are not limited to:

- New HVAC installation
- HVAC Changeout
- Replacement of furnace, coil, FAU, or condenser
- Relocation of an existing HVAC unit
- Adding or replacing more than 40ft ducting in unconditioned space

2008 BUILDING ENERGY EFFICIENCY STANDARDS (Title 24, Part 6) REQUIREMENTS INCLUDE:

1. Heating equipment must have a minimum 78% AFUE (Exception: Wall & floor furnaces; room heaters).
2. Central air conditioners & heat pumps less than 65,000 Btu/hr must have a minimum 13 SEER.
3. Newly installed or replaced ducts must have a minimum insulation value of R-4.2. When more than 40 ft of ducting will be installed or replaced, the duct insulation value must be R-6 (CZ 10-13), or R-8 (CZ 14 and 15).
4. A setback type thermostat (24 hr clock with four set points) is required for all alterations.
5. New or replacement ducts must meet the mandatory requirements of Section 150(m):
 - All joints and openings in the in the HVAC system must be sealed.
 - Only UL 181, UL 181A, or UL 181B approved tapes or mastic shall be used to seal duct openings.
 - Connections of metals ducts and the inner core of flex ducts shall be mechanically fastened. Flex ducts must be connected using a metal sleeve/coupling.
 - Flex ducts that are suspended must be supported every 4ft. max for horizontal runs with no more than 2" of sag between supports and 6 ft. max for vertical runs.



CF-1R-ALT-HVAC: Page 2, Fill-in Form

Additions and Alterations

Simplified Prescriptive Certificate of Compliance: 2008 Residential HVAC Alterations	CF-1R-ALT-HVAC
Climate Zones 10 to 15	

<i>Site Address:</i>		<i>Enforcement Agency:</i>	<i>Date:</i>	<i>Permit #:</i>
Equipment Type¹	List Minimum Efficiency²	Duct insulation requirement	Conditioned Floor Area	Thermostat
<input type="checkbox"/> Packaged Unit <input type="checkbox"/> Furnace <input type="checkbox"/> Indoor Coil <input type="checkbox"/> Condensing Unit <input type="checkbox"/> Other _____	<input type="checkbox"/> AFUE _____ <input type="checkbox"/> SEER _____ <input type="checkbox"/> EER _____ <input type="checkbox"/> COP _____ <input type="checkbox"/> HSPF _____ <input type="checkbox"/> Resistance _____	Over 40 ft of ducts added or replaced in unconditioned space <input type="checkbox"/> R 6 (CZ 10-13) <input type="checkbox"/> R 8 (CZ 14-15)	Served by system _____ sf	<input type="checkbox"/> Setback <i>(If not already present, must be installed)</i>

1. **Equipment Type:** Choose the equipment being installed; if more than one system, use another CF-1R-ALT-HVAC for each system.
2. **Minimum Equipment Efficiencies:** 13 SEER, 78% AFUE, 7.7HSPF for typical residential systems.

HERS VERIFICATION SUMMARY Listed below are four HVAC alteration Options. The installer decides what work is being done and picks **one** of the appropriate Options. Each Option lists the HERS measures that must be conducted. A copy of the forms shall be left on site for final inspection and a copy given to the homeowner. At final, the inspector verifies that the work listed on this form was in fact the work completed by the installer. The inspector also verifies that each appropriate CF-6R and registered CF-4R forms (no hand filled CF-4Rs allowed) are filled out and signed. **Beginning October 1, 2010, a registered copy of the CF-1R and CF-6R shall also be on site for final inspection.**

<input type="checkbox"/> 1. HVAC Changeout	Required Forms:
<ul style="list-style-type: none"> • All HVAC Equipment replaced 	CF-6R forms: MECH-04, MECH-21-HERS and (for split systems) MECH- 25-HERS CF-4R forms: MECH- 21 and (for split systems) MECH-25
<ul style="list-style-type: none"> • Condenser Coil and/or • Indoor Coil and/or • Furnace 	CF-6R forms: MECH-21-HERS and (for split systems) MECH- 25-HERS CF-4R forms: MECH- 21 and (for split systems) MECH-25

For Split Systems: Duct leakage < 15 percent; RC, CCA ≥ 300 CFM/ton(Minimum Air Flow Requirement), TMAH
For Packaged Units: Duct leakage < 15 percent
 Exempted from duct leakage testing if:

- 1. Duct system was documented to have been previously sealed and confirmed through HERS verification, or
- 2. Duct systems with less than 40 linear feet in unconditioned space, or
- 3. Existing duct systems are constructed, insulated or sealed with asbestos



Re-certified ACMs in July, 2010

- EnergyPro and Micropas are currently scheduled to be recertified for the low-rise residential standards in July, 2010; current EP and MP versions will be decertified later (date not yet certain)
- No major changes in TDV energy expected except:
 - Existing+Addition+Alteration calculation in EnergyPro when the fenestration in the existing house is $< 20\%$
 - This scenario with EPv5.0 is much easier to pass than in the 2005 standards because of a glitch in the language of the 2008 Residential ACM Manual
 - Will be corrected, but be aware: these E+A+A projects done originally with EPv5.0 will be more difficult to comply if they're revised after June 30th w/ EPv5.1



Energypro v5 Input Caution ..

- EnergyPro v5.0 now automatically changes the “Front” orientation whenever “Rotation” changes (not the reverse); it’s different from EP v4.4 in which the two inputs operate independently from one another

Building -

Project Design Data | Project Title | Designer | Lighting Designer | Mechanical Designer | Utility | Outdoor | HER3

General

Building Name:

Building Type: New

Job No:

Front Orientation: 120

Rotation: 120

Number Of Dwelling Units: 1

Location

Country: UNITED STATES

State: California

City: San Luis Obispo

User Defined





New Attic Model in ACMs

- New Attic Unconditioned Zone Model (UZM) and 2008 TDV energy multipliers producing interesting results with radiant barriers and cool roofs
- Example: 2,500 sf 2-story house in CZ12 (Sacramento); 20% fenestration, Low-E vinyl windows, slab floor, R-19 walls, with R-38 attic and no radiant barrier or cool roof, R-6 attic ducts; passes by a 1.5% compliance margin with EnergyPro v5
 - Only add radiant barrier: 7.1% compliance margin = **5.6%** improvement
 - Only add cool roof, Reflect=0.55, Emitt=0.75: 3.3% compliance margin = **1.8%** improvement
 - Add both radiant barrier and cool roof: 12.6% compliance margin = **11.1%** improvement
 - According to the model, apparent synergy in having both



Energy Measures in Exceeding Code by 15%

- New Construction for GreenPoint Rated, for New Solar Homes Partnership (NSHP), and to comply with local green building or energy ordinances
- Based on the energy cost-effectiveness studies completed by Gabel Associates (by individual climate zone) in support of local ordinances for CEC approval:
 - Extraordinarily difficult and/or costly to exceed code by 15% without HERS measures
 - Mix of HERS and non-HERS measures according to building design, base case measures, climate zone





Summary of Programs *(from CABEC Advanced Trainings)*

Exceeding Title 24

	Program	Program Type	Administered By	Certification of Energy Analyst	Verification Other than for Title 24
California	GreenPoint Rated [CA]	Green Certification	Build It Green	none ¹	GreenPoint Rater
	New Solar Homes Partnership [CA]	Solar PV Incentive	State of California	Certified Energy Plans Examiner (CEPE)	State of California or IOUs
	Utility Incentives [CA]	Energy Efficiency Incentive	Investor-owned & other utilities	not required	IOUs
	HERS II for Existing Homes [CA]	Energy Efficiency Rating	State of California and HERS Providers	HERS II Rater or HERS II Energy Analyst	HERS Rater
	Local Green Building and Energy Ordinances [CA]	Mandatory standards exceeding Title 24	Local governments (cities and counties)	not required	Depends on the ordinance²
	California Green Building Standards [CA]	Voluntary tiers exceeding Title 24	Building Standards Commission	not required	Local building departments
CA & US	Low Income Housing Tax Credits [CA/US]	Energy Efficiency Tax Credits	California Tax Credit Allocation Committee	not required	Building Owner Certification
U.S.-wide	Federal Energy Efficiency Tax Credits thru 12/31//2013 [US]	Energy Efficiency Tax Credits	Internal Revenue Service	not required	HERS Rater
	ENERGY STAR [US]	Energy Efficiency Marketing	EPA/DOE/IOUs	not required	HERS Rater
	LEED for Homes [US]	Green Certification	USGBC	not required	HERS Rater / LEED Homes Rater

¹ GreenPoint Rated for Existing Homes uses the HERS II rating procedure that has its own certification requirements

² Many local green building ordinances require GPR verification for residential buildings and LEED AP for nonresidential buildings.



Summary of Programs (from CABEC Advanced Trainings)

Exceeding Title 24

Program	Energy Software	Minimum Energy Performance	Program Website
GreenPoint Rated [CA]	EnergyPro v5.0 or Micropas 8	15% better than Title 24	greenpointrated.org
New Solar Homes Partnership [CA]	EnergyPro v5.0 or Micropas 8	15% better than Title 24	gosolarcalifornia.ca.gov
Utility Incentives [CA]	EnergyPro v5.0 or Micropas 8	15% better than Title 24	flexyourpower.com
HERS II for Existing Homes [CA]	EnergyPro v5.0	no minimum required / rating only (not Title 24)	energy.ca.gov/HERS/index.html
Local Green Building and Energy Ordinances [CA]	EnergyPro v5.0 or Micropas 8	15% better than Title 24 (generally)³	energy.ca.gov/title24/2008standards/ordinances/
California Green Building Standards [CA]	EnergyPro v5.0 or Micropas 8	15% better than Title 24	documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf
Low Income Housing Tax Credits [CA/US]	EnergyPro v5.0 or Micropas 8	ENERGY STAR Appliances/ Lighting 10% or 15% better than Title 24	treasurer.ca.gov/CTACAC/
Federal Energy Efficiency Tax Credits thru 12/31//2013 [US]	EnergyPro v5.0 or Micropas 8	50% better than 2004 IECC	energy.gov/additionaltaxbreaks.htm
ENERGY STAR [US]	EnergyPro v5.0 or Micropas 8	15% better than Title 24 plus all ES requirements	energystar.gov
LEED for Homes [US]	EnergyPro v5.0 or Micropas 8	15% better than Title 24 plus ENERGY STAR plus prerequisites	usgbc.org/homes/

³ A few local ordinances (e.g., Chula Vista) may have a different requirement. Check the governing ordinance for details.



CEC-Approved Green Building Ordinances

- Periodically check the Energy Commission web site to see if local jurisdictions where you do projects have a legally enforceable green building or energy ordinance
- <http://www.energy.ca.gov/title24/2008standards/ordinances/>
- Current approved ordinances include: Chula Vista, Hayward, Morgan Hill, Palo Alto, Richmond, San Francisco, San Jose, Santa Clara County, Sonoma County, Union City
- Ordinances pending approval include: San Rafael, Marin County, Los Altos, Redwood City
- Other green building ordinances have passed or are pending local government approval, but have not been approved by the CEC





2008 Nonresidential Issues

Includes High-rise Residential and Hotel/Motel



Prescriptive Envelope: Alterations

General rules:

All altered envelope components must meet the prescriptive requirements — with a few exceptions ([Section 149\(b\)1.A.i.](#))

- May replace < 150 sf fenestration in entire building and not meet the RSGC or SHGC values; **or**,
- May add < 50 sf fenestration and not meet the RSGC or SHGC values
- For high-rise residential and hotel/motel buildings, may add < 150 sf fenestration and < 50 sf skylights if both the following are met:
 - The RSGC for 30% – 40% WWR
 - The 2.1% – 5.0% SHGC for skylights



Envelope Performance: Alterations

- **General modeling rule:** Software user must specify each assembly, fenestration, equipment and other related inputs as one of four conditions (no change from the 2005 standards)
 - **“Existing:”** an existing condition that does not change as part of the alteration
 - **“Altered:”** a replacement or upgrade of the existing condition for that item
 - **“Removed:”** an item is removed as part of the overall remodel (and not replaced or upgraded)
 - **“New:”** an entirely new construction assembly or other feature not in the existing building
- The software (e.g., EnergyPro) automatically sets the energy budget for the standard design **based on the condition (“Status”) of the feature, and whether each altered measure meets the designated threshold value**
- **These rules are likely to make many Alterations difficult to work using the performance approach**



Prescriptive Envelope Overall TDV Energy



Alterations “*shall not increase the Overall TDV Energy of the building envelope*” (Section 149(b)1.A.ii.) for **“*alterations to the building envelope other than those subject to 149(b)1.B* [i.e., cool roofs]”** (Section 149(b)1.A)

- Demonstrate only that post-alteration Overall TDV energy is less than pre-alteration Overall TDV energy including roof, wall, floor U-factors; fenestration U-factors, SHGC values, exterior shading and cool roofs (see “Exception 1 to Section 149(b)1B”)
- Note: this is a correction to the slide in the November, 2009 CABEC Advanced Trainings
- EP v5 does the Overall TDV calculation, but does not automate the pre- and post-alteration comparison; set up two separate files, run them, print and document comparison of Overall TDV values (note: no longer any “User Defined” reports in EPv5)



Cool Roof: Alterations

If: Replacing, recovering or recoating the exterior surface of existing roofs; **and**, > 50% of existing roof area or > 2,000 sf is replaced (whichever is less)

Then: Must meet all prescriptive cool roof requirements unless:

- Existing roof & new roof have a rock or gravel surface; **and**,
- No removal of existing roof layers > 50% or > 2,000 sf (whichever is less); **and**,
- No recoating with a liquid applied coating; **and**,
- No installation of a recover board, rigid insulation or other rigid smooth substrate to separate and protect new roof covering from the existing roof



Roof: Alterations

- When low-sloped roofs ($\leq 2:12$) are exposed to roof deck or recover boards, exposed area must be insulated per Table 149-A (**Section 149(b)1.B.iv.**)
 - Nonresidential: R-8 in zones 1, 3 - 8; R-14 in zones 2, 10–16
 - High-rise Residential and Hotel/Motel: R-14 in all zones

Exceptions:

- **Existing roof > R-7 or < 0.089 U-factor;** or,
- Mechanical equipment on roof not disconnected and lifted, so maximum insulation thickness must allow 8" from roof membrane to top of base flashing; or, a similar exception with penthouse or parapet walls that meet other conditions; or,
- Tapered insulation okay if average "thermal resistance" [sic] \geq value specified in Table 149-A (e.g., average U-factor x area)



Prescriptive Indoor Lighting: Alterations

- Title 24 triggered when (a) more than 50% of fixtures replaced or moved; or, (b) when increasing connected w/sf
- Alterations no different from prescriptive indoor lighting for new construction, except:
 - Decide which enclosed spaces or floor areas are part of the lighting alterations
 - Existing lighting fixtures which remain must be included if they are within the altered lighting areas
 - Assumptions must be illustrated clearly
- Additions are handled the same as new construction



Fenestration U-Factor

U-Factors can be used from the following:

- Table 116-A Default Fenestration Product U-Factors
- NFRC rated fenestration products or NFRC label certificate
- **Nonresidential Appendix 6-1 U-Factor Formula**
Converts a center-of-glass U-factor to an overall fenestration U-factor
- **CMA (Component Modeling Approach)**
Developed by NFRC for nonresidential fenestration



Fenestration U-Factor

NEW

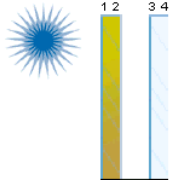
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507-451-9555
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"The Leader in Class Fabrication™"

Solarscreen Products
Solar Optical Properties and Thermal Characteristics*
Tue May 8 16:36:24 2001

Solarscreen 2000 Low-E Insulating Glass
VE-2M Insulating

Make-up:



1/4" (6mm) VE 4-2M #2
1/2" (13.2mm) Airspace
1/4" (6mm) Clear

Transmittance

Visible Light:	42%
Solar Energy:	19%
Ultra-Violet**:	5%

Reflectance

Visible Light-Exterior:	7%
Visible Light-Interior:	10%
Solar Energy:	16%

ASHRAE U-Value

Winter Nighttime:	0.29 Btu/(hr x sqft x °F)
Summer Daytime:	0.30 Btu/(hr x sqft x °F)

European U-Value: 1.6

Shading Coefficient:	0.30
Solar Factor (SHGC):	0.26

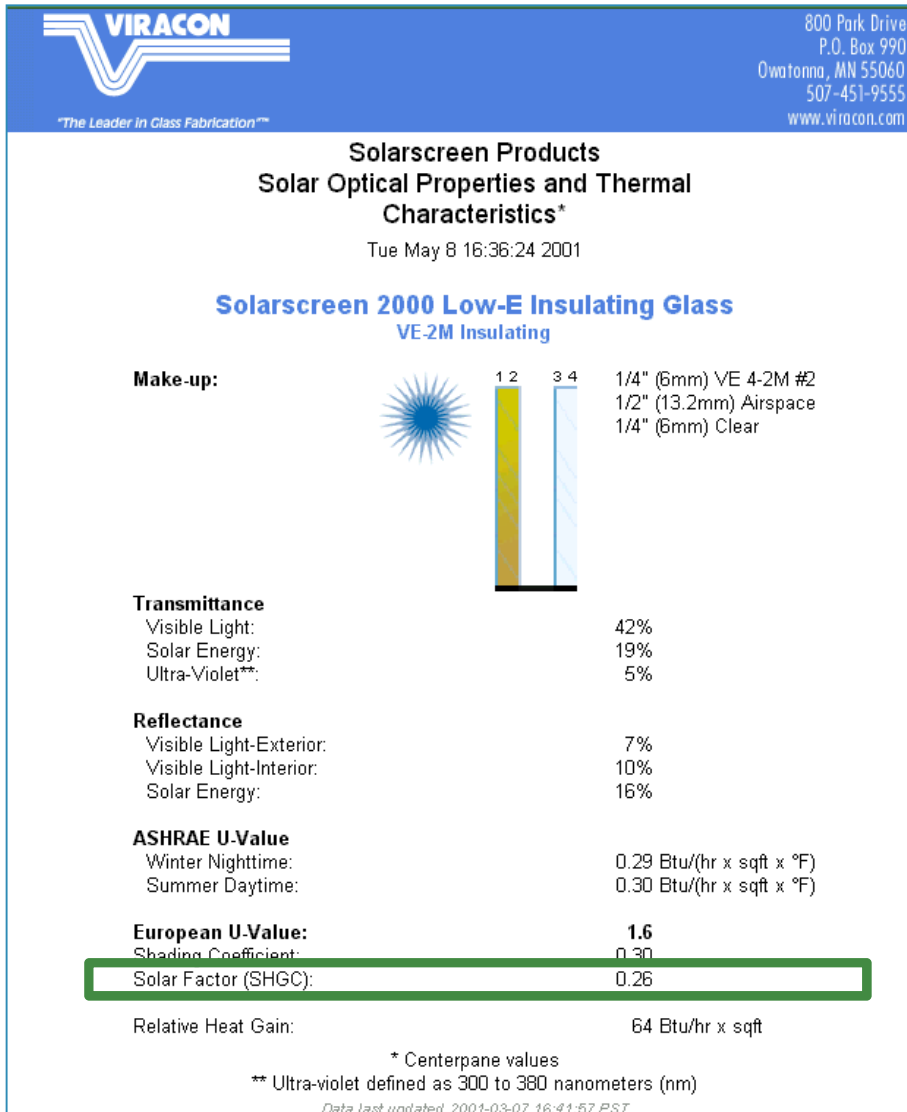
Relative Heat Gain: 64 Btu/hr x sqft

* Centerpane values
** Ultra-violet defined as 300 to 380 nanometers (nm)
Data last updated 2001-03-07 16:41:57 PST

U-Factor formula based on center-of-glass U-Factor from manufacturer specifications

- Nonresidential Appendix 6-1: U-Factor formula
 - Converts a center-of-glass (“COG”) U-factor to overall fenestration U-factor
 - **Only for skylights and *site built glazing* in buildings with < 10,000 sf vertical glass**
- Built into EnergyPro v5 and documented on new ENV-1C

Fenestration SHGC (no change from 2005 standards)



- SHGC formula based on center-of-glass SHGC (from manufacturer)
- Nonresidential Appendix 6-2 Alternate SHGC calculation converts COG SHGC to overall SHGC (only for skylights and site built glazing in buildings with < 10,000 sf vertical glass)
- Built into EnergyPro v5 and documented on new ENV-1C
- NFRC rating for SHGC must be used instead of the COG SHGC if building has > 10,000 sf of vertical glazing



Center-of-Glass (COG) U-Factor or SHGC

- Restricted for permitting to buildings where vertical site built glazing < 10,000 sf
- Because the overall U-factor and SHGC values that come out of the COG method are conservative, they can generally be used as a conservative estimate of the final NFRC values derived from the glass type selected
- Can use EnergyPro to calculate the overall U-factor and SHGC from COG values, but they must be input into EP as NFRC values
- However: be sure client(s) understand and follow up with getting the NFRC ratings and/or label certificates before final inspection





Mandatory Lighting Controls

Mandatory Multi-Level Lighting Controls (Section 131(b))

No change from the 2005 standards

- General lighting in spaces \geq 100 square feet; and, which has an LPD $>$ 0.80 watts/sf must have:
 - Multi-level lighting controls with at least one step between 30% and 70% of design lighting power and allow the power of all lights to be manually turned off
 - Reasonably uniform level of illuminance shall be achieved with:
 - Continuous or stepped dimming of all lamps or luminaires; or
 - Switching alternate lamps in luminaires, alternate luminaires and alternate rows of luminaires



Mandatory Lighting Controls



Mandatory (On/Off) Occupancy Sensors (OS) in Section 131(d)4

NEW

- Offices < 250 square feet
- Multipurpose rooms < 1000 square feet
- Any size classrooms
- Any size conference rooms

Must meet all requirements of Section 119(d) for Occupant Sensors, Motion Sensors and Vacancy Sensors

Remember: These spaces don't count for any lighting compliance (PAF) credit unless the designer specifies "Multi-Level Occupancy Sensors"



Lighting Controls for Compliance Credit

Table 146-C Lighting Power Adjustment Factors (PAFs)

TABLE 146-C LIGHTING POWER ADJUSTMENT FACTORS

TYPE OF CONTROL		TYPE OF SPACE	FACTOR
Multi-level occupant sensor (see Note 2) combined with multi-level circuitry and switching in accordance with Section 146(a)2D		Any space \leq 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, corridor, conference or waiting room.	0.20
Multi-level occupant sensor (see Note 2) that reduces lighting power at least 50% when no persons are present. May be a switching or dimming (see Note 3) system.		Hallways of hotels/motels, multi-family, dormitory, and senior housing	0.25
		Commercial and Industrial Storage stack areas (max. 2 aisles per sensor)	0.15
		Library Stacks (maximum 2 aisles per sensor)	0.15
Dimming system	Manual	Hotels/motels, restaurants, auditoriums, theaters	0.10
	Multiscene programmable	Hotels/motels, restaurants, auditoriums, theaters	0.20
Demand responsive lighting control that reduces lighting power consumption in response to a demand response signal. (See Note 1)		All building types	0.05
Manual dimming of dimmable electronic ballasts. (see Note 3)		All building types	0.10
Demand responsive lighting control that reduces lighting power consumption in response to a demand response signal when used in combination with manual dimming of dimmable electronic ballasts (see Note 1 and 3).		All building types	0.15
Combined controls	Multi-level occupant sensor (see Note 2) combined with multi-level circuitry and switching in accordance with Section 146(a)2D combined with automatic multi-level daylighting controls	Any space \leq 250 square feet within a daylight area and enclosed by floor-to-ceiling partitions, any size classroom, corridor, conference or waiting room. The PAF may be added to the daylighting control credit	0.10
	Manual dimming of dimmable electronic ballasts (see Note 3) when used in combination with a multi-level occupant sensor (see Note 2) combined with multi-level circuitry and switching in accordance with Section 146(a)2D.	Any space \leq 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, corridor, conference or waiting room	0.25



Multi-Level Occupant Sensors

TABLE 146-C LIGHTING POWER ADJUSTMENT FACTORS

TYPE OF CONTROL	TYPE OF SPACE	FACTOR
Multi-level occupant sensor (see Note 2) combined with multi-level circuitry and switching in accordance with Section 146(a)2D	Any space \leq 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, corridor, conference or waiting room.	0.20
Multi-level occupant sensor (see Note 2) that reduces lighting power at least 50% when no persons are present. May be a switching or dimming (see Note 3) system.	Hallways of hotels/motels , multi-family, dormitory, and senior housing	0.25
	Commercial and Industrial Storage stack areas (max. 2 aisles per sensor)	0.15
	Library Stacks (maximum 2 aisles per sensor)	0.15

(e) **Multi-Level Occupant Sensor.** Multi-level occupant sensors shall have an automatic OFF function that turns off all the lights, and either an automatic or a manually controlled ON function capable of meeting all the multi-level and uniformity requirements of Section 131(b) for the controlled lighting. The first stage shall be capable of activating between 30-70 percent of the lighting power in a room either through an automatic or manual action, and may be a switching or dimming system. *After that event occurs* the device shall be capable of all of the following actions when manually called to do so by the occupant:

1. Activating the alternate set of lights.
2. Activating 100 percent of the lighting power.
3. Deactivating all lights.





Multi-Level Occupant Sensors (continued)

- “*After that event occurs ..*” means that all lights cannot be switched on simultaneously
- According to Gary Flamm of the CEC, one can meet the mandatory shutoff requirements, as well as get a PAF, for a two-switch leg, manual-on occupant sensor
- To qualify for the PAF, the MLOS must sequence through at least two [non-simultaneous] control events: one action may be either manual or automatic, but the second action must be manual
- It is the 30% -70% initial on level that primarily differentiates the PAF-compliant MLOS from a system minimally compliant with 131(b) and 131(d)4; but the controls technically do not qualify if all lights can be turned on simultaneously (e.g., with one switch)
- Two manual-on switches meet the requirement, according to the CEC, but this option may be eliminated in the 2011 standards





Mandatory Controls: Skylit Areas > 2,500 sf

Enclosed spaces with **skylit areas $\geq 2,500 \text{ ft}^2$** shall have **automatic daylighting controls** for electric lighting

NEW
MEP





Mandatory Controls: Skylit Areas $\geq 2,500$ sf

Exceptions in Section 131(c)2B:

- Skylit daylight areas where existing adjacent structures obstruct sunlight for ≥ 6 hrs/day on March 21st/Sept. 21st
- When skylight “effective aperture” [i.e., Area x Visible Transmittance] is $> 4\%$ and all general lighting in skylit area is controlled by a multi-level astronomical time [Section 119(h)] switch and has an override switch [Section 131(d)2]
- When skylight effective aperture is $< 0.6\%$ [e.g., Kalwall skylights with a low VT]



Mandatory Controls: Skylit Areas \geq 2,500 sf

When is this triggered?

- You're not likely to see skylit areas drawn on plans; however, remember to "eyeball" larger nonresidential spaces with lots of skylights to consider whether the requirement is triggered
- If it appears to need the automatic daylighting controls, remind your client(s) to draw – or have someone draw -- the skylit area to identify which fixtures are affected
- If your client(s) have no idea what you're talking about, refer them to the *Nonresidential Compliance Manual*





Skylit Area: Building Section

- See p. 3-22 of the *Nonresidential Compliance Manual*
- Still lack of clarity in some conditions (e.g., ceiling height with sloped ceilings and/or sloped skylights)

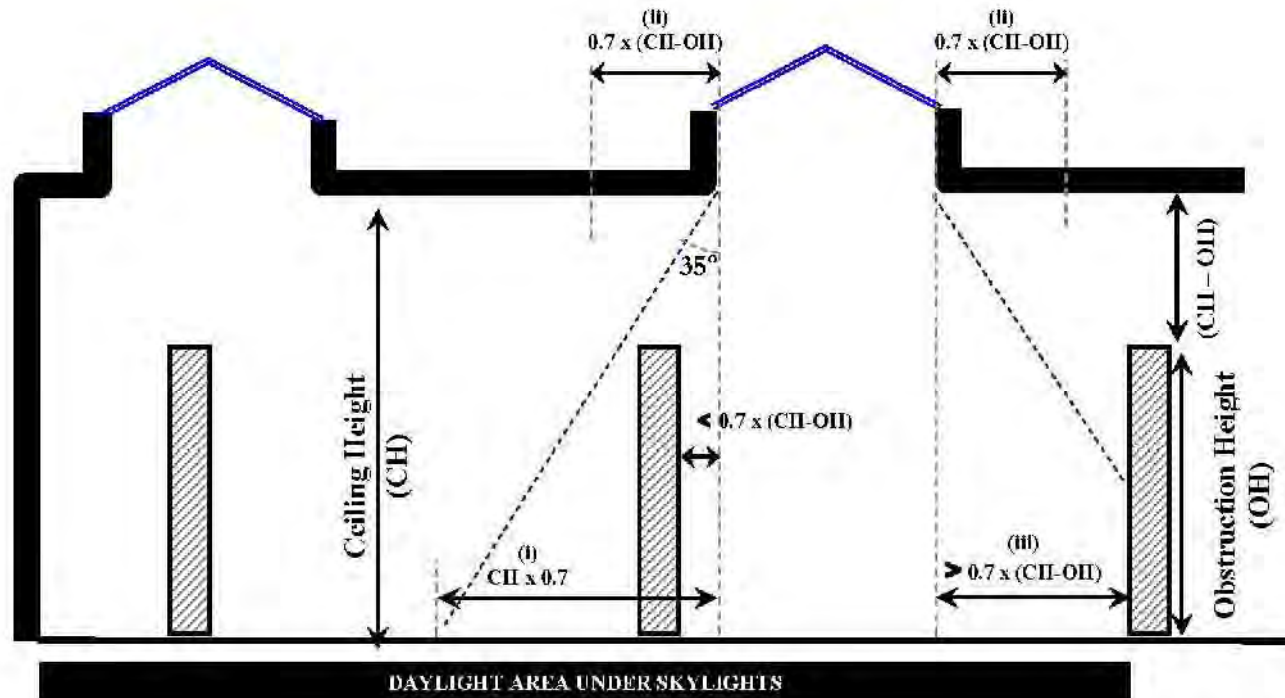


Figure 3-5 – Daylit Area under Skylights



Automatic Daylighting Control PAF and VT

Automatic multi-level daylighting controls (Sec Note 1)	Total primary sidelit daylight areas less than 2,500 ft ² in an enclosed space and all secondary sidelit areas. (sec Note 4)	Effective Aperture				
		General Lighting Power Density (W/ft ²)	>10% and ≤20%	>20% and ≤35%	>35% and ≤65%	> 65%
		All	0.12	0.20	0.25	0.30
Automatic multi-level daylighting controls (Sec Note 1)	Total skylit daylight areas in an enclosed space less than 2,500 square feet, and where glazing material or diffuser has ASTM D1003 haze measurement greater than 90%	Effective Aperture				
		General Lighting Power Density (W/ft ²)	0.6% ≤ EA < 1%	1% ≤ EA < 1.4%	1.4% ≤ EA < 1.8%	1.8% ≤ EA
		LPD < 0.7	0.24	0.30	0.32	0.34
		0.7 ≤ LPD < 1.0	0.18	0.26	0.30	0.32
		1.0 ≤ LPD < 1.4	0.12	0.22	0.26	0.28
		1.4 ≤ LPD	0.08	0.20	0.24	0.28

- EA = Effective Aperture calculated in Equations 146-A, B and C
- EA is a function of daylight area, fenestration area and VT (and Well Efficiency in Skylit EA)
- VT = Visible Light Transmittance which includes frame effects per NFRC testing procedures
- However, frequently only a center-of-glass “VLT” is known
- Since there is no COG VLT to VT conversion algorithm, the CEC allows VT and COG VLT to be used interchangeably for now



Mandatory Demand Control Ventilation



- Remind your clients about this new mandatory measure:
 - If airside economizer; and
 - Serves a high density space (< 40 sf / occupant); and
 - Is **single zone** or is **multiple zone with Zone Level DDC**; then
- **CO₂ sensor required in each high density space**



Mandatory Demand Control Ventilation

Remember: Exceptions to CO₂ sensor requirement are good performance method credits:

- Classrooms
- Call centers
- Office spaces served by multiple zone systems that are continuously occupied during normal business hours
- Healthcare facilities and medical buildings,
- Public areas of social services buildings
- Beauty Salon
- Spaces < 150 sqft or < 10 people
- Exhaust CFM > Design Ventilation CFM – 0.2 cfm/ft²)
- Spaces with processes or operations that generate dusts, fumes, mists, vapors, or gases and are not provided with local exhaust ventilation



Exceeding Title 24 Per Local Ordinances

- How are local green building ordinances (GBOs) written?
- For High-rise residential buildings, GBOs typically reference GreenPoint Rated, sometimes reference LEED, and a few are beginning to reference the California Green Building Standards (“CAL Green”)
- For Nonresidential and Hotel/Motel buildings, GBOs typically reference LEED; and a few are beginning to reference CAL Green
- If showing that a nonresidential building exceeds the standards by 15%, the accepted rule is that in the %-better-than calculation:
 - Process and receptacle energy use components may be omitted from both the Standard and Proposed designs; or,
 - In high-rise residential buildings, lighting, process and receptacle energy use components may all be omitted from both the Standard and the Proposed designs



LEED Minimum Energy Requirement

- Check the local ordinance that references LEED as to which of these applies in demonstrating that the minimum energy performance requirement has been met:
 - The ordinance – or an administrative bulletin referenced in the ordinance – offers an option to exceed the standards by 15% to meet the LEED energy requirement (e.g., San Francisco)
 - The ordinance explicitly requires exceeding the standards by 15% apart from the LEED energy pre-requisite (e.g., Chula Vista and Palo Alto)
 - In rate instances, the ordinance offers no 2008 Title 24 equivalent to LEED, in which case one of the LEED energy methods must be used and full LEED energy documentation must be submitted



Conclusions

- **Let the CABEC Standards Committee know of problems as they come to light (email mike@gabelenergy.com or admin@cabec.org)**
- **If you can, propose solutions – either a quick fix under the 2008 standards, or a better solution under the 2011 standards**
- **Consider joining the CABEC Standards Committee to work on these issues**
- **To improve enforcement: if you have a good relationship with your local building departments, recommend that they host a free, on site Title 24 training sponsored by the utility company**
- **Jill Marver of PG&E is coordinating building department trainings, and will speak about utility Codes & Standards work this afternoon at 4:30 pm**