

CALIFORNIA ENERGY COMMISSION

# BLUEPRINT

EFFICIENCY AND RENEWABLE ENERGY DIVISION

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## Descriptions of the *Standards* and Supporting Documents

### *2008 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Standards)*

#### Purpose

The *Standards*, which comprise Title 24, Parts 1 and 6, of the *California Code of Regulations*, are a legal document establishing the minimum energy efficiency for newly constructed buildings, additions, and alterations in California.

#### Building Types Covered

- The residential portions of the *Standards*, and the *Residential Compliance Manual*, cover newly constructed single-family dwellings of any number of stories, duplex (two-family) dwellings of any number of stories, multi-family dwellings of three or fewer habitable stories,\* and additions or alterations to any of the above.
- The nonresidential portions of the *Standards*, and the *Nonresidential Compliance Manual*, cover newly constructed offices; stores; restaurants; assembly and conference areas; industrial work buildings; commercial and industrial storage; schools; churches; theaters; hotels and motels; apartments and multi-family buildings with

four or more habitable stories; long-term care facilities with four or more habitable stories; dormitory-style sleeping quarters with six or more “guest rooms”; private garages, carports, sheds, and agricultural buildings; and additions or alterations to any of the above.

- A multi-family building with four or more habitable stories is under the scope of the nonresidential requirements, but the dwelling units must meet the lighting, water heating, and setback thermostat requirements for low-rise residential buildings.
- The *Standards* do not apply to California Building Code Occupancy Group I, which includes hospitals, daycare facilities, nursing homes, and prisons. The *Standards* also do not apply to buildings that fall outside the jurisdiction of California Building Codes, such as mobile structures. If outdoor lighting is associated with a Group I occupancy, it is exempt from *Standards* compliance.

### *Residential Compliance Manual and Nonresidential Compliance Manual*

The *Residential Compliance Manual* and *Nonresidential Compliance Manual* are intended to help anyone involved in the planning of newly constructed buildings, additions, or alterations understand, comply with, and enforce the *Standards*. The manuals include compliance strategies, sample compliance options, and questions and answers regarding *Standards* compliance.

\*The *Standards* define a “habitable story” as one that contains space in which humans may live or work in reasonable comfort, having at least 50% of its volume above grade.

## 2008 Reference Appendices

The *Reference Appendices* are composed of three sections:

- The “Joint Appendices,” applicable to both residential and nonresidential construction, consist of:
  - A glossary.
  - Reference weather and climate data.
  - Time dependent valuation information.
  - U-factor, C-factor, and thermal mass data.
  - Charge indicator display information.
  - Installation procedures for medium-density, closed-cell spray foam.
  - Light-emitting diode light source testing procedures.
- The “Reference Residential Appendices” include HERS measures that were moved from the *Residential Alternative Calculation Method (ACM) Manual* as well as additional new information, and consist of:
  - HVAC sizing information.
  - Residential HERS verification, testing, and documentation procedures.
  - Residential field verification and diagnostic test protocols.
  - Energy efficiency measure eligibility criteria.
  - Interior mass capacity information.
- The “Reference Nonresidential Appendices” include acceptance tests that were moved from the *Nonresidential ACM Manual* as well as additional new information and consist of:
  - Nonresidential HERS verification, testing, and documentation procedures.
  - Nonresidential field verification and diagnostic test procedures.
  - Fan motor efficiencies.
  - Compliance procedures for relocatable public school buildings.
  - The overall envelope time dependent valuation energy approach (envelope tradeoff procedure).
  - Alternate default fenestration procedure to calculate thermal performance.
  - Acceptance requirements for nonresidential buildings.
  - Illuminance categories and luminaire power.

## Terms Used in the 2008 Building Energy Efficiency Standards and Supporting Documents

The **prescriptive approach** to compliance offers relatively little design flexibility but is easy to use. For residential construction, the prescriptive approach requires that each building component meet or exceed the minimum efficiency level specified in the appropriate package. Refer to Section 1.6.2 of the *Residential Compliance Manual* for information on the prescriptive compliance packages. For nonresidential construction, the prescriptive approach requires that the building components (envelope, mechanical, and lighting) meet the requirements of certain sections of the *Building Energy Efficiency Standards (Standards)*. Refer to Section 142 of the *Standards* for the locations of the prescriptive requirements for nonresidential construction.

The **performance approach** to compliance uses an Energy Commission-approved computer software program to model a proposed building, determine its allowed energy budget (based on prescriptive Package D), calculate its energy use, and determine whether the design complies with the budget. This approach is more complicated than the prescriptive approach but offers considerable design flexibility. The programs that are approved for demonstrating compliance with the residential standards are EnergyPro 5<sup>®</sup>, CalRes<sup>®</sup>, and Micropas 8<sup>®</sup>. The programs that are approved for demonstrating compliance with the nonresidential standards are EnergyPro 5 and PERFORM 2008<sup>®</sup>.

When using the performance approach, **compliance credit** is available if the proposed design exceeds the Package D requirements in certain areas. Refer to Chapter 7 of the *Residential Compliance Manual* for the list of areas where compliance credit is available and for more information about the performance approach.

**Mandatory measures** must be met whether the builder intends to use the prescriptive approach or the performance approach for compliance. When the chosen approach calls for a more stringent requirement than a mandatory measure, or vice versa, the more stringent requirement must be followed. The following examples illustrate this principle:

- Under the performance approach, even if the software program used to model a home indicates that the home would meet the required energy efficiency with less than R-19 insulation in the ceiling, R-19 is the minimum

insulation that may be used because R-19 is specified in the mandatory measures.

- Under the prescriptive approach, ceiling insulation of at least R-30 must always be installed; in this case, the mandatory measure is superseded by the requirements of the prescriptive approach.

Some prescriptive measures regulated by the *Standards* vary by **climate zone**, either in stringency or whether they are required at all, so it is important to know what climate zone you are in when applying the *Standards*. Go to [http://www.energy.ca.gov/maps/building\\_climate\\_zones.html](http://www.energy.ca.gov/maps/building_climate_zones.html) to find out what climate zone a proposed project is in.

## HVAC Updates for the 2008 Standards

### 2008 Residential HVAC Updates

- A new prescriptive package is introduced, Package E, which allows for the use of metal frame fenestration products. This package offsets the higher U-factors by requiring higher duct insulation values and higher efficiency equipment in certain climate zones when compared to Package D.
- Duct sealing is required for both newly constructed buildings and changeouts; there are no alternatives to duct sealing when using the prescriptive approach.
- Performance compliance credits are available for low-leakage ducts in conditioned space and for low-leakage air handlers (furnaces), and the maximum rated total cooling capacity performance credit has been modified.
- Thermostatic expansion valves can no longer serve as an alternative to the refrigerant charge verification requirement for split system air conditioners. However, the installation of a charge indicator display (not yet available) can serve as an alternative. Refer to Section 4.3.2 of the *Residential Compliance Manual* for more information on the use of a charge indicator display.
- All prescriptive packages with central forced air handlers in climate zones 10 - 15 are required to meet the cooling coil airflow and fan watt draw criteria found in Section 4.3.3 of the *Residential Compliance Manual*. Performance compliance credits are available for cooling coil airflows that exceed the prescriptive requirements

and for fan watt draws that are less than the prescriptive requirements.

- All newly constructed low-rise residential buildings are required to have a whole-building ventilation system and satisfy other requirements to achieve acceptable indoor air quality. The Energy Commission adopted the requirements of *ASHRAE Standard 62.2-2007*, except that opening windows is not an acceptable option for providing whole-building ventilation in California. The mechanical ventilation and indoor air quality requirements are mandatory measures. Refer to *Blueprint 93* for an overview of these new requirements; they are covered more thoroughly in Section 4.6 of the *Residential Compliance Manual*.
- If a central fan integrated ventilation system is used to meet the *ASHRAE Standard*, the watt draw of the furnace fan in air distribution mode must be less than 0.58 W/CFM.
- There are performance compliance credits available for evaporatively cooled condenser air conditioners (Sections 4.7.3 and 4.7.8 of the *Residential Compliance Manual*) and ice storage air conditioners (Section 4.7.9 of the *Residential Compliance Manual*).

### 2008 Nonresidential HVAC Updates

- There are new mandatory requirements for refrigerated warehouses with a floor area of 3,000 or more square feet. Refer to Section 126 of the *Standards* or Chapter 8 of the *Nonresidential Compliance Manual* for more information.
- The direct control ventilation requirements are expanded to multi-zone systems with direct digital controls but exempt spaces with high occupant density from these requirements to ensure adequate ventilation (*Standards* Section 121[c]).
- There are new mandatory and prescriptive requirements for hotels and motels to use residential water heating models (*Standards* Sections 113 and 145).
- There are new variable air volume control requirements, effective January 1, 2012, for larger air-conditioning units serving single zones (*Standards* Section §144[1]).
- Direct digital control system requirements are expanded to zone level for HVAC systems (*Standards* Section 122[b]), including demand shedding controls (*Standards* Section 122[h]) and VAV zone minimums (*Standards* Section 144[d]).

## Energy Education Center

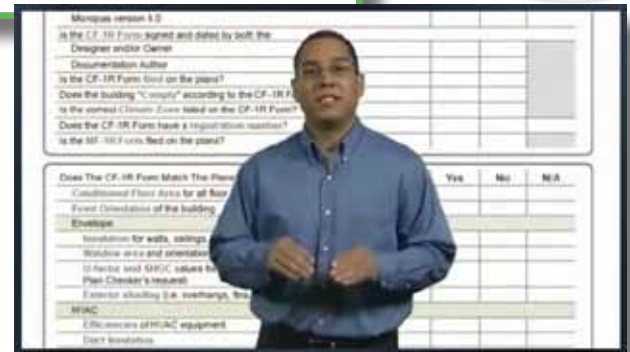
On December 21st, the California Energy Commission (Energy Commission) launched the Energy Education Center, a website covering the 2008 *Building Energy Efficiency Standards (Standards)*. The Energy Commission is the state's primary energy policy and planning agency and promotes energy efficiency by adopting and publishing the *Standards*. The Energy Commission is also responsible for providing education to local building officials and enforcement personnel regarding the *Standards*. Building department staff understanding the *Standards* is an integral part of achieving compliance and managing enforcement processes, and the Energy Commission recognizes the limited budgets and resources some building departments are faced with. The Energy Education Center will allow building department personnel and others to learn the new *Standards* without the time and expense of travel; the site is available free of charge 24 hours a day, 7 days a week.

Consisting of an Online Learning Center (OLC) and an Energy Videos Center (EVC), the site should result in:

- Building department personnel having greater knowledge of the *Standards*, allowing them to enforce the *Standards* more effectively, resulting in greater energy savings.
- Builders being better able to construct buildings that are in compliance with the *Standards*.
- Consumers having increased knowledge of the *Standards* and insisting on *Standards*-compliant construction.

### Online Learning Center

The OLC provides builders, contractors, enforcement agency/building department personnel, and consumers with educational tools to guide the design and construction of efficient, durable, and sustainable buildings in California. Complete with courses, study guides, interactive checklists, tutorials, exams, and completion certificates, this educational program is designed to bring building departments up to speed on plan review and building inspection for compliance with the 2008 *Standards*. The five courses currently available, each about one hour in length, focus on the 2008 updates to the residential and nonresidential portions of the *Standards*, plan review for residential and nonresidential newly constructed buildings, and plan review for residential alterations.



Course completion, in most instances, can be used toward continuing education units. Lessons in the Residential and Nonresidential Plan Review courses have "Additional Information" tabs with short videos offering a deeper understanding of material covered in the lessons. The "resource library" tab contains links to the *Standards* and related documents, as well as interactive plan review checklists and guides.

The second phase of the OLC, expected to be released in late spring 2010, will focus on building inspection and efficient lighting.

### Energy Videos Center

The EVC provides informational videos covering the *Standards*, building science, renewable energy, and plan review and inspection. Additionally, the "Resources" tab contains a link to the Collaborative for High Performance Schools Video Series.

The Energy Education Center is compatible across PC and Mac platforms, and provides video transcripts that comply with the requirements of the Americans with Disabilities Act.

Please visit the Energy Education Center at

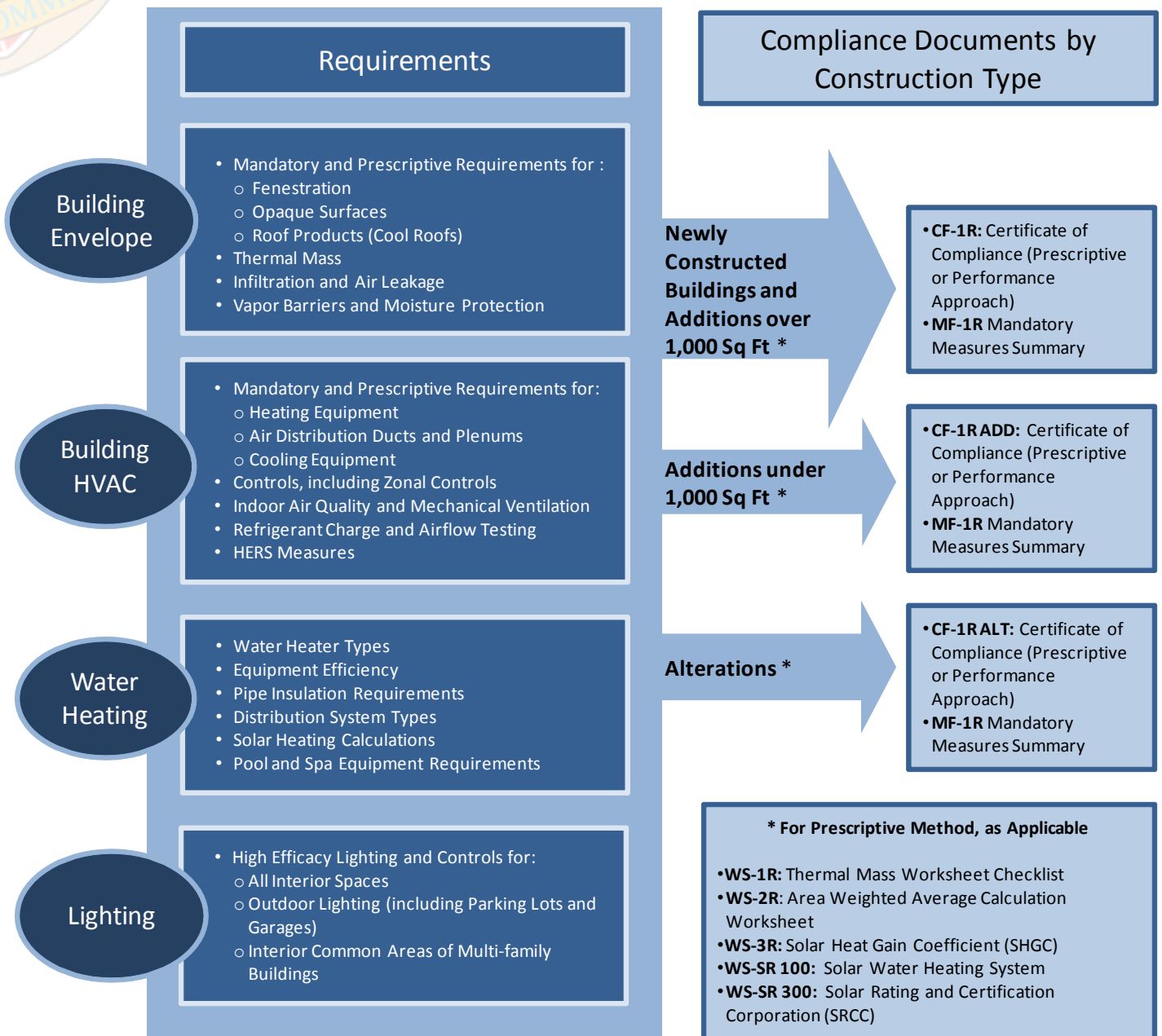
[www.energyvideos.com](http://www.energyvideos.com).

# Forms Required for Permitting Under the 2008 Building Energy Efficiency Standards

The diagrams below outline the energy efficiency requirements that must be addressed when planning a newly constructed building, an addition, or an alteration, and the forms that are required to be on the plans when submitted for review.

## Low-Rise Residential Construction

- Single-family buildings with any number of stories
- Duplexes with any number of stories
- Multi-family buildings with three or fewer habitable stories



### Nonresidential Construction

- Occupancy Groups A, B, E, F, H, M, S, and U
- Multi-family buildings with four or more habitable stories
- Hotels and Motels

#### Requirements

#### Compliance Forms

##### Building Envelope

- Mandatory and Prescriptive Requirements for
  - Fenestration, including Skylights
  - Opaque Surfaces, including Cool Roofs
  - Infiltration and Air Leakage
- Relocatable Public School Buildings
- Overall Envelope TDV Approach
- Additions and Alterations

- **ENV-1C:** Certificate of Compliance and Field Inspection Checklist
- **ENV-2C:** Envelope Component Approach
- **ENV-3C:** Overall Envelope TDV Energy Approach
- **ENV-4C:** Skylight Area Support Worksheet (Prescriptive Method Only)

##### Mechanical (including HVAC and Water Heating)

- Mandatory and Prescriptive Requirements for
  - HVAC Equipment
  - Service Water Heating Equipment
  - Air Distribution System
- Mechanical and Natural Ventilation
- Equipment Sizing and Load Calculations Req.
- Additions and Alterations

- **MECH-1C:** Certificate of Compliance and Field Inspection Checklist
- **MECH-2C:** Air, Water Side System, Service Hot Water and Pool Requirements
- **MECH-3C:** Mechanical Ventilation & Reheat
- **MECH-4C:** Fan Power Consumption (Prescriptive Method Only)
- **MECH-5C:** Equipment Details (Performance Method Only)

##### Lighting (Indoor)

- Luminaire Power Calculations
- Mandatory Lighting Measures
- Actual Lighting Power Calculations and Control Credits
- Allowed Lighting Power Calculations (Prescriptive Approach)
- Additions and Alterations

- **LTG-1C:** Certificate of Compliance and Field Inspection Checklist
- **LTG-2C:** Lighting Controls Credit Worksheet
- **LTG-3C:** Indoor Lighting Power Allowance
- **LTG-4C:** Tailored Method Worksheet
- **LTG-5C:** Line Voltage Track Lighting Worksheet

##### Lighting (Outdoor)

- Outdoor Lighting Zones and Ordinances
- Mandatory Lighting Measures
- Determining Actual Lighting Power
- Allowed Outdoor Lighting Power Allowances
- Lighting Alterations

- **OLTG-1C:** Certificate of Compliance and Field Inspection Checklist
- **OLTG-2C:** Outdoor Lighting Worksheet

##### Lighting (Sign)

- Determining Actual Sign Lighting Power
- Mandatory Lighting Controls
- Alternative Lighting Sources
- Sign Alterations

- **SLTG-1C:** Certificate of Compliance

##### Refrigerated Warehouses

- Mandatory Building Envelope Requirements
- Mandatory Building Mechanical Systems Req.
- Additions and Alterations

- **RWH-1C:** Certificate of Compliance

## HERS Rater Decertification

A Home Energy Rating System (HERS) field verification and diagnostic testing rater certified by one of the three approved HERS providers for the *2005 Building Energy Efficiency Standards* was decertified effective February 2, 2010, after it was found that the rater knowingly provided untrue field verification and diagnostic testing results on a CF-4R to the Sutter County Community Services Department, Building Inspection Division.

