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TITLE 24 ISSUES & RECOMMENDATIONS FOR THE 2008 BUILDING ENERGY STANDARDS[1]

INITIATIVES TO IMPROVE COMPLIANCE WITH THE ENERGY CODE:

- LICENSING: The C.E.C. should mandate a professional licensing requirement for certain building types, and either run this program in-house, or sanction an outside entity to run this program on the C.E.C.'s behalf. Licensed energy professionals should be required to prepare Title 24 compliance reports for all nonresidential buildings (possibly excepting small buildings) and all multi-family residential buildings (possibly excepting two and three unit buildings).

  Any person who wants to do professional building energy analysis work should welcome the chance to prove their professional qualifications. The argument that certain engineers don't need to separately qualify for this work because their engineering credentials prove their knowledge of the energy code does not conform to reality. Many engineers simply purchase an energy compliance program, and produce reports without training in the energy code. Because building departments often do not scrutinize energy reports carefully (perhaps especially those produced by established engineering firms), the engineers producing erroneous reports often do not receive crucial feedback that their reports are in fact not in conformance with the energy code.

  While some people prepare erroneous energy compliance reports due to lack of knowledge, others purposely bend the rules, knowing that the likelihood of their non-conforming reports being rejected by a building department are fairly slim. When licensing is a professional requirement, professionals are much less likely to jeopardize their career by bending the rules.

- ENFORCEMENT: 1) Once there is a class of licensed energy analysts, they could optionally review and stamp construction documents before submittal to building departments; building departments might be willing to discount energy plan check fees for such submittals; 2) Encourage building departments to use third-party energy plan reviewers (with firm restrictions on business relationships between the reviewers and the design firms); 3) Mandate or encourage building departments to confidentially accept "whistle-blower" information about specific projects; 4) Encourage utilities to provide energy plan reviews and field checking to building departments; 5) The C.E.C. should spot check building departments on a routine basis.

- COMPLIANCE FORM INFORMATION: Include pertinent information on the compliance forms. For example, previous envelope forms included frame material and spacing on the ENV-3, which could also be noted as part of the assembly name listed on the ENV-1 and/or PERF-1. The previous LTG-1 listed the luminaries, which is missing on the 2005 LTG-1 form. Also, the previous MECH-1 listed the mechanical system

[1] Note that this paper is a work-in-progress and does not represent CABEC.

models, which is missing on the 2005 MECH-1 forms. Field inspections are difficult enough without reducing the information available.

- MAKE THE STANDARDS MORE RATIONAL, AND MORE FORGIVING OF SMALL INEFFICIENT MEASURES WHICH ENCOURAGE SOME TO DEVIATE FROM THE CODE. Examples of difficult or awkward code provisions and possible changes that would help make the Standards more acceptable:

Current code provision	Issue	Possible change
1. No credit given for low-rise residential glazing areas that are less than the prescriptive standard.	Is, and appears, irrational, and in some cases encourages larger glazing areas.	Restore credit for residential glazing areas that are lower than the prescriptive allowance.
2. Very low SHGC glass is prescriptive requirement for coastal high-rise residential. Clear glass is prescriptