CALIFORNIA
ENERGY
COMMISSION

INITIAL STUDY/PROPOSED NEGATIVE DECLARATION FOR THE 2005 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS

STAFF REPORT

September 2003
P400-03-018

Gray Davis, *Governor*

Mary D. Nichols,
Secretary for Resources

CALIFORNIA
ENERGY
COMMISSION

William J. Keese
Chairman

Commissioners:
Robert Pernell
Arthur H. Rosenfeld
James D. Boyd
John L. Geesman

Robert L. Therkelson
Executive Director

Valerie Hall,
Deputy Director
ENERGY EFFICIENCY and DEMAND ANALYSIS DIVISION

Bill Pennington,
Office Manager
Residential Buildings and Appliances Office

Project Manager
Mazi Shirakh

Report Contributors:
Rob Hudler
Elaine Hebert
Tony Rygg

TABLE OF CONTENTS

INITIAL STUDY
for the
2005 BUILDING ENERGY EFFICIENCY STANDARDS
FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS

I. EXECUTIVE SUMMARY

As a result of energy crises in California in the years 2000 and 2001, the Legislature passed Assembly Bill 970 (AB 970, Statutes of 2001) to help reduce peak demand for electricity in the state. Among the directives in AB 970 was a mandate for the Energy Commission to adopt amended building energy efficiency standards (Title 24, Part 6 of the California Code of Regulations) within 120 days. The Commission succeeded in this effort because of research and other efforts already in progress. However, during the development of the 2001 Standards, the Commission identified a number of additional measures that could add significant energy savings but required more time to analyze.

California law requires that the State Building Code be updated on a triennial basis. The Commission has initiated this rulemaking to comply with its legal duty to periodically update the building efficiency standards. Many of the measures identified in the 2001 emergency rulemaking process, but not included in that rulemaking, are included in the current triennial effort to update the standards for 2005, described herein.

The 2005 Building Energy Efficiency Standards include changes to the requirements for building energy efficiency for residential buildings and nonresidential buildings and add requirements for outdoor lighting. The 2005 Standards are available on the Commission's website at www.energy.ca.gov/2005_standards/rulemaking/documents.

A. Changes That Apply to All Building Types Covered by the Standards

A key change to be implemented in the 2005 Standards is that the basis of the performance standards calculations will change to incorporate time dependent valuation (TDV), substantially increasing the importance of measures that reduce peak electricity consumption relative to measures that impact energy use in off-peak periods. Other changes that apply to all building types are listed below and described more fully in Section V of this report:

- Certify factory-assembled cooling towers to standards set by the Cooling Technology Institute
- Update default U-factors and Solar Heat Gain Coefficients for fenestration to reflect recently adopted National Fenestration Rating Council (NFRC) test procedures
- Require insulation to be placed directly in contact with a continuous roof or ceiling
- Increase insulation in demising walls from R-11 to R-13
- Establish minimum insulation levels, water absorption rates, and insulation protection requirements for heated slab floors
- Revise cool roof requirements to allow for roofs with very high reflectance and lower emittance to qualify, and revise requirements for liquid applied roofing products to be more widely applicable to the range of available coatings

- Establish means to ensure the reliability of Automatic Daylighting Control Devices, Multi-Level Astronomical Time-Switch Controls, and Automatic Multi-Level Daylighting Controls
- Adopt new federal air conditioner and water heater standards as the basis of the energy budgets (applies to residential and to many commercial buildings that use "residential size" air conditioners)

B. Changes to Standards for Low-Rise Residential Buildings

The salient changes to the residential sector are these: residential buildings will have to meet more stringent requirements for duct insulation in some climate zones, pipe insulation to kitchens, and efficiency of lighting equipment or controls as specified for all hard-wired fixtures; builders may take credit for certified high quality installations of wall and ceiling insulation; and allowable glass area will be standardized for all 16 climate zones. Builders will not be able to reduce glass area and take tradeoffs, and budgets for centralized water heating systems in multi-family dwellings will be compared to central systems, not to individual water heaters. A list of all the residential measures follows (expanded descriptions can be found in Section V of this report).

List of Standards Changes for Low-Rise Residential Buildings – New Construction

- Modify residential lighting requirements
- Increase the minimum air conditioner efficiency to meet federal standards
- Increase the minimum efficiency of small storage gas water heaters to meet federal standards
- Increase duct insulation levels
- Increase the allowable glazing area to 20% of floor area for all climate zones
- Set the standard glazing area equal to the glazing area of the proposed building in the performance approach
- Set a limit on west-facing glass in the prescriptive approach
- Base fenestration performance ratings on 2003 National Fenestration Rating Council (NFRC) procedures
- Modify the multi-family water heating calculation method to close loopholes
- Adopt a pipe insulation requirement for water lines from supply to kitchen
- Adopt a compliance credit for construction quality for walls and ceilings
- Modify distribution losses for single- and multi-family buildings
- Increase wall framing factors from 15 to 25 percent for studded walls 16 inches-on-center
- Modify modeling assumptions
- Adopt compliance credits for ducts buried in attic insulation, high quality insulation installation, high efficiency air conditioning, properly sized air conditioners, cooling using natural gas, and efficient air conditioner fan motors

List of Standards Changes for Low-Rise Residential Buildings - Additions

- Modify the fenestration exception for 500 square foot additions
- Adopt an exception to allow 50 square feet of added glass
- Require that prescriptive levels be met before performance standards credit applies

List of Standards Changes for Low-Rise Residential Buildings - Alterations

- Require replacement windows to be high-efficiency
- Require duct sealing and higher insulation for replacement ducts and require duct sealing when replacing some air conditioning system components

C. Changes to Nonresidential, High-Rise Residential, and Hotel/Motel Buildings

Nonresidential buildings will have reductions in the allowable lighting wattage for various occupancy types. New lighting categories will better match existing occupancy types. Demand control ventilation will be become a mandatory measure rather than a compliance option. Day lighting occupancy control requirements will be increased, and credits for lighting controls will be modified to eliminate some existing credits and add new ones. New or revised performance requirements for pumps, motors, hydronic systems, variable air volume (VAV) systems, chillers, and cooling towers, and measurable criteria for code compliance and acceptable performance (referred to as "acceptance requirements") will be added for a number of features to assure proper installation and operation. As prescriptive measures, cool roofs will be required for new construction low-sloped roofs and in specified cases of replacement roofs, and skylights (natural lighting) will be required for certain large low-rise buildings. A list of the nonresidential measures follows. For expanded descriptions of each measure, refer to Section V of this report.

List of Standards Changes for Nonresidential Buildings – New Construction

- Adopt a requirement for skylights to provide 50% daylighting for low-rise nonresidential buildings over 25,000 square feet
- Modify requirements for natural ventilation for high-rise residential buildings, hotels and motels
- Modify the cool roof credit to become a prescriptive requirement for low-slope roofs
- Adopt 2003 NFRC fenestration requirements
- Change the performance standard design to new federal and state air conditioner and water heater requirements
- Modify ceiling insulation requirements to prevent insulation on T-bar ceilings, with some exceptions
- Increase demising partitions minimal insulation to R-13 from R-11
- Establish minimal insulation requirements for heated slabs
- Require continuous insulation in roofs containing metal framing or decking as specified for prescriptive compliance
- Establish a duct insulation requirement of R-8 for all climate zones
- Establish prescriptive duct sealing for buildings where more than 25% of ducts are outside the building's conditioned envelope
- Extend mandatory demand control ventilation (DCV) requirements to moderate- to high-density occupancy building types
- Establish a variable speed fan efficiency requirement for all motors over ten horsepower
- Require electronically commutated motors (ECM) for series fan power terminal units
- Modify a requirement for all cooling towers with certain condenser pumps to be run in parallel
- Require cooling towers serving loads of 300 tons and greater to use propeller fans
- Require chiller plants over 300 tons to limit air-cooled chillers to 100 tons or less, with the remainder of the capacity to be provided through water-cooled equipment

- Require cooling towers to be designed so that flow can be turned down to 33 percent of the design flow for the cell
- Require chilled and hot water pumping to be designed for variable flow
- Require chillers and boilers to be designed so that equipment can be isolated to prevent flow through the equipment when the equipment is shut off
- Require chilled and hot water systems with a design capacity greater than 500,000 Btu/h to have temperature reset controls
- Require water-loop heat pumps to have isolation valves and variable speed drives on the pumps
- Require variable flow chilled and condenser water pump systems to have variable speed drives and controls
- Lower allowed lighting power densities for many spaces
- Require automatic multi-level astronomical time switch controls for daylighting
- Modify multi-level controls installation requirements
- Modify daylighting controls installation requirements
- Modify performance requirements such that west-facing fenestration area is limited to 40 percent of the west-facing wall area, not 40 percent of total wall area for all glass
- Implement relocatable classroom requirements (including prescriptive requirements)
- Establish portable classroom special compliance approach
- Establish acceptance requirements for space heating and cooling systems: require a Certificate of Acceptance prior to issuance of occupancy permits to verify that any installed air ducts, plenums, economizers, variable speed fans, and hydronic systems meet applicable energy standards
- Establish acceptance requirements for demand control ventilation systems, space conditioning controls, and lighting controls (test before occupancy)
- Remove inefficient lamp types
- Modify alterations requirements for performance compliance
- Modify lighting requirements to include unconditioned buildings
- Modify time switch controls
- Establish maximum high-rise residential ventilation rate

List of Standards Changes for Nonresidential Buildings – Additions

- Establish that any upgraded energy component must meet the requirements for alterations

List of Standards Changes for Nonresidential Buildings – Alterations

Prescriptive Approach

- Require that the standards for newly constructed buildings apply to altered components, or that alterations neither increase the overall heat gain nor increase the overall heat loss of the building envelope
- Apply cool roof requirements when more than 50% of the exterior surface or 2,000 square feet of roof (whichever is less) of nonresidential low-slope roofs is replaced, recovered, or recoated
- Require that when new or replacement ducts are installed to serve an existing building where the ducts are located in unconditioned or indirectly conditioned space, the duct system must meet the mandatory requirements (sealed, tested, and field verified)

Performance Approach

- Require that altered buildings be improved so that the building uses no more energy than an energy budget based on cool roof requirements for roof replacements, on having no other changes to the existing envelope, or on compliance with prescriptive requirements for mechanical and lighting system alterations

D. New Standards for Outdoor Lighting

As mandated in Senate Bill 5X (SB5X, Statutes of 2001), regulation of outdoor lighting will be added to the efficiency standards. A list of the outdoor lighting measures follows. For an expanded description of each measure, refer to Section V of this report.

List of Standards Changes for Outdoor Lighting - New Construction

- Establish minimal efficacy for lamps rated over 100 watts
- Establish cutoff (shielding) requirements for lamps rated over 175 watts
- Establish control strategies for outdoor lighting on building façades, parking lots, canopies, and outdoor sales areas
- Establish outdoor lighting power allowances for hardscapes (including parking lots, driveways, site roads, sidewalks, walkways and bikeways), building façades, entrances and canopies; vehicle service stations with or without canopies; outdoor sales lots, frontage and canopies; non-sales canopies; and landscape and ornamental lighting
- Establish lighting power allowances for internally and externally illuminated signs, including alternatives to lighting power allowances through use of specified lighting technologies

List of Standards Changes for Outdoor Lighting - Alterations

- Establish lighting power allowances for alterations to existing outdoor lighting systems that increase the connected load or that involve replacing more than 50 percent of the luminaires
- Establish efficiency requirements for new internally and externally illuminated signs installed in conjunction with alterations and for alterations to signs that increase the connected lighting load or involve replacing more than 50 percent of the ballasts in existing signs

E. Energy and Emissions Effects of Changes

This Initial Study concludes that the 2005 Standards will not have a significant effect on the environment, and provides the basis for that conclusion. No mitigation measures are therefore being proposed.

The expected overall consequences of implementing these standards will be positive for the environment. Staff has estimated a reduction in statewide annual energy consumption of electricity by 619 gigawatt-hours per year (GWh/yr) and in demand by 181 megawatts (MW). Natural gas consumption will be reduced by 10 million therms.[1] Table 1 lists each sector and the

[1] This reduction in natural gas consumption excludes natural gas reductions from power plant electricity savings just identified.

estimated related energy savings. The resulting net effects of these energy savings to air quality are a net reduction in statewide emissions of 49 tons of NO_x, 5 tons of PM10, and 15 tons of CO. Each sector's emissions savings are also listed in Table 1.

Table 1 – Estimated Statewide Energy and Emissions Savings of Proposed 2005 Building Energy Efficiency Standards by Sector

	Natural Gas - Million therms/yr	Electri-city - GWh/yr	NO_x – tons/yr	PM10 – tons/yr	CO – tons/yr	CO_2 – tons/yr*	Electrici-ty demand - MW
Residential Total	8.5	142.7	42	4	13	48,910	66.4
Nonresidential Total	0.5	315.6	2	0	1	2,820	44
Outdoor Lighting	0	17.2	0	0	0	0	0
Portable Classrooms	0	3.1	0	0	0	0	0
Residential Alterations	3	0	15	2	5	17,250	26.7
Nonresidential Alterations	-2**	140.6	-10	-1	-3	-11,500	44.3
TOTALS***	10	619.1	49	5	15	57,480	181

* See the next section "Effects outside California"

** Negative numbers appear for nonresidential alterations because staff calculates that the proposed 2005 Standards for cool roofs in the nonresidential sector will save electricity for air conditioning in summer but will slightly increase the use of natural gas for heating in winter, because buildings with new cool roofs will gain less heat through the roof from the sun heating the roof. This table does not include emissions effects from reductions in electricity from power plants, because it is impossible to determine what portion of the electricity saved is instate or from California's out-of-state electricity sources.

*** Totals may reflect rounding errors.

Effects outside California

The actions of the State of California may result in air quality benefits to the other western states because California obtains 11 to 16 percent of its electricity from coal power plants in surrounding states, and these plants emit criteria pollutants that contribute to smog and particulate pollution levels. (California also purchases hydroelectric power from surrounding states and Canada and nuclear power from surrounding states, both of which have virtually no air pollutant emissions). The adoption of the 2005 Standards by California has the potential to reduce the need to purchase power from out-of-state compared to continuing with the current standards. Commission staff estimates that annual reductions in emissions from out-of-state power plants, based on a savings of 479 GWh per year, would be as follows: 92 tons of NO_x, 14 tons of PM10, 55 tons of CO, and 287,112 tons of CO_2. Note that CO_2 (carbon dioxide, which is not a criteria pollutant but contributes to global warming) emissions are a somewhat special case because their effects are neither local nor regional- CO_2 rises into the upper atmosphere where it behaves as a greenhouse gas. Consequently, the effects of CO_2 reductions on California air basins are not easily documented and will not be discussed further in this report.

F. Staff Conclusions

Energy Commission staff have reviewed contractors' analyses and conducted further research on the environmental impacts of the proposed 2005 Building Energy Efficiency Standards for residential and nonresidential buildings and outdoor lighting. Issues of noise, volatile organic

compounds, nighttime glare, dark sky interference, and materials use were considered. Staff found no significant impacts and in fact calculated net energy and emissions savings. Therefore staff recommends adoption of a Negative Declaration.

II. PROJECT HISTORY, DESCRIPTION, AND ENVIRONMENTAL SETTING

A. History of the Standards

In 1974 the Legislature enacted statutes creating the Energy Commission and requiring it to, among other things, adopt energy efficiency standards for buildings. The standards must be cost effective, based on the life-cycle of the building, must include performance and prescriptive compliance approaches, and must be periodically updated to account for technological improvements in efficiency technology. Accordingly, the Commission has adopted and periodically updated energy efficiency standards (codified in Title 24, Part 6 of the California Code of Regulations) to ensure that building construction and system design and installation achieve energy efficiency and preserve outdoor and indoor environmental quality. These standards establish a *minimum* level of building energy efficiency. A building can be designed to a higher efficiency level, resulting in additional energy savings.

The energy efficiency standards are aimed at the major building components that affect energy use in new residential and nonresidential buildings, additions, and alterations: lighting, water heating, and space conditioning systems, and the building envelope. These standards are fundamentally performance standards requiring buildings to meet allowable energy budgets and providing flexibility in selecting features. The standards also include prescriptive alternatives and some mandatory requirements. Compliance with energy standards must be demonstrated to the local permitting agency, usually a city or county Building Department, before an occupancy permit is issued.

Since 1975, the standards (along with standards for energy efficient appliances) have helped Californians save more than $15.8 billion in electricity and natural gas costs. Energy Commission analysts estimate that that number will climb an additional $43 billion by 2011.[2] These savings and energy use reductions result in environmental benefits not only in California, but also in other parts of the Western United States from which California imports energy.

The Commission must amend the building standards periodically to account for improvements in energy efficiency technologies, changes in the cost of fuels and energy-conserving strategies, improved building science research findings, and better understanding of California building energy performance. The Commission generally makes such amendments every three years to comply with the statutory requirements that building codes be updated on a three-year cycle. The Commission must determine that the standards and any changes thereto are cost-effective before adoption.

B. Environmental Setting: Reasons for This Project

Approximately one third of the energy consumed in California is consumed by its buildings. The energy consumed is both natural gas and electricity. Every year, hundreds of thousands of new buildings are constructed, added on to, or remodeled that add to this energy use. This new

[2] Cited on the California Energy Commission's website, http://www.energy.ca.gov/title24/index.html.

construction provides an important opportunity to require significant energy efficiency strategies in new construction, many of which cannot be effectively realized (or as effectively realized) on a retrofit basis. The energy efficiency standards adopted by the Commission provide an elaborate performance-based approach to making new buildings much more energy efficient that they would be were there no such standards.

The energy standards make buildings more efficient, and thus result in reduced consumption of both natural gas and electricity. Such reductions in turn result in lower emissions from natural gas combustion, and lower emissions from the generation of electricity that powers our buildings. For this reason, this project to update the energy efficiency standards to require greater efficiencies will **reduce** the harmful criteria air pollutants that harm public health. Because the project will reduce fuel consumption, it will also reduce carbon dioxide emissions that are believed to contribute directly to global warming. One project goal is to reduce "peak" period electricity use. Since "peak" electricity use often relies in part on less efficient power plants or even backup diesel generators, reduction in electricity peak loads should have an even greater salutary effect on air quality. Lower peak electricity use also dramatically lowers the costs associated with electricity use.

The origins of the current standards update project date back three years. The California energy crises of 2000/2001 resulted in emergency legislation, Assembly Bill 970 (AB 970, Statues of 2000), to address reduction in peak electricity demand. AB 970 directed the Energy Commission to update the building energy efficiency standards within 120 days of passage of AB 970, or as soon as possible. Because of the relatively abbreviated time frame for making changes to building standards, the Commission decided to change the standards in two phases. Phase 1 resulted in the emergency 2001 Standards. This project, the 2005 Building Energy Efficiency Standards, is Phase 2 and coincides with a regular triennial update of the Standards.

Following the state's energy crises, the state legislature also passed Senate Bill 5X (SB 5X) as emergency legislation, mandating that the Energy Commission create energy efficiency standards for outdoor lighting and indoor and outdoor signs that are illuminated internally or externally. The 2005 Standards will include these new standards.

The proposed 2005 Standards will not only reduce peak demand for electricity, but will address efficiency in natural gas use, value energy according to market conditions by time of day and by season, address inconsistencies in the residential standards, and capture for the first time energy savings from outdoor lighting improvements.

C. Proposed Project

The objective of the energy efficiency standards is to increase the efficiency of natural gas and electricity used in new buildings, additions, and alterations and to create comfortable, healthy, and well-lit buildings using cost-effective measures.

Starting with a list of possible changes carried over from the 2001 Standards proceedings, and with input from numerous outside stakeholders, Energy Commission staff identified a number of measures for consideration as changes to Title 24, Part 6, for 2005. After review and analysis, and with assistance from outside energy consultants, Commission staff proposes the specific changes listed in Section V of this report.

Implementation of Title 24, Part 6 applies to the entire state of California. Figure 1 shows the boundaries of the 16 climate zones within the state. The energy efficiency measures for buildings in each climate zone are justified by computer simulation and life cycle cost analysis.

D. Methodology

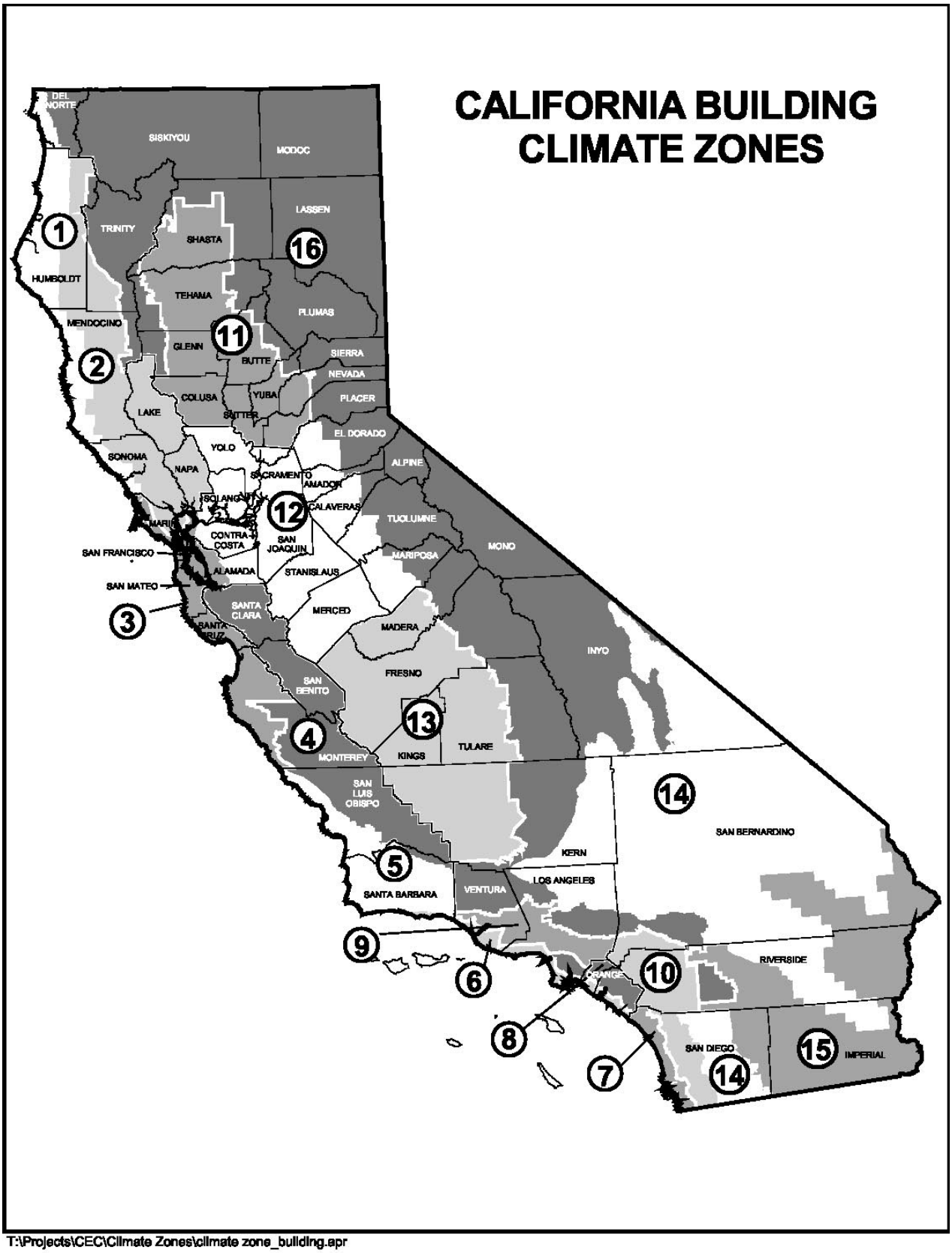
The development of this EIR started with an energy use analysis and cost-effectiveness analysis for the proposed new standards. Energy Commission subcontractors used computer modeling with the software called Micropas for the residential sector and DOE 2.1e for the nonresidential sector. The subcontractors modified the software to model the standard design (based on the 2001 Standards) and a series of sample proposed new buildings to measure energy use based on Time Dependent Valuation (TDV), which assigns multipliers to the value of electrical energy use depending on the hour of the day and the season. The resulting energy use data were compared to determine the highest energy use cases. Cost effectiveness was based on a life cycle cost analysis using the defined life expectancies for buildings: 30 years for residential buildings and 15 for nonresidential. Each measure was also assigned a life expectancy and a cost. Depreciation and inflation were included in the analysis for replacement costs. The final cost effectiveness of a measure was based on the ratio of the total cost of the measure vs. the amount of savings for that measure over the life of the building. The environmental analysis used data generated in the energy analysis. These data were converted into emissions values based on industry standard assumptions for site-specific appliances (furnaces and water heaters). Potential emissions reductions from generation sources were calculated separately. Beyond the emissions impacts, the environmental analysis looked at specific impacts such as materials use, noise pollution, and lighting impacts that might result from the proposed standards changes. In addition, the environmental analysis looked at the emissions impacts if the proposed standards were not adopted.

E. Organization of the Standards

The building energy efficiency standards are organized into three basic components: mandatory features, prescriptive package requirements, and performance compliance guidelines. Mandatory features are, as the name suggests, required, unless a specific exception exists. The prescriptive package requirements are composed of a list of energy features that comprise a “prescription” for how to construct a building; following the precise “prescription” results in a building that complies. In the third component of the standards, performance compliance, the prescriptive requirements create a “standard design” building model within the software programs to establish the energy budget for a proposed building; a number of modeling assumptions, including weather data, are built into the software and are applied to both the proposed building and the standard design case.

Another element related to building energy efficiency is the energy efficiency of appliances. Federal and state appliance standards dictate the testing procedures and minimal efficiency requirements for most major appliances, including central air conditioning and space heating systems and water heaters that are included in new buildings. Appliance standards are referenced in the building standards for California as appropriate.

FIGURE 1 – California Climate Zone Map



III. LIST OF AGENCIES THAT WILL USE THE EIR IN DECISION OR COMMENTS

The intended use of this Environmental Impact Report is as follows: the California Energy Commission is the lead agency on this and any rulemaking regarding the California Building Energy Efficiency Standards. The Commission will use this document in its public process as part of the documentation package used in the standards approval process. The Commission will solicit public comment on this EIR and consequently make any appropriate modifications to the proposed standards. The Commission will move to consider adoption of the 2005 Standards before the end of the 2003 calendar year. Following thee adoption, the Standards must be reviewed and approved by the California Building Standards Commission, who will have access to this EIR and all other documents related to the rulemaking.

IV. LIST OF PERMITS AND OTHER APPROVALS REQUIRED TO IMPLEMENT THE PROJECT

No permits are needed for this project. The California Energy Commission and the California Building Standards Commission are the only agencies that must approve changes to Title 24, Part 6 of the California Code of Regulations.

V. DESCRIPTIONS OF 2005 PROPOSED CHANGES TO BUILDING ENERGY EFFICIENCY STANDARDS

A. Standards Changes for All Building Types

The most significant overall change in the 2005 Standards is the manner in which energy is valued: Time Dependent Valuation (TDV) assigns multipliers to the value of electrical energy depending on the hour of the day and the season. Electricity use during summer peak demand periods strains the electricity delivery system, raising energy prices and demand charges for the end user and increasing the threat of blackouts. By properly estimating the relative impact of electrical needs, especially for space cooling, more appropriate signals will be given for the selection of energy efficiency features.

Another overall change is the adoption of recently updated National Fenestration Rating Council (NFRC) testing and labeling procedures for energy efficiency ratings of windows and other fenestration products. These procedures apply to both the residential and nonresidential sectors and reflect more accurate testing methods for fenestration efficiency.

In addition, the 2005 Standards will reflect changes in the federal appliance regulations for efficiency of water heaters and air conditioners.

A description of the changes that apply to all building types follows (section numbers from the Standards are included):

Time Dependent Valuation (TDV) (§102). The basis of the performance standards calculations will change to time dependent valuation, substantially increasing the importance of measures that reduce peak electricity consumption relative to measures that impact energy use in off-peak periods.

Performance Requirements for Heat Rejection Equipment (§112, Table 112-G). Factory-assembled cooling towers will be required to be certified by the Cooling Technology Institute (CTI) to meet the requirements of CTI STD-201. There will be no certification requirements for field-erected cooling towers.

Fenestration Default Values (§116). The default values for fenestration (windows, skylights, and glazed doors) U-factors and Solar Heat Gain Coefficients (SHGC) will be updated to agree with recently revised National Fenestration Rating Council (NFRC) test procedures.

Placement of Insulation at the Roof/Ceiling (§118(e)). The new Standards will require that insulation be placed directly in contact with a continuous roof or ceiling. Placement on top of a suspended ceiling with removable ceiling panels will be deemed to have no insulative affect except in very limited situations.

Demising Walls in Nonresidential Buildings (§118(f)). The R-value for insulation between framing members of demising walls will increase from R-11 to R-13. (A demising wall is a wall that separates conditioned space from enclosed unconditioned space.)

Insulation for Heated-Slab Floors (§118(g)). Minimum insulation levels, water absorption rates, and insulation protection requirements will be established for insulation used with heated slab floors.

Cool Roofs (§118(i)). The current requirements for cool roofs to qualify for compliance credit and to meet prescriptive and performance standards requirements will be moved to this location and expanded to allow a means for roofs with very high reflectance and lower emittance to qualify. Requirements for liquid applied roofing products will be revised to be more widely applicable to the range of available coatings.

Daylighting Controls (§119(e), (h) and (i)). Requirements to insure the reliability of Automatic Daylighting Control Devices, Multi-Level Astronomical Time-Switch Controls, and Automatic Multi-Level Daylighting Controls will be added. (Daylighting controls are used to control electric lighting in areas that receive natural light through windows or skylights.)

B. Standards Changes for Low-Rise Residential Buildings

Residential buildings offer opportunities for energy savings from efficiency measures applied to the envelope, mechanical system, lighting, and water heating. Making homes more efficient also provides an opportunity to reduce peak electricity demand. According to the Energy Commission (www.energy.ca.gov/electricity/consumption_by_sector.html), the residential sector's electricity use growth rate exceeded the average growth rate for electricity consumption, and the residential sector made up over 30 percent of the total load. Natural gas use had comparable numbers (www.energy.ca.gov/naturalgas/consumption.html) with a high growth rate in the residential sector, which makes up over 25 percent of the total use of natural gas in California. With growing peak demand, the impact of the residential sector on electricity use at peak times is critical since a portion of the peak demand period is 2 to 6 pm when residents are arriving home and turning on air conditioners.

One objective of the 2005 Standards for the residential sector was to eliminate inequities. A range of items were changed including the allowances and method for glass area and the calculation base for multi-family buildings with central water heating systems.

With these significant changes in new construction, equally important changes were made for additions and alterations. For example, the minimum efficiencies for glass U-factor and Solar Heat Gain Coefficient were increased to match the requirements for new construction.

A description of residential changes follows:

Residential New Construction - Mandatory Requirements

Air Retarding Wrap (§150(f)). The requirements for an infiltration barrier, which no longer apply, will be replaced by requirements for air retarding wraps as specified in the Residential Alternative Calculation Method (ACM) Manual.

Design Conditions (§150(h)2). Outdoor design conditions for equipment sizing will be required to be the 1.0 percent Cooling Dry Bulb and Mean Coincident Wet Bulb temperatures listed in the Joint Appendices (a new supplement to the 2005 Standards, publication #P400-03-001JA-ET45), Chapter II.

Water Piping and Cooling System Line Insulation Thickness and Conductivity (§150(j)2). Hot water pipes from the water heater to the kitchen will require insulation. The method for specifying water piping and cooling system line insulation requirements that has previously been used for nonresidential and high-rise residential buildings will be applied to low-rise residential buildings while maintaining the overall stringency of the existing low-rise residential requirements. This change will add clarity and flexibility for calculating insulation thickness for the complete range of insulation materials commonly in use. Insulation requirements will be clarified to apply to all cooling system refrigerant suction, chilled water, and brine lines.

Residential Lighting (§150(k)). The requirements for residential lighting will be substantially revised to increase clarity and specificity The new Standards will require high efficacy lighting equipment or energy-savings controls for permanently installed luminaries in all lighting functions, and recessed luminaries in insulated ceilings will have to be airtight. At least 50 percent of the lighting wattage in kitchens will be required to be high efficacy. Lighting in bathrooms, garages, laundry rooms, and utility rooms will be required to be high efficacy or controlled by an occupancy sensor. Lighting in other indoor spaces will be required to be high efficacy or be controlled by a dimmer switch. Outdoor lighting permanently mounted to a building will be required to be high efficacy or be controlled by a motion sensor with an integral photosensor. Lighting in parking lots and parking garages for eight or more vehicles will be required to meet all applicable mandatory and prescriptive requirements in other sections of the Standards that apply to such lighting. Lighting installed in the common areas of low-rise residential buildings with four or more dwelling units will be required to be high efficacy or be controlled by an occupant sensor.

Residential New Construction - Performance Standards

Water Heating Budgets (§151(b)1). The water heating budget for systems serving multiple dwelling units will be based on a central recirculating water heating system with gas water heaters and timer controls. For systems serving individual dwelling units, a single storage type gas water heater meeting the prescriptive and mandatory standards will be the basis of the energy budget. The energy budget for systems serving individual dwelling units will also be met by installation of an instantaneous gas water heater.

Space-conditioning Budgets (§151(b)2). The space conditioning budgets will change to be based on the revised prescriptive requirements in §151(f) using a Commission-approved calculation method..

Residential New Construction - Prescriptive Standards

Fenestration Glazing (§151(f)3). Area-weighted average U-factors will be allowed to be used to comply with U-factor requirements. The U-factor requirements in Package D will be updated to reflect present NFRC test procedures. The maximum allowed fenestration area in Package D will be revised to be 20 percent in all climate zones. In specific climate zones with substantial summer cooling energy use, the west-facing fenestration area in Package D will be limited to 5 percent of the conditioned floor area.

Shading (§151(f)4). Area-weighted average Solar Heat Gain Coefficients (SHGC) will be allowed to be used to comply with SHGC requirements for fenestration products other than skylights. Skylights will continue to be required to comply with SHGC requirements individually.

Space Heating and Space Cooling (§151(f)7). Air conditioners and heat pumps will be required to meet new federal appliance standards as specified in the state Appliance Efficiency Regulations.

Water-Heating Systems (§151(f)8). Water heaters will be required to meet new federal appliance standards as specified in the Appliance Efficiency Regulations. For systems serving individual dwelling units, either a single gas storage type water heater, 50 gallons or smaller, with no recirculation pumps and meeting the mandatory insulation requirements for storage tanks and hot water pipes to the kitchen or an instantaneous gas water heater will be required. For systems serving multiple dwelling units, a central recirculating water heating system with gas water heaters with timer controls will be required.

Space Conditioning Ducts (§151(f)10). Duct insulation requirements for Package D will be R-4.2 in climate zones 6, 7, and 8; R-6 in climate zones 1-5, and 9-13; and R-8 in climate zones 14, 15 and 16. Duct insulation requirements for Package C will be R-8 statewide.

Residential Additions and Alterations

Additions - *Prescriptive Approach* (§152(a)1)

The fenestration in additions up to 100 square feet will be required to meet the U-factor requirements in Package D.

Additions - *Performance Approach* (§152(a)2)

When the builder chooses to show compliance for an addition by upgrading a component of the existing building to compensate for failing to meet a prescriptive requirement applicable to additions, the upgraded component will have to meet the requirements for alterations. When ducts will be extended from an existing duct system to serve an addition and the performance approach is used for energy compliance, the ducts will be allowed to meet the duct sealing requirements for alterations to existing duct systems.

Alterations - *Prescriptive Approach* (§152(b)1)

Alterations that add fenestration area of 50 square feet or more will have to meet the fenestration area limits and U-factor and SHGC requirements of Package D. (Added fenestration of less than 50 square feet will be exempted from having to meet fenestration area limits but will still have to meet U-factor and SHGC requirements.)

Replacement fenestration, where all the glazing in an existing fenestration opening is replaced with a new manufactured fenestration product, will be required to meet the U-factor and SHGC requirements of Package D. Glass replaced in an existing sash and frame or replacement of a single sash in a multi-sash fenestration product are considered repairs, which are not required to comply.

When more than 40 feet of new or replacement space conditioning ducts are installed to serve an existing building, the new ducts will be required to meet the mandatory requirements in §150 (m) and the duct insulation requirements in Package D, and in climate zones 2 and 9-16 the combined new and existing duct system will be required to be sealed, tested, and field verified. Ducts that form entirely new duct systems will be sealed to meet the prescriptive requirements for newly constructed buildings. New ducts that extend an existing duct system will have three options: i) the measured duct leakage for the combined new and existing duct system will be less that 15 percent of fan flow; ii) the duct leakage to outside will be less than 10 percent of fan flow; or iii) the duct leakage prior to sealing will be reduced by more than 60 percent and a visual inspection and smoke test will be required to show that all accessible leaks have been sealed. The Energy Commission recognizes none of the three options for extensions of existing duct systems may be possible. In that case, compliance will require a certified HERS rater to verify through observation and a smoke test that all accessible leaks have been sealed. Duct sealing will not be required when an existing duct system that is extended is constructed, insulated, or sealed with asbestos.

When a space conditioning system is altered by the installation or replacement of space conditioning equipment, including replacement of an air handler, cooling or heating coil, or furnace heat exchanger, the existing duct system that is connected to that new or replaced space conditioning equipment will be required to be sealed, tested, and verified following the same requirements for new ducts that extend an existing duct system. Duct sealing will not be required when only a new outdoor condensing unit of a split system air conditioner or heat pump is installed; when the existing duct system is documented to have been previously been sealed, tested and field verified; or when the existing duct system is less than 40 linear feet in unconditioned spaces or when the existing duct system is constructed, insulated, or sealed with asbestos.

Alterations - *Performance Approach* (§152(b)2)

The altered building will be required to use no more energy than the unchanged existing building. No energy trade-offs will be allowed for altered energy components that do not meet prescriptive or mandatory requirements.

C. Standards Changes for Nonresidential, High-Rise Residential, and Hotel/Motel Buildings

Nonresidential buildings provide further opportunity for statewide energy savings and demand reduction. The range of applications for energy savings includes lighting technologies, mechanical systems efficiency and controls, and envelope improvements. New lighting measures include improvements in control technologies and strategies for increased use of natural light. For mechanical systems, opportunities for energy savings exist through size limits and controls on equipment components that have not been previously regulated - cooling towers and hydronic heating systems. Quality control and equipment performance verification will be defined. For building envelopes, the Standards will expand compliance credit for cool roofing and increase requirements for roof insulation.

A complete list of nonresidential changes follows:

Nonresidential New Construction - Mandatory Requirements

Natural Ventilation (§121(b)1). Current requirements for natural ventilation will be clarified. The dimensions of spaces allowed to be naturally ventilated (that is, not mandated to have mechanical ventilation) in high-rise residential dwelling units and hotel/motel guest rooms will be increased.

Outdoor Air and Demand Control Ventilation (§121(c)1, 3, 4, and 5). Demand control ventilation will not be allowed as an alternative to continuous ventilation when operations or processes are present that generate specified pollutants, and exhaust ventilation is not provided. With this exception, the current requirements for demand control ventilation will be expanded to include specific occupancies with moderate to high occupant densities that have an outdoor air economizer. Demand control ventilation devices will have new performance requirements. The 2005 Standards will establish "acceptance" requirements (testing and verification procedures) to insure that demand control ventilation systems are tested and verified for performance before occupancy. Minimum ventilation rates will change for bars, cocktail lounges, and casinos.

Space Conditioning Controls Acceptance (§122(h)). Acceptance requirements will be established to insure that space conditioning controls are tested before occupancy to determine that they meet Standards requirements.

Duct Insulation (§124(a) and (g)). Insulation requirements for ducts in unconditioned or indirectly conditioned spaces will be increased to R-8. Flexible ducts having porous inner cores will not be allowed.

Mechanical System Acceptance (§125(a), (b), (c), and (d)). Acceptance requirements will be established to insure mechanical systems, including air distribution system ducts and plenums, economizers, variable air volume systems, and hydronic system controls, are tested before occupancy to determine that they meet Standards requirements,.

Indoor Lighting in High-rise Residential Living Quarters and Hotel/Motel Guest Rooms (§130(b)). Lighting in these spaces will be required to meet the same new requirements for low-rise residential buildings in §150(k).

Luminaire Power (§130(c)). The 2005 Standards will clarify that the wattage of incandescent or tungsten-halogen luminaires with medium screw base sockets will be the maximum relamping rated wattage of the luminaire shown on a permanent factory-installed label as specified by Underwriters Laboratories.

Multi-Level Lighting Controls (§131(b)). Current requirements for lighting controls will be clarified and made more specific.

Daylit Areas (§13 (c)). Current requirements for lighting controls in daylit areas will be clarified and made more specific.

Shut-off Controls (§131(d)). Current requirements for lighting shut-off controls will be clarified and made more specific.

Lighting Control Acceptance (§131(f)). Acceptance requirements will be established to insure lighting controls are tested before occupancy to determine that they meet Standards requirements.

Outdoor Lighting (§132(a)). The current requirements for high efficacy exterior lighting will be moved to this location and extended to all outdoor lighting with specific exceptions.

Luminaire Cutoff Requirements (§132(b)). All outdoor luminaires that use lamps rated greater than 175 watts in hardscape areas including parking lots, building entrances, sales and non-sales canopies, and all outdoor sales areas will be required to be rated as "Cutoff" for light distribution.

Controls for Outdoor Lighting (§132(c)). The current requirement for exterior lighting to be controlled by a photoelectric or astronomical time switch will be moved to this location and extended to all outdoor lighting with specific exceptions. The requirement that has been long in effect for indoor lighting for controls capable of "bi-level switching" will be extended to outdoor lighting with specific exceptions.

Nonresidential New Construction - Performance Standards

Space-Conditioning Budget (§141(a)1). The space conditioning energy budget will be determined by Time Dependent Valuation energy, a cool roof for nonresidential buildings with low-slope roofs, a maximum west-wall glazing area, skylights with daylighting controls, and other new and existing prescriptive measures.

Relocatable Public School Buildings (§141(d)). The energy budget will be based on either the special statewide prescriptive envelope requirements for relocatable public school buildings (relocatables) or the prescriptive envelope requirements for schools that vary by climate zone. Relocatables for operation anywhere in the state will demonstrate that compliance for the most severe climates. Relocatables for operation in only specific climate zones will demonstrate compliance for each of those climates. Compliance will be demonstrated in all orientations.

Nonresidential New Construction - Prescriptive Standards

Envelope Component Approach (§143(a)). This prescriptive checklist approach will be changed so that nonresidential buildings with low-slope roofs will be required to have cool roofs. Insulation will have to be placed in direct contact with a continuous roof or drywall ceiling. To comply with prescriptive R-values, roofs with metal framing members or a metal deck will be

required to install continuous insulation either above the roof deck or between the roof deck and the structural members supporting the roof deck as specified. West-facing window area will be limited to no more than 40 percent of the wall area. The Prescriptive Envelope Criteria in Tables 143-A and 143-B will be updated to base wall U-factors on increased framing percentages, make minor recalculations on other roof/ceiling and floor/soffit U-factors, and match window and skylight U-factors to new NFRC test procedures. Requirements for relocatable public school buildings will be clarified, including the establishment of special Prescriptive Envelope Criteria (Table 143-C) for installation of relocatables in any climate zone in the state., The new Standards will require that relocatables be labeled to identify that they can be installed anywhere statewide or only in specific climate zones.

Overall Envelope Approach (§143(b)). This prescriptive tradeoff approach for building envelopes will be changed to establish a limit on west-wall area in the Standard Heat Loss Equation and to provide tradeoffs to account for Cool Roof Rating Council (CRRC) certified reflectance and emittance ratings relative to Standard Heat Gain calculations. The Standard Heat Gain calculations will assume a cool roof for nonresidential low-slope roofs and a nominal default reflectance for nonresidential high-slope roofs and roofs for high-rise residential buildings and hotel/motels.

Minimum Skylight Area for Large Enclosed Spaces in Low-Rise Buildings (§143(c)). Low-rise conditioned or unconditioned enclosed spaces that are greater than 25,000 square feet, are directly under a ceiling more than 15 feet high, and have a general lighting power density lighting greater than 0.5 watt/square feet, will be required to have at least one-half of the floor area daylit by skylights. The skylights will be required to effectively diffuse the daylight, and multi-level daylighting controls will be required.

Outdoor Design Conditions (§144(b)4). Outdoor design conditions for equipment sizing will be required to be the 1.0 percent Cooling Dry Bulb and Mean Coincident Wet Bulb temperatures listed in Chapter II of the Joint Appendices (a new supplement to the 2005 Standards, publication #P400-03-001JA-ET45). Cooling design wet bulb temperatures for cooling towers will be the Summer Design Wet Bulb 0.5 percent temperatures.

Variable Air Volume (VAV) Systems (§144(c)2). Variable air volume systems with motors 10 horsepower or larger will be required to have variable speed drives. Static pressure sensors will be required to be placed such that the controller set point is no greater than one-third the total design fan static pressure. The static pressure set point will be required to be reset based on the zone requiring the most pressure.

Fan Motors of Series Fan-Powered Terminal Units (§144(c)3). Fan motors of series fan-powered terminal units will be required to be electronically-commutated or have a minimum motor efficiency of 70 percent.

Economizer Acceptance (§144(e)4). Acceptance requirements will be established to insure that economizers are tested before occupancy to determine that they meet Standards requirements.

Heat Rejection Systems (§144(h)). Open cooling towers will be required to be designed so that flow can be turned down to 33 percent of the design flow for the cell. Cooling towers with a combined rated capacity of 900 tons or greater will be required to use propeller fans rather than centrifugal fans.

Limitation of Air-Cooled Chillers (§144(i)). Chilled water plants with more than 300 tons capacity will be required to have not more than 100 tons provided by air-cooled chillers.

Hydronic System Measures (§144(j)). Chilled and hot water pumping will be required to be designed for variable flow. Chillers and boilers will need to be designed so that equipment can be isolated to prevent flow through equipment when the equipment is shut off. Chilled and hot water systems with a design capacity greater than 500,000 Btu/h will be required to have temperature reset controls. Water-loop heat pumps will be required to have isolation valves and variable speed drives on the pumps. Variable flow chilled and condenser water pump systems will be required to have variable speed drives and controls.

Air Distribution System Duct Leakage Sealing (§144(k)). Duct systems with more than 25 percent duct surface area in unconditioned or indirectly conditioned spaces will be required to be sealed with leakage not greater than 6 percent of fan flow, confirmed through diagnostic testing and field verification.

Air Distribution System Duct and Plenum Acceptance (§144(l)). Acceptance requirements will be established to insure that duct systems are tested before occupancy to determine that they meet all Standards requirements.

Reduction of Wattage through Controls (§146(a)4). Installing effective controls reduces the time that lighting equipment is on, thereby reducing energy use. Compliance credit may be taken for installing lighting controls meeting specific criteria through the use of Power Adjustment Factors which create tradeoffs against the lighting power density allowances in the Standards. To qualify for the Power Adjustment Factor credit in small offices, occupant sensors will be required to have an automatic 'off' function and either a manual 'on' function or a bi-level automatic 'on' function with multi-level circuitry and switching. New Power Adjustment Factor credits will be established for the above occupancy sensor combined with daylighting controls in specific spaces and for the above occupancy sensor combined with manual dimming with dimmable electronic ballasts. A new Power Adjustment Factor credit will be established for occupant sensor controlled multi-level switching or dimming that reduces power at least 50 percent when no people are present in hallways of hotels/motels, commercial and industrial storage stack areas, and library stacks. To qualify for the Power Adjustment Factor credit for automatic daylighting controls with windows, stepped switching or stepped dimming/continuous dimming will be required. A Power Adjustment Factor credit for automatic multi-level daylighting controls with skylights will be established with a requirement for the skylight glazing material or diffuser to be highly diffusing as specified. Some previously available Power Adjustment Factor credits will be discontinued.

Lighting Wattage Excluded (§146(a)5). The list of lighting applications that may be excluded when showing compliance with lighting power density requirements will be clarified to respond to clarification questions that staff has received on the current Standards. Specific lighting applications, in particular for unconditioned buildings and parking garages and signs, will be excluded from the indoor lighting power density requirements.

Complete Building Method (§146(b)1). This method allots maximum lighting power densities for complete buildings. New allotments will be added for financial institutions, hotels, auditoriums and parking garages. The allotments for some existing building types will be reduced to save energy. The use of the power allotment for retail and wholesale stores will be clarified to not allow its use in situations where it is not known at time of permitting if the tenants in a multi-tenant building actually will all be retail and wholesale stores and in situations where the merchandise sales function area makes up less than 70 percent of the building area. The lighting

power density allowance for parking garages will not be allowed to be traded off with the lighting power density allowance for the conditioned portion of buildings.

Area Category Method (§146(b)2). This method allots maximum lighting power densities for specific spaces within a building. New allotments will be established for civic meeting rooms, financial transaction areas, public and commons areas in housing, parking garages, religious worship areas, tenant lease spaces, and transportation functions. The allotments for some existing building types will be reduced to save energy. The tenant lease space allotment will be required for multi-tenant spaces where a tenant is not identified at the time of permitting.

Tailored Method (§146(b)3). This method allots lighting power for specific types of lighting functions that create special lighting needs not present in all buildings or areas within buildings, and that occur infrequently in most buildings. This method allows lighting power allotments to be established for these cases so that the allotment is "tailored" to the specific building. The Tailored Method will be substantially revised to clarify its use, update the allotments for specific lighting functions to require the use of more energy efficient equipment, and constrain its use to situations where special lighting needs truly exist while maintaining flexibility of its use in those situations.

Nonresidential Additions and Alterations

Additions - *Prescriptive Approach* (§149(a))

When the owner chooses to show compliance for an addition by upgrading a component of the existing building to compensate for failing to meet a prescriptive requirement, the upgraded component will have to meet the requirements for alterations. When ducts will be extended from an existing duct system to serve an addition, the ducts will be allowed to meet the duct sealing requirements for alterations to existing duct systems.

Alterations - *Prescriptive Approach* (§149(b)1)

Alterations to the building envelope other than for roof replacements, recovering, or recoating, will have to meet one of the following: i) the requirements for new buildings that apply to the altered component (in the case of no changes to fenestration area), or ii) the requirement that there be no increase in the overall heat gain or heat loss through the building envelope. An exception to option i) will allow increases of less than 50 square feet of fenestration area or replacements to only a portion of the building's fenestration area to meet the requirements for newly constructed buildings (except solar heat gain requirements).

When more than 50 percent of the exterior surface or more than 2,000 square feet of roof (whichever is less) of nonresidential low-slope roofs is replaced, recovered, or recoated, the requirements for cool roofs will apply. A tradeoff option will be established which allows other features of the building envelope to be improved to compensate for opting not to meet the cool roof requirements. An exception will be established for roof recoverings allowed by the California Building Code when both the existing roof and the new roof have a rock or gravel surface, when there is no removal of existing layers of roof coverings, and when there is no recoating with a liquid applied coating.

When new or replacement ducts are installed to serve an existing building where the ducts are located in unconditioned or indirectly conditioned space as specified by § 144 (k), the duct system will be required to meet the mandatory requirements in §124 and be sealed, tested, and field

verified. Ducts that form entirely new duct systems will be sealed to meet the prescriptive requirements for newly constructed buildings. New ducts that extend an existing duct system will have two options: i) the measured duct leakage for the combined new and existing duct system will be less than 15 percent of fan flow, or ii) the duct leakage prior to sealing will be reduced by more than 60 percent, and a visual inspection will be required to show that all accessible leaks have been sealed. The Energy Commission recognizes that neither option may be possible. In that case, compliance will require that a certified Home Energy Rating System (HERS) rater verify that all accessible leaks have been sealed. Duct sealing will not be required for an existing duct system that is being extended in a building alteration if the duct is constructed, insulated, or sealed with asbestos.

When a space conditioning system is altered by the installation or replacement of space conditioning equipment, including replacement of an air handler, cooling or heating coil, or furnace heat exchanger, the existing duct system that is connected to that new or replaced space conditioning equipment will be required to be sealed, tested, and verified to the same requirements for new ducts that extend an existing duct system. Duct sealing will not be required when only a new outdoor condensing unit of a split system air conditioner or heat pump is installed; when the existing duct system is documented to have been previously sealed, tested and field verified; when the existing duct system is altered to no longer be within the scope of §144 (k); or when the existing duct system is constructed, insulated, or sealed with asbestos.

Alterations to existing outdoor lighting systems that increase the connected load or replace more than 50 percent of the luminaries will be required to meet the lighting power allowances in §147.

New internally and externally illuminated signs installed in conjunction with alterations will be required to meet §148, as will alterations to signs that increase the connected lighting load or replace more than 50 percent of the ballasts in existing signs.

Alterations - *Performance Approach* (§149(b)2)

The altered building will be required to be improved so that the building uses no more energy than a building showing i) compliance with the cool roof requirements for roof replacements, ii) no other changes to the existing building envelope, and iii) compliance with the prescriptive requirements for mechanical and lighting system alterations.

D. New Standards for Outdoor Lighting

Making outdoor lighting more efficient provides an untapped opportunity for statewide energy savings. A study funded by the Commission[3] found that commercial and industrial outdoor lighting annual energy consumption is estimated to be 3,067 GWh. This is roughly 1.4% of the total statewide annual energy consumption of 227,087 GWh reported for 2001, or about 3% of nighttime energy use. The maximum peak demand from commercial outdoor lighting is 809 MW, about 2.6% of the State's total.

Outdoor lighting includes a wide range of applications that use a variety of lighting technologies, including incandescent, magnetic-ballasted fluorescent, electronic-ballasted fluorescent, mercury vapor, high pressure sodium, pulse-start metal halide, and probe start metal halide. The objective of the standard is to upgrade all applications of outdoor lighting to more efficient lighting

[3] *Outdoor Lighting Baseline Assessment*, New Buildings Institute. See Appendix B for the full citation.

strategies appropriate to each use while maintaining acceptable lighting levels and lighting quality.

The proposed outdoor lighting standards will apply primarily to new installations. They will not require existing outdoor lighting systems to be replaced unless the energy load is increased or if 50 percent or more of the existing lighting fixtures are replaced.

The applications covered by the new outdoor lighting standards include lighting for hardscape areas, sites that are paved and have other structural features, including but not limited to curbs, bridges, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, ramps, tunnels, water features and pools, storage or service yards, boat ramps, loading docks, stairs, amphitheaters, outdoor sales lots, and private monuments and statuary; lighting attached to exterior surfaces of buildings (lighting building entries or exits and the exterior surfaces of buildings, not including horizontal roofing, signs, and surfaces not visible from any reasonable viewing location); sales lots and canopies (vehicle service station and other sales and non-sales canopies); landscaping lighting (lighting that is recessed into the ground or paving, mounted on the ground, mounted less than 42 inches above grade, or mounted onto trees or trellises, and that is intended to be aimed at landscape features) and ornamental lighting (post-top luminaries, lanterns, pendant luminaries, chandeliers, and marquee lighting); and internally and externally illuminated signs.

The development of the outdoor lighting standards took into consideration public health and safety issues such as glare and environmental issues such as light pollution. A list of the proposed standards follows:

Outdoor Lighting Power (§147). Outdoor lighting power allowances with specific exceptions will be established for the following general outdoor illumination applications: hardscapes for automotive vehicular use, hardscapes[4] for pedestrian use, pathways, building entrances without canopies, and outdoor sales lots. The Standards will allow tradeoffs among general outdoor illumination applications to provide design flexibility. The Standards will also establish allowances for the following specific illumination applications: building facades, outdoor sales frontage, vehicle service stations, other sales canopies, non-sales canopies, and ornamental lighting. The specific illumination allowances will be "use it or lose it" allowances that can't be traded-off against the allowances for general illumination applications. The lighting power allowances for each illumination application will be established for each of four lighting zones, as specified in Part 1, §10-114. Methods for calculating allowed lighting power levels will be specified. Higher power allowances for hardscapes will be provided if specific light levels are required by law through a local ordinance.

Requirements for Signs (§148). Lighting power allowances will be established for internally illuminated and externally illuminated signs for both indoor and outdoor use. Alternatives to the lighting power allowances will be established that allow compliance merely if electronic ballasts

[4] A hardscape is an improvement to a site that is paved and has other structural features, including but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary. This definition is in the proposed 2005 Standards (45 day language) available at http://www.energy.ca.gov/2005_standards/rulemaking/documents/express-terms/2003-07-30_BUILDINGS_STD.PDF.

or specific light sources are used. The requirements for signs will apply statewide and will not depend on lighting zone.

VI. ENERGY AND ENVIRONMENTAL EFFECTS

Energy Commission staff evaluated each proposed change to the building energy efficiency standards for its energy and environmental effects. However, the Commission is required to report only the cumulative effects, as directed by the Warren-Alquist Act of 1974. Staff has estimated the cumulative effects of all the proposed changes taken together (Section VII of this initial study), and as well, has reported below the energy and environmental effects of the proposed changes by sector - low-rise residential buildings; nonresidential, high-rise residential, and hotel/motel buildings; and outdoor lighting.

A. Low-Rise Residential Buildings

Energy Effects

The cumulative effects of the 2005 Standards changes for low-rise residential buildings (compared to not adopting these changes) will result in first year energy savings of 143 GWh in electricity and 8.5 million therms of natural gas, and peak demand will decrease by 180 MW. Energy savings contributions from each of the residential sectors are included in Table 2.

Table 2
Statewide Residential Energy Savings and Peak Demand Reduction

	Million therms/yr	GWhr/yr	MW
Residential Single Family	3.7	85.1	52.1
Residential Multi-Family	1.8	16.2	14.3
Residential Alterations/Additions	3.0	41.4	27.7
RESIDENTIAL TOTAL	**8.5**	**142.7**	**94.1**

Environmental Effects

Emissions. The annual combined emissions savings from the construction of 108,000 single family homes, 47,600 apartment units,[5] and estimated additions and alterations applying the proposed 2005 energy efficiency standards, compared to the 2001 Standards, will be 80 tons of NO_x, 18 tons of CO, and 10 tons of PM10. The emission savings are listed in Table 3 by residential sectors.

Table 3
Residential Emissions Reductions

	NO_x - tons/yr	PM10 - tons/yr	CO - tons/yr
Residential Single Family	18	2	6
Residential Multi-Family	9	1	3
Residential Alterations/Additions	15	2	5
RESIDENTIAL TOTAL	**42**	**4**	**13**

[5] Construction figures are from the Construction Industry Research Board (see Appendix B, References, for full citation).

With respect to emissions, special consideration must be given to gas-fired space cooling. Air conditioning using natural gas combustion can help reduce peak demand for electricity in the nonresidential and residential sectors; however, this additional use of natural gas may increase emissions in individual air basins. The most reasonable scenario is that the penetration of gas fired cooling will not exceed 1% penetration per year of the total air conditioning market.[6] Based on this scenario, emissions were calculated for each of the 15 air basins at 1% penetration of gas cooling market share above existing market share. The estimated statewide totals for emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), reactive organic gases (ROG), and particulates 10 microns or smaller (PM10) are shown in Table 4. Table 4 also shows the current levels of emissions in California's air basins. The estimated contribution from gas cooling to the five pollutants will be less than a 0.001 percent increase from current emissions. These very minor emissions increases are dwarfed by the overall emissions decreases attributable to the new standards. Significantly, gas-fired cooling will result in reduction of peak electricity use during periods when air emissions that result from electricity use are greatest. This air quality tradeoff is impossible to accurately quantify, as emissions from electricity use vary with the power generating units on line, as well as the amount of electricity being imported on interstate transmission lines. Nevertheless, it is likely that the overall effect of gas-fired cooling will be neutral regarding air quality. Since several of California's air basins experience occasional violations of the state and (sometimes) federal ambient air quality standards, some air districts may elect to restrict the use of gas-fired cooling based on its localized air quality effect. Such restriction would not conflict with the standards, but merely eliminate gas-fired cooling as an efficiency standards compliance option in that air district.

Table 4
Estimated Emissions in Tons/year from 1% Market Penetration of Gas Cooling above Current Levels Compared to Total Current Emissions

AIR BASIN	NO_x - tons per year	CURRENT FOR BASIN	SO_x - tons per year	CURRENT FOR BASIN	CO - tons per year	CURRENT FOR BASIN	ROG - tons per year	CURRENT FOR BASIN	PM10 - tons per year	CURRENT FOR BASIN
North coast	0.01	20,407	0.00	1,219	0.02	190,209	0.01	22,849	0.00	30,788
Northeast Plateau	0.00	8,964	0.00	613	0.00	148,478	0.00	14,164	0.00	31,361
Sacramento Valley	0.17	99,317	0.08	4,833	0.29	588,318	0.14	95,393	0.06	97,013
Lake County	0.00	3,110	0.00	245	0.00	38,318	0.00	4,997	0.00	5,537
San Francisco Bay	0.46	228,172	0.20	30,014	0.83	1,025,566	0.41	195,713	0.17	68,160
Mountain Counties	0.06	20,666	0.03	1,310	0.10	252,982	0.48	35,525	0.02	45,387
Lake Tahoe	0.01	1,905	0.01	110	0.02	23,473	0.01	3,216	0.01	1,945
Great Basin Valleys	0.00	2,201	0.00	314	0.00	25,561	0.00	4,581	0.00	314,710
San Joaquin Valley	0.23	200,279	0.11	16,673	0.39	812,862	0.19	172,904	0.09	172,842
North Central Coast	0.02	31,861	0.01	1,475	0.04	188,858	0.02	28,707	0.01	27,923
South Central Coast	0.10	45,359	0.04	6,745	0.17	266,976	0.08	56,433	0.04	31,857
South Coast	1.29	392,926	0.57	28,072	2.34	2,040,372	1.14	343,673	0.48	139,083
San Diego	0.38	83,311	0.18	4,869	0.63	489,757	0.61	82,683	0.15	47,830
Salton Sea	0.05	23404	0.02	876	0.08	112391	0.04	17922	0.02	97681
Mojave Desert	0.16	82567	0.07	5501	0.27	172083	0.13	31343	0.07	62112
STATEWIDE	2.93	1,244,449	1.32	102,869	5.19	6,376,204	3.26	1,110,103	1.13	1,174,229

[6] Randall Higa, Southern California Gas Company. See Appendix B for contact information.

Noise

Gas fired air conditioning. Noise levels of electric air conditioning and absorption-type gas-fired air conditioning are comparable. Gas-fired engine-driven units produce louder sound than electric equipment and may require sound abatement strategies such as built enclosures in order to meet local noise ordinances.

Materials

One goal of the residential standards changes was to reduce peak demand and at the same time improve overall energy efficiency. These improvements will result in some physical changes in equipment and building components and in some potential corresponding increases and decreases in certain materials that comprise building components. All materials impacts are negligible compared to the statewide use of those materials.

Metals. The measures proposed for the 2005 residential standards are expected to result in a reduction in the use of metals. The possibility of oversizing air conditioning equipment in new construction will be decreased. Oversized cooling equipment requires more aluminum for larger condensing and expansion coils, more steel for compressors, casings, and framing, and possibly more copper for line-sets.

Recent changes in fenestration test methods for energy efficiency have resulted in marginal improvements in the efficiency of metal-framed windows. Commission staff believes this will not significantly increase the use of such windows in California. The vast majority of builders in California choose vinyl-framed fenestration because these products generally are more energy efficient than metal-framed products, and they comprise one of the most cost-effective ways to gain energy compliance credit.

Insulation components. The current standards require that the first five feet of hot water pipe from the water heater be insulated and that all main water lines be insulated if a recirculation system is installed. For those cases where no recirculation system exists, the 2005 Standards will require installing insulation on water pipes between the source (water heater) and the kitchen. For the projected 108,000 new homes and 47,600 apartment units built annually, an estimated 2.6 million feet of additional pipe insulation will be needed per year.

Pipe insulation is typically made from polyethylene, a product of coal or other fossil fuels. The polyethylene manufacturing process results in volatile organic compounds (VOC) emissions. Data from polyethylene manufacturers list emissions at 0.1 gram per kilogram of insulation materials. Based on an estimated 160,000 tons of added insulation from proposed 2005 Standards, VOC emissions from the additional pipe insulation will be approximately 16 tons per year. In comparison, total annual VOC emissions in California are 1.052 million tons. In the context of statewide air quality, 16 tons of VOC emissions from polyethylene insulating pipe is less than significant, particularly when one understands that the material will be used to achieve energy efficiency and the attendant lower emissions of air pollutants..

The energy savings from added pipe insulation are estimated at 235 thousand therms per year. This will result in emissions reductions of 1.16 tons of NO_x, 0.117 tons of PM10, and 0.35 tons of CO per year.

Glass. The 2005 Standards will add two requirements related to glazing. The first increases the glass area allowance from 16 percent to 20 percent of the floor area for seven of the sixteen climate zones. Assuming that the average house size is 2,300 square feet and that all houses in

those climate zones would have had 16 percent glass with the current standards and 20 percent under the 2005 Standards (an unlikely scenario, but a worst-case scenario), the amount of added glass based on distributed population growth would increase total glass use for new houses and apartments by approximately 10 percent or 1,015 tons, with a corresponding decrease in the quantity of framing materials and insulation.[7] (Statewide use of silica, the basis of glass, computer chips, and other products, is approximately 3.3 million tons.) This proposed Standards change results in a 0.03 percent increase in the use of silica sands, which staff considers less than significant. While increased glazing area has the potential for increasing energy use (glass allows heat to pass through it more easily than an insulated wall does), this may not occur. Analyses by Regional Economic Research (RER)[8] and Bruce Wilcox[9] show that builders in those climate zones where 20 percent of the floor area is already allowed as wall fenestration actually build homes with less than 20 percent glazing due to cost restrictions and limitations related to privacy and subdivision planning.

The second change in 2005 Standards affecting glass will have an environmental benefit: no tradeoffs will be allowed between reduced glass area and other efficiency measures. For example, multi-family buildings are typically built with 10 to 14 percent glazing area statewide. Under the 2001 Standards, the energy budget was set by a building with 16 or 20 percent glazing area (depending on climate zone), and any lesser amount of glass resulted in a credit toward the total energy use that could then be traded off by reducing other building efficiency measures. Many multi-family buildings complied by installing single-pane glass and minimum allowed insulation levels. Under the 2005 Standards, this will no longer be allowed. A building designed with 14 percent glazing will have its budget set by a building with 14 percent glazing and standard features, which lowers the allowed energy budget compared to using 16 or 20 percent glazing. An Eley Associates analysis[10] prepared for the Commission indicates that the impacts to multi-family buildings combined with the current statewide patterns of glass area installed will result in energy savings.

B. Nonresidential, High-Rise Residential, and Hotel/Motel Buildings

Energy Effects

The projected total annual savings from the nonresidential sector under the proposed 2005 Standards is about 0.49 million therms of natural gas, 319 GWh of electricity, and 82 MW of reduced demand. Table 5 shows the breakdown by sector.

Table 5
Nonresidential Energy Savings and Peak Demand Reduction

	Millions therms/yr	GWh/yr	MW
Nonresidential New Construction	0.69	140.6	44
Portable Classrooms	0	3.1	0
Nonresidential Alterations/Additions	-0.2	175	44.3
Nonresidential Total	0.49	318.7	88.3

[7] Commission staff did not attempt to estimate savings in framing materials and insulation under this scenario, believing it to be less than significant.
[8] *Residential New Construction Study*, Regional Economic Research (RER). See Appendix B for the full citation.
[9] *Energy Characteristics, Code Compliance and Occupancy of California 1993 Title 24 Houses*. See Appendix B.
[10] *Impact Analysis, 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings*. See Appendix B.

Environmental Effects

Indoor air quality**.** Demand Control Ventilation (DCV) is a means of controlling the mixing of outdoor air into the indoors with mechanical ventilation to maintain indoor air quality. Traditionally, ventilation systems were designed such that they tended to operate frequently at maximum capacity with little flexibility in that operation schedule. DCV systems have CO_2 sensors that monitor the amount of carbon dioxide in a room from human respiration. The DCV controls adjust the mechanical outdoor air intake on an as-needed or demand basis. It is an energy-saving measure because it optimizes the rate of outside air intake and allows the system to run at less than maximum capacity.

DCV was introduced in the 2001 Standards and will become mandatory in the 2005 Standards. Compared to the 2001 Standards, mandatory DCV will increase energy efficiency for ventilation by at least 4.5 percent.[11] The resulting energy savings are approximately 24 GWh per year (based on 159 million square feet of new construction and 3.38 kWh per square foot, the 2001 value for cooling energy consumption).

Emissions. The annual savings in emissions from implementing the 2005 nonresidential energy standards are estimated at 2 tons of NO_x, and 2,820 tons of CO. No significant savings in PM10 are estimated. The breakdown by sector is shown in Table 6.

Table 6
Nonresidential Emissions Savings

	NO_x - tons/yr	PM10 - tons/yr	CO - tons/yr
Nonresidential New Construction	3	0	3.970
Portable Classrooms	0	0	0
Nonresidential Alterations/Additions	-1*	0	-1,150
Nonresidential Total	2	0	2,820

* Negative numbers appear for nonresidential alterations because staff calculates that the proposed 2005 Standards for cool roofs in the nonresidential sector will save electricity for air conditioning in summer but will slightly increase the use of natural gas for heating in winter, because buildings with new cool roofs will gain less heat through the roof from the sun heating the roof. This table does not include emissions effects from reductions in electricity from power plants, because it is impossible to determine what portion of the electricity saved is instate or from California's out-of-state electricity sources.

Materials Effects

Cool roofs. The surface of many traditional roofs can reach temperatures of 150-170 degrees F during a hot summer day. Cool roofs can lower the temperature by 50-60 degrees F, thus reducing the conduction of heat into a building and lowering the amount of air conditioning needed to remove that heat.

Cool roofs are available in several forms, and one example is liquid roof coatings. Two main types of liquid cool roof coatings are cementitious and elastomeric. Cementitious coatings - - as the name implies - - contain cement particles. Elastomeric coatings have added polymers that make the coatings pliable and improve their adhesion. Some coatings contain both cement particles and polymers. With the proposed 2005 Standards, a small increase in the use of polymers

[11] Calculated by staff from *CO_2 "Demand-Control Ventilation" (DCV) and Intake Rate Contro*l by Len Damiano, AutomatedBuildings.com, and from *Research Finds Economizers Plus Demand Control Ventilation Delivers Highest Energy Savings* by Honeywell, Inc. See Appendix B for the full citations.

and cement particles is expected. Since the cement is premixed into the solution at the plant where health codes address inhalation concerns, there are no expected public health hazards from the cement particles.

Under current Air Resources Board regulations, most types of reflective roof coatings are limited to 500 grams per liter of volatile organic compound (VOC) emissions. [12] The projected increase in nonresidential building construction is estimated at 159 million square feet per year, or 19.9 million square feet of new roof area (the average number of stories per building is eight). With coverage rates around 1 gallon per 100 square feet, the estimated amount of additional VOCs from cool roofs would be 377.5 tons per year. Current statewide releases of VOCs total 1.052 million tons, which means that the increase would be 0.035 percent, an amount staff deems less than significant.

While increased manufacturing of cool roof materials may increase release of VOCs at plants around the country, local environmental benefits accrue where cool roofs are installed. Cool roofs can reduce the urban heat island effect, a phenomenon resulting from surfaces such as streets, parking lots, and roofs absorbing the sun's energy, releasing it back into the surroundings, and causing higher local temperatures in cities compared to nearby suburban or rural areas. Higher temperatures can increase the incidence of smog and ground-level pollutants thus impacting human health. Cool roofs also result in lower air conditioning loads within buildings, with the consequent decrease in the need for peak demand of electricity and associated reductions in power plant emissions.

Duct Insulation. Duct insulation requirements increased for both residential and nonresidential buildings. For residential buildings, minimum duct insulation levels for Package D will remain at R-4.2 in climate zones 6, 7, and 8 but will increase to R-6 in climate zones 1-5 and 9-13 and to R-8 in climate zones 14, 15, and 16. In residential alterations, when more than 40 feet of new or replacement space conditioning ducts are installed to serve an existing building, the new ducts will be required to meet the duct insulation requirements in Package D. Nonresidential insulation requirements for ducts in unconditioned or indirectly conditioned spaces will be increased to R-8.

The annual increase in the amount of insulation due to this change in the standards is estimated at 11.7 tons for residential and nonresidential buildings. In comparison, California currently uses approximately 3,000 tons of duct insulation for the residential sector alone. Manufacturing the added insulation will add approximately 0.585 tons of VOC nationally, compared to California's total emissions of VOC of 1.052 million tons. This measure will result in a reduction of 94 GWh per year of electricity use and a reduction of 4.8 million therms, mostly from natural gas, annually. Emissions reductions from space heating in California will be 24 tons of NO_x, 7 tons of CO, and 2 tons of PM10 annually.

Skylights. The 2005 Standards will mandate that under the prescriptive approach, nonresidential buildings of 25,000 square feet or more and with ceilings 15 feet or higher must have at least one-half of the floor area illuminated with natural light from skylights. Daylighting reduces the need for electrical lighting, and since electrical lighting emits heat inside the building, the load on air

[12] "All districts that have a graphic arts category in their architectural coating rules have a 500 g/l VOC limit. This category is exempt in the Bay Area, Butte County, Colusa County, Feather River, and Monterey districts. The VOC limit in the U.S. EPA's National Architectural Coatings Rule is 500 g/l…. Kentucky and the California districts are at 500 g/l (U.S. EPA, 1998)." From www.arb.ca.gov/coatings/arch/sreport/vol2-6bc.htm.

conditioning equipment to remove that heat is lessened. Since nonresidential buildings are almost always cooling load-dominant, effects on heat loss from buildings are minimal.

Determining the environmental and materials effects of this measure is complicated and cannot be accomplished with precision. The location and square footage of buildings that would fall into this category of construction are two large variables. An additional difficulty is determining the ratio of the square footage to the ceiling area since the building can be up to three stories in height.

Determining energy effects is also difficult for the same reasons. However, some limited estimates can be made: a single-story 25,000 square foot office building with 1.2 watts per square foot of allowed lighting density would annually use 66,000 kWh per year of electricity for lighting. Under the proposed standards, the same building would reduce its load by an estimated 16,000 kWh per year (based on one-half of the square footage times an adjustment factor for seasonal changes and hourly daylight availability).

Relocatable Classrooms. Under the proposed 2005 Standards, the basic energy requirements for relocatable classrooms will not change; however, the 2005 Standards will introduce a compliance option that allows builders of portable classrooms to design and build portables so that they can be located in any climate zone in the state. Consequently, some relocatable classrooms will be designed for energy efficiency for California's most severe climates.

Commission staff did not attempt to estimate effects on materials used for construction of relocatable classrooms under the new Standards; there is no way to determine what the population and distribution of new relocatable classrooms will be several years from now. Staff were able to generate only general estimates of energy savings from this measure. Based on current statistics, about 3,000 new units are built each year for use in California, typically 24 by 40 feet. The average energy savings from the 2005 Standards over current standards is estimated at 1,043 kWh per year per unit, for a total of 3.1 GWh for 3,000 units. The energy consequences are affected by the design particulars and the building's orientation, which may change with each relocation.

C. Outdoor Lighting

Energy Effects

The projected energy savings for outdoor lighting standards is 17.15 GWh/yr. While the largest effect on demand is not coincident with peak, a reduction of nighttime load demand is estimated at less than 1 MW.

Environmental Effects

Glare. Because the 2005 Standards will address outdoor lighting for the first time, the issue of nighttime glare must be considered. Glare occurs in two ways. First, it is possible to have too much light, causing the observer to have a simple physical response such as squinting, blinking, or looking away. Second, glare occurs when the range of luminance in a visual environment is too large (too much light contrast). Glare of this sort can have two effects: a reduction in visual performance and a feeling of discomfort.

Nighttime glare can affect automobile and other vehicle drivers near stadiums, car dealerships, and other places with relatively bright lighting. Commission staff expects that increased energy efficiency in outdoor lighting will reduce nighttime glare of both types to a small degree or have no effect. The 2005 Standards will not require modifying existing lighting except in some limited

cases, so it is expected that new installations of outdoor lighting will not become a significant portion of the total of outdoor lighting for some years.

Dark sky interference. Dark sky is a concern for astronomers and other observers of the night sky, as outdoor lighting can spill sideways and upward into areas not needing or intended to be lit. The 2005 Standards will place controls on outdoor lights to help prevent operation when they are not needed and encourage the use of technologies that use electricity more efficiently, and therefore use less electricity, for a given lighting task. Although the 2005 Standards will not address the spillage of lighting sideways or upward, staff believes that the new Standards will not result in increased dark sky interference.

Emissions. The new outdoor lighting standards are projected to have insignificant emissions reductions compared to having no outdoor lighting regulations for energy efficiency.

Materials Effects

The emphasis of the outdoor lighting standards is increased lighting equipment efficiency through the use of controls and (secondarily) reduced wattage. Adding controls will add metal (aluminum or steel) for the casing, copper and possibly gold for circuits, and a range of trace minerals or other metals for capacitors, sensors, resistors, etc. When comparing the potential increase in the use of these materials to their statewide use, the increased amounts are negligible. For example, the casing for the controls will weigh no more than a few ounces, and one control can manage an entire parking lot, a whole sign, or several street lights. Commission staff approximates the number of controls to be installed annually to be 20,000 units. Assuming a worst case in which the control casings weigh a pound each, the total annual amount of aluminum needed would be 20,000 pounds. In comparison, annual statewide use of aluminum is 200,000 tons.[13] A similar comparison can be made for other materials that would be included in the controls. Since the luminaires themselves will be essentially the same, no increase in materials is expected. Overall, the potential change in total material consumption will be approximately 0.0005 percent of existing materials use, an amount staff deems less that significant.

VII. CUMULATIVE EFFECTS

A. Energy

The estimated cumulative energy effects of implementing the proposed 2005 Standards will be to reduce annual energy consumption of electricity by 619 gigawatt-hours per year (GWh/yr) and to reduce demand by 263 megawatts (MW). Natural gas consumption will be reduced by 10 million therms.

The proposed efficiency changes were selected based on the life cycle cost analysis requirement of the Warren-Alquist Act. In response to this mandate, the 2005 Standards include measures that will "ensure the maximum feasible reductions in wasteful, uneconomic, inefficient, or unnecessary consumption of electricity." Efficiency improvements included in the 2005 Standards will affect an estimated 108,000 homes and 159 million square feet of nonresidential construction in the first year alone.

[13] From *Mineral Commodity Summaries* by the U.S. Geological Survey. See Appendix B.

B. Environmental

Air Quality

Reducing natural gas and electricity use will result in emissions reductions both at individual buildings and at power plants in California and other western States. The estimated quantities of each type of emissions reductions are shown in Table 7.

Most traditional *emergency* electricity generators burn fossil fuel, usually diesel or gasoline, and are not subject to emissions limitations. Reducing the need for emergency generators through the efficient use of energy helps "spare the air" in California and surrounding states. As discussed in the nonresidential environmental impact section of this report (pp. 23-25), gas fired cooling may increase localized emissions, but the increases are extremely small and less than significant when offsetting air quality benefits are considered.

Energy Commission staff evaluated emissions impacts of the changes by climate zone and by air basin (see Figure 2 for a map of air basins and Figure 1 for a map of climate zones). Staff then multiplied the energy use from each air basin by the emissions factors in Table B-1 (in Appendix B) to determine NO_x, CO, and PM10 emissions shown in Table 7 for each air basin. The process was repeated for NO_x, CO_2, and PM10 (see Table 8) for the rest of the Western states.

Noise Pollution

The only component of the 2005 Standards that has any potential for creating noise pollution is gas-fired cooling. Some gas cooling technologies produce louder sound than electric cooling. Since local jurisdictions have noise ordinances in place that apply to noise from electric air conditioners, and a number of mitigation strategies exist to block or muffle such noise, staff expects that those same ordinances will apply to gas-fired cooling. Staff deems the impact from noise to be less than significant.

Volatile Organic Compounds (VOCs)

The application of an increased number of nonresidential cool roofs under the proposed 2005 Standards will result in an estimated 0.035 percent increase in the release of VOCs into California's air, an amount staff deems less than significant. Not considered in this calculation is the amount of VOCs that will be *avoided* by installing cool roofs in place of noncool roofs that would be installed without the 2005 Standards.

The 2005 Standards are projected to increase the amount of duct insulation used in California residential and nonresidential construction, resulting in less than one thousandth of a percent increase in VOCs emitted at insulation manufacturing plants around the country.

In the residential sector, the 2005 Standards will result in an increase in the use of water pipe insulation. Commission staff could not locate specific data on manufacturing and VOC releases from water pipe insulation, but using emission rates for similar products, staff estimated VOC emissions for the additional pipe insulation at 4 tons per year, which is less than significant on a statewide basis.

Light Trespass, Glare, and Dark-Sky Effects

The analysis has show that the implementation of the outdoor lighting requirements will have no negative impacts related to these concerns. For a more detailed discussion refer to the nonresidential environmental effects section.

Table 7
ESTIMATED REDUCTIONS IN NATURAL GAS USE AND EMISSIONS BY AIR BASIN AND STATEWIDE (including gas fired cooling)*

AIR BASIN	Natural gas – therms/yr	NOx – tons/yr	PM10 –tons/yr	CO – tons/yr
North coast	99,327	0	0	0
Northeast Plateau	35,038	0	0	0
Sacramento Valley	755,444	4	0	1
Lake County	7,399	0	0	0
San Francisco Bay	1,306,616	6	0	1
Mountain Counties	592,906	3	0	1
Lake Tahoe	122,095	1	0	0
Great Basin Valleys	23,810	0	0	0
San Joaquin Valley	1,134,775	5	0	1
North Central Coast	118,328	1	0	0
South Central Coast	429,307	2	0	0
South Coast	2,305,752	10	1	1
San Diego	877,664	4	0	1
Salton Sea	286,117	1	0	0
Mojave Desert	917,633	4	0	1
STATEWIDE	9,012,211	42	3	8

* Figures are rounded to the nearest whole number. Totals may reflect rounding errors.

Table 8
Estimated Reduction in Electricity Generation and Emissions in the Western States

Electricity – GWh/yr	NO_x – tons/yr	PM10 tons/yr	CO – tons/yr
479	92	14	55

FIGURE 2 - California Air Basins Map

Materials
While the standards will increase the use of some metals, electrical component materials, and glass, the amount of increase compared to the total use of each material in the state is relatively small and deemed to be insignificant. For quantifications of specific materials refer to Section VI of this report, the environmental section for residential, nonresidential, or outdoor lighting.

California Environmental Quality Act (CEQA) Issues
Commission staff completed an environmental checklist to address CEQA issues for this project. See Appendix A.

VIII. STAFF RECOMMENDATIONS

Staff's analysis for the proposed amendments to the energy efficiency standards concludes that there will be no significant impact on the environment. Staff recommends that the Commission adopt a Negative Declaration for the 2005 Building Energy Efficiency Standards for residential and nonresidential buildings and outdoor lighting.

IX. INITIAL STUDY PREPARERS

This Initial Study was prepared by California Energy Commission staff Rob Hudler and Elaine Hebert of the Energy Efficiency and Demand Analysis Division, Residential Buildings and Appliances Office, with contributions from Tony Rygg from the same office, Nancy Tronaas of the Systems Assessment and Facilities Siting Division, Siting Office, and Caryn Holmes and Dick Ratliff of the Office of the Chief Counsel.

APPENDIX A - California Environmental Quality Act (CEQA) Checklist

Project title:	2005 Energy Efficiency Standards for Residential and Nonresidential Buildings
Lead agency name and address	California Energy Commission 1516 Ninth Street Sacramento, California 95814
Contact person and phone number:	Tony Rygg, Efficiency Standards CEQA Project Manager, Energy Efficiency Division, (916) 653-7271
Project Description	The Commission is proposing changes to the energy efficiency standards for residential and nonresidential buildings as mandated by the Warren-Alquist Act. In addition the Commission is proposing new standards to include efficiency measures for outdoor lighting as mandated in SB 5X. A list of the proposed changes is included in the Executive Summary of this Initial Study.
Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)	The California Building Standards Commission must approve the changes.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

	I. Aesthetics		II. Agriculture Resources		III. Air Quality
	IV. Biological Resources		V. Cultural Resources		VI. Geology /Soils
	VII. Energy		VIII. Hazards & Hazardous Materials		IX. Hydrology / Water Quality
	X. Land Use/ Planning		XI. Mineral Resources		XII. Natural Resources
	XIII. Noise		XIV. Population/ Housing		XV. Public Services
	XVI. Recreation		XVII. Transportation/ Traffic		XVIII. Utilities/ Service Systems
	XIX. Mandatory Findings of Significance				

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
I. **AESTHETICS --** Would the project:				
a) Have a substantial adverse effect on a scenic vista?				X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?				X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?				X
d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on aesthetics.				
II. **AGRICULTURE RESOURCES** -- In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				X
c) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on agricultural resources.				
III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Significi-cant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?				X
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?			X	
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)?			X	
d) Expose sensitive receptors to substantial pollutant concentrations?				X
e) Create objectionable odors affecting a substantial number of people?				X
The building standards changes taken cumulatively will result in reduced power plant operation (in California and the Western United States) and will therefore result in reduced emissions from power plants. Staff believes that there may be small amounts of emissions from gas-fired air conditioning in the residential and nonresidential sectors as this technology enters the market; however, market penetration is likely to be limited to 1% of the air conditioning market above current levels in the foreseeable future. Because a number of air basins in California are not in compliance with air quality regulations, some of those air basins may prohibit the use of gas air conditioning. Staff expects that overall, California will experience a net environmental benefit and net reductions of emissions for air conditioning resulting from the proposed 2005 Standards. Staff estimates that increased emissions of VOCs from projected increases in water pipe and duct insulation manufacturing, in and outside California, will be less than significant.				
IV. **BIOLOGICAL RESOURCES** -- Would the project**:**				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?				X
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
or by the California Department of Fish and Game or US Fish and Wildlife Service?				
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?				X
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?				X
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				X
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on biological resources.				
V. **CULTURAL RESOURCES** -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?				X
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?				X
c) Directly or indirectly destroy a unique pale ontological resource or site or unique geologic feature?				X
d) Disturb any human remains, including those interred outside of formal cemeteries?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on cultural resources.				

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
VI. **GEOLOGY AND SOILS** -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				X
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.				X
ii) Strong seismic ground shaking?				X
iii) Seismic-related ground failure, including liquefaction?				X
iv) Landslides?				X
b) Result in substantial soil erosion or the loss of topsoil?				X
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?				X
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?				X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on geology and soils.				
VII. **ENERGY** -- Would the project:				
a) Use exceptional amounts of fuel or energy?				X
b) Increase demand upon existing sources of energy, or require the development of new sources of energy?				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
The objective of the 2005 Standards is to reduce energy use in California. Staff has determined that the proposed Standards will save energy statewide.				
VIII. **HAZARDS AND HAZARDOUS MATERIALS** -- Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?				X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?				X
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				X
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?				X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?				X
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?				X
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				X
h) Expose people or structures to a significant risk of loss, injury or death involving wild land fires, including where wild lands are adjacent to				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Significi-cant Impact	No Impact
urbanized areas or where residences are intermixed with wild lands?				
Commission staff deems that the proposed 2005 Standards will have no effects on hazards and hazardous materials.				
IX. **HYDROLOGY AND WATER QUALITY** -- Would the project:				
a) Violate any water quality standards or waste discharge requirements?				X
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?				X
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner, which would result in substantial erosion or siltation on- or off-site?				X
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?				X
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?				X
f) Otherwise substantially degrade water quality?				X
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?				X
h) Place within a 100-year flood hazard				

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Significi-cant Impact	No Impact
area structures that would impede or redirect flood flows?				X
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?				X
j) Inundation by seiche, tsunami, or mudflow?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on hydrology and water quality.				
X. **LAND USE AND PLANNING** -- Would the project:				
a) Physically divide an established community?				X
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?				X
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on land use and planning..				
XI. **MINERAL RESOURCES** -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?				X
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?				X
Commission staff has determined that the proposed 2005 Standards will have insignificant impacts on mineral resources..				
XII. **NATURAL RESOURCES** -- Would the project result in:				
a) Significant increase in the rate of use of any natural resources?				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Significi-cant Impact	No Impact
b) Significant depletion of any non-renewable natural resource?				X
Commission staff has determined that the proposed 2005 Standards will have insignificant impacts on natural resources..				
XIII. **NOISE** -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?			X	
b) Exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels?				X
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?				X
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?				X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				X
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?				X
One type of gas-fired cooling technology recognized in the 2005 Standards is known to create louder noise than traditional electric-based cooling. The penetration of this technology into the air conditioning market is likely to be limited to 1% or less of the air conditioner market. Staff expects that noise mitigation strategies such as sound-muffling enclosures will be engaged in areas where local noise ordinances exist.				
XIV. **POPULATION AND HOUSING** -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses)				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
or indirectly (for example, through extension of roads or other infrastructure)?				
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?				X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on population and housing..				
XV. **PUBLIC SERVICES** -- Would the project:				
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				X
Fire protection?				X
Police protection?				X
Schools?				X
Parks?				X
Other public facilities?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on public services..				
XVI. **RECREATION** -- Would the project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				X
b) Does the project include recreational facilities or require the construction or				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
expansion of recreational facilities that might have an adverse physical effect on the environment?				
Commission staff has determined that the proposed 2005 Standards will have no impacts on recreation.				
XVII. **TRANSPORTATION AND TRAFFIC** -- Would the project:				
a) Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?				X
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?				X
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?				X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				X
e) Result in inadequate emergency access?				X
f) Result in inadequate parking capacity?				X
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on transportation and traffic..				
XVIII. **UTILITIES AND SERVICE SYSTEMS** -- Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?				X
b) Require or result in the construction of new water or wastewater treatment				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?				
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?				X
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?				X
e) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the projects projected demand in addition to the providers' existing commitments?				X
f) Be served by a landfill with sufficient permitted capacity to accommodate the projects solid waste disposal needs?				X
g) Comply with federal, state, and local statutes and regulations related to solid waste?				X
Commission staff has determined that the proposed 2005 Standards will have no impacts on utilities and service systems.				
XIX. **MANDATORY FINDINGS OF SIGNIFICANCE**				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?				X
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?				X

Issues	Potentially Significant Impact	Less Than Significant with Mitigation Incorpora-tion	Less Than Signifi-cant Impact	No Impact
Improvements in the energy efficiency of outdoor lighting and residential and nonresidential buildings will have insignificant impact to the concerns listed in this matrix. The 2005 Building Standards taken cumulatively will result in **reduced** power plant operation and **reduced** natural gas consumption in California and the Western States with associated reductions in emissions. Staff has considered the effects on materials use, glare, dark sky interference, and other issues and deemed them to be insignificant.				

DETERMINATION:
On the basis of this evaluation:

X	I find that the proposed project WILL NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
	I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
	I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
	I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
	I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

/Original Signed/
Robert L. Therkelsen
Executive Director
California Energy Commission

Date:
September 11, 2003

Appendix B – References

***The 1999 California Almanac of Emissions and Air Quality*, California Air Resources Board**, Planning and Technical Support Division, Sacramento, California, date of publication not given.

***2001 Energy Efficiency Standards for Residential and Nonresidential Buildings*, California Energy Commission**, Publication Number P400-01-024, Sacramento, California, August 2001. Available from the Commission's Publications Office and at http://www.energy.ca.gov/title24/standards/index.html.

ASHRAE HVAC Systems & Equipment Handbook 2000, **American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE),** Atlanta, Georgia, 2000.

ASHRAE Fundamentals Handbook 2001, **American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE),** Atlanta, Georgia, 2001.

California Construction Review, **Construction Industry Research Board**, Burbank, California, 1999.

California Statistical Abstract, **California Department of Finance**, Sacramento, California, December 2002. Available at http://www.dof.ca.gov/html/fs_data/STAT-ABS/sec_I.htm.

CO_2 "Demand Control Ventilation" (DCV) and Intake Rate Control, **Len Damiano**, Contributing Editor, AtuomatedBuildings.com, May 2001. Available at www.enthpower.com/demand_control_ventilation.htm.

Emissions from Residential Gas-Fired Appliances, Topical Report from the Institute of Gas Technology, **J. Cole and T. Zawacki**, GRI0-84/0165, Des Plaines and Chicago, Illinois, 1985.

Energy Characteristics, Code Compliance and Occupancy of California, 1993 Title 24 Houses, **Bruce Wilcox**, for the California Energy Commission, Sacramento, California, 1995.

Higa, Randall, Southern California Gas Company, email correspondence with Rob Hudler of the California Energy Commission regarding estimated market penetration of gas cooling, August 22-26, 2003. Mr. Higa can be reached at rhiga@semprautilities.com or 213.244.3661.

Impact Analysis, 2005 Update to the California Energy Efficiency Standards For Residential and Nonresidential Buildings, **California Energy Commission**, Publication Number 400-03-014, Sacramento, California, June 2003. Available from the Commission's Publications Office and at http://www.energy.ca.gov/2005_standards/rulemaking/documents/index.html.

Low-Rise Multifamily Building - New Construction Characteristics Study, prepared by Regional Economic Research for the **California Energy Commission**, Publication Number P400-00-

012, Sacramento, California, July 2000. Available from the Commission's Publications Office and at http://www.energy.ca.gov/reports/2000-10-05_400-00-012.PDF.

Mineral Commodity Summaries, **Patricia A. Plunkert**, U.S. Geological Survey, January 2003. Available at http://minerals.usgs.gov/minerals/pubs/commodity/aluminum/050303.pdf.

Outdoor Lighting Baseline Assessment, prepared by the **New Buildings Institute** for the Public Interest Energy Research program of the California Energy Commission, Sacramento, California, November 11, 2002. Available from the Commission's Publications Office and at http://www.energy.ca.gov/outdoor_lighting/documents/2003-05-06_LGHT-BASELINE.PDF.

Research Finds Economizer Plus Demand Control Ventilation Delivers Highest Energy Savings, **Honeywell, Inc.**, Golden Valley, Minnesota, June 1998. Available at http://content.honeywell.com/building/components/catalog/pdfdocs/63-9058.pdf.

Residential New Construction Study – Year #2, prepared by **Regional Economic Research** for Pacific Gas & Electric, September 2001. Unpublished interim report. (The final report was published in September 2002.)

Staff Report for the Proposed Suggested Control Measure for Architectural Coatings, Volume II: Technical Support Document, **California Air Resources Board**, Sacramento, California. No date given. Available at http://www.arb.ca.gov/coatings/arch/sreport/vol2-6bc.htm.

Ventilation for Acceptable Indoor Air Quality, **American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE)**, ASHRAE Standard 62-1989, Atlanta, Georgia, 1989.

Table B-1
Emissions Factors for Calculating Reduced Emissions from Energy Savings

Emissions Factors	NO_x	CO	CO_2	PM10
Natural Gas, California (lbs/MMBtu)	0.094	0.03	115	0.01
Electricity, Western States (lbs/MWh)	0.383	0.23	1200	0.06

Provided by the Energy Commission's System Assessment and Facilities Siting Division.

Appendix C – Glossary of Terms

Alternative Calculation Method (ACM)

An alternative calculation method is one of "the Commission's Public Domain Computer Programs, one of the Commission's Simplified Calculation Methods, or any other calculation method approved by the Commission."[*BEES*, Section 101]

Alternative Component Packages

An alternative component package is one of the sets of prescriptive requirements contained in Section 151(f) and Tables 1-Z1 through 1-Z16 of the Standards (Chapter 3) which a building may meet to achieve compliance with the standards. These are often referred to as the "prescriptive packages" or "packages."

ASHRAE

American Society of Heating, Refrigerating and Air Conditioning Engineers.

ASTM

American Society for Testing and Materials.

BEES

See Building Energy Efficiency Standards

Bi-Level Switching

Lighting controls that allow a portion of the lights to be turned off while maintaining balanced lighting throughout a space.

Btu/hr (Btuh)

British thermal unit per hour. One Btu equals the amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit. Used for measuring heating and cooling equipment output.

Building Energy Efficiency Standards (BEES)

The California State energy standards as set forth in the California Code of Regulations, Title 24, Part 6.

Climate Zone

The Energy Commission established 16 climate zones that represent a geographic area for which an energy budget is established. These energy budgets are the basis for the energy efficiency standards. Following is a list of a major city in each climate zone:

CZ01:	Arcata	CZ07:	San Diego	CZ12:	Sacramento
CZ02:	Santa Rosa	CZ08:	El Toro	CZ13:	Fresno
CZ03:	Oakland	CZ09:	Pasadena	CZ14:	China Lake
CZ04:	Sunnyvale	CZ10:	Riverside	CZ15:	El Centro
CZ05:	Santa Maria	CZ11:	Red Bluff	CZ16:	Mount Shasta
CZ06:	Los Angeles				

Cool Roofs

A roof that reflects significantly more solar energy than a traditional roof and therefore keeps the building's interior cooler. Cool roofs are usually light-colored and applied as a tile product (residential) or coating (nonresidential). An alliance called the Cool Roof Rating Council has been formed to establish criteria and rating systems for cool roofs.

CO

Carbon Monoxide (CO): A colorless, odorless gas resulting from the incomplete combustion of hydrocarbon fuels. CO is regulated as a primary pollutant.

CO_2

Carbon dioxide, A gas by-product of combustion that is known to behave as a greenhouse gas in the earth's atmosphere.

Demand Control Ventilation

Demand Control Ventilation is the ability to adjust the amount of ventilation air provided to a space based on the extent of occupancy (as measured by CO_2 sensors). An assembly building that is occupied on an intermittent basis would use demand controls to change the ventilation rates based on the number of people in the space, thereby saving substantial energy when the space is sparsely occupied. Occupancy sensors, air quality sensors, or other devices may accomplish this.

EER (Energy Efficiency Ratio)

The ratio of cooling capacity of an air conditioning unit in Btus per hour to the total electrical input in watts under specified test conditions. Compare to *SEER*.

Emittance

The property of emitting radiation; possessed by all materials to a varying extent.

Energy Budget

"Energy budget is the maximum amount of source energy that a proposed building, or portion of a building, can be designed to consume, calculated with the approved procedures specified in Title 24, Part 6." [*BEES*, Section 101]

Fenestration Product

A fenestration product is "any transparent or translucent material plus any sash, frame, mullions, and dividers, in the envelope of a building, including, but not limited to: windows, sliding glass doors, French doors, skylights, curtain walls, garden windows, and other doors with a glazed area of more than one-half of the door area." [*BEES*, Section 101]

Gigawatt-hour (GWh)

One thousand megawatt-hours, one million kilowatt-hours, or one billion watt-hours of electrical energy.

Glazing

Transparent or translucent material (typically glass or plastic) used for admitting light.

Heating, Ventilating and Air Conditioning (HVAC)

The mechanical heating, ventilating and air conditioning system of the building is also known as the HVAC system. The standards use various measures of equipment efficiency defined according to the type of equipment installed.

Kilowatt (kW)

One thousand watts of power. A kilowatt is a measure of demand, or how many thousand watts are being drawn at any instant.

Kilowatt-hour (kWh)

One thousand watt-hours of energy.

Lighting Power Density (LPD)

A measure of the amount of light in a room. For the purpose of this document, LPD represents the amount of watts per square foot of lighting that can be installed for a specific task.

Low-e glazing

Glazing that has been coated with a low-emissivity medium that reduces heat transfer.

Low-Rise Residential

Any building of the residential occupancy group R (as defined in the Uniform Building Code), excluding all hotels, all motels and apartment buildings, with four or more habitable stories.

Megawatt (MW)

One million watts of power. A megawatt is a measure of demand or how many million watts are being draw at any instant (*see also* kilowatt).

MBtu

One million Btus of energy.

NFRC

The National Fenestration Rating Council, a national organization of manufacturers of fenestration products, glazing and related materials, utilities, state energy offices, laboratories, homebuilders, architects and public interest groups. This organization is responsible for rating the U-factors and solar heat gain coefficient of manufactured fenestration product lines (i.e., windows, skylights, and glazed doors) that must be used in compliance calculations. In California, all manufactured fenestration products must be labeled with NFRC rated values or with approved default U-factors.

NO_x

Oxides of nitrogen, usually NO and NO_2, that are chief components of air pollution and produced by the combustion of fossil fuels.

Outside Air

"Outdoor air is air taken from outdoors and not previously circulated in the building." [*BEES*, Section 101]

Proposed Design

The proposed building designs that must comply with the standards before receiving a building permit.

PM10

Solid particulate matter that is 10 microns in size or smaller. Usually considered pollutants, particulates are released from combustion processes in exhaust gases at fossil fuel plants and from mobile and other fugitive particle sources.

Radiant Barriers

Reflective material installed on or below the underside of the roof to block radiant gains from a solar-heated, hot roof to keep from raising attic temperatures and increasing conduction through duct and ceiling insulation.

SEER (Seasonal Energy Efficiency Ratio)

The total cooling output of a central air conditioning system in Btus during its normal usage period for cooling divided by the total electrical input in watt-hours during the same period, as determined using specific test procedures.

Solar Heat Gain Coefficient (SHGC)

A measure of the effectiveness of a fenestration product or window covering to stop solar heat gain through the window. SHGC is the “ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.” [*BEES*, Section 101]

Standards

The *California Building Energy Efficiency Standards* as set forth in the *California Code of Regulations*, Title 24, Part 6.

Thermostatic Expansion Valve (TXV)

A refrigerant metering valve that controls the flow of liquid refrigerant entering the evaporator in response to the superheat of the gas leaving it. Its basic function is to keep the evaporator active without permitting liquid to be returned through the suction line to the compressor. TXVs compensate for common installation problems caused by incorrect refrigerant charge and incorrect airflow.

Time Dependent Valuation (TDV)

A method of valuing electricity and other building energy sources differently according to varying demand conditions; for example, the cost of electricity in California rises at peak demand times in hot weather due to a much larger need to power air conditioning. TDV energy includes energy used at the building site as well as that consumed in producing and

delivering energy to the site, including but not limited to generation, transmission, and distribution losses.

U-factor (formerly U-value)

A measure of energy efficiency of a wall assembly or fenestration, defined as the "overall coefficient of thermal transmittance of a construction assembly, in Btu/(hr x ft^2 x ºF), including air film resistances at both surfaces." [*BEES*, Section 101]

Ventilation Air

"Ventilation air is that portion of supply air which comes from outside plus any recirculated air that has been treated to maintain the desired quality of air within a designated space." [*BEES* (2001), Section 101]

Watt (W)

A unit of measure of electric power at a point in time, as capacity or demand.

Watt-hour (Wh)

One watt of power expended for one hour.