The Sutter County Building Inspector received a CF-4R that had not been completely filled out and immediately reported it to the California Energy Commission's Standards Compliance and Enforcement Unit. Through an investigation and interviews it was found that the HERS rater had falsified the CF-4R, did not have a CF-6R from the contractor, and did not visit the project site to conduct the diagnostic tests prior to signing the CF-4R. These actions were cause for the rater's certification to be immediately revoked by the provider.

This is a reminder to all HERS raters that **it is a felony to submit falsified documents to a government agency**. The Energy Commission's Standards Compliance and Enforcement Unit is actively investigating complaints and taking action to increase compliance with the *2008 Building Energy Efficiency Standards*. HERS raters who are decertified by a provider for fraudulent activity cannot be certified by another provider. Providers are made aware of any rater decertification.

For projects permitted on or after January 1, 2010, the CF-4Rs that building department personnel receive for a final will be registered with a HERS provider. The registered CF-4R will be computer generated, have a watermark on the document identifying the HERS provider, be electronically signed by the HERS rater, and have a registration number on the bottom of the form. The registration number can be verified by referencing the HERS provider's data registry at

[www.CalCERTS.com](http://www.CalCERTS.com) or [www.CHEERS.org](http://www.CHEERS.org).

Currently CalCERTS and CHEERS are the only HERS providers certified for field verification and diagnostic testing for the *2008 Building Energy Efficiency Standards*.

If you have knowledge of unlawful activity by a HERS rater or a contractor, please report it to the rater's provider or call the Energy Commission's Energy Standards Hotline at (800) 772-3300.

## Download or Purchase the *2008 Building Energy Efficiency Standards* and Supporting Documents

Electronic versions of the *Standards* and supporting documents are available at

<http://www.energy.ca.gov/title24/2008standards/>

Building department staff, please contact the Energy Standards Hotline prior to ordering publications.

For hard copies, please submit a request in writing, along with payment and publication number, to:

California Energy Commission  
Attention: Publications Office  
1516 9<sup>th</sup> Street  
Sacramento, CA 95814

Title	Publication Number	Cost
<i>2008 Standards</i>	400-2008-001-CMF	1st copy free; additional copies \$10 each.
<i>2008 Residential Compliance Manual</i>	400-2008-016-CMF-Rev 1	\$35
<i>2008 Nonresidential Compliance Manual</i>	400-2008-017-CMF-Rev 1	\$40
<i>2008 Reference Appendices</i>	400-2008-004-CMF	Free with the purchase of a manual.

## Building Energy Efficiency Standards Training

Please visit the Energy Commission's new Energy Education Center at:

[www.energyvideos.com](http://www.energyvideos.com)

For training offered by utilities and others, please visit the following websites:

**PG&E**

[www.pge.com/mybusiness/edusafety/training/pec/classes/](http://www.pge.com/mybusiness/edusafety/training/pec/classes/)

**SoCal Gas Company**

<http://seminars.socalgas.com>

**San Diego Gas and Electric**

<http://seminars.sdge.com>

**SCE**

[www.sce.com/b-sb/energy-centers/workshops-classes.htm](http://www.sce.com/b-sb/energy-centers/workshops-classes.htm)

**SMUD**

[www.smud.org/en/education-safety/](http://www.smud.org/en/education-safety/)

**CALBO**

[www.calbo.org](http://www.calbo.org)

**CABEC**

[www.cabec.org](http://www.cabec.org)



**Flex Your Power News**

[www.fypower.org/news](http://www.fypower.org/news)



[www.gosolarcalifornia.org](http://www.gosolarcalifornia.org)

*The 2008 Building Energy Efficiency Standards are now in effect.*

Arnold Schwarzenegger  
Governor



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**Need Help?**  
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or (916) 654-5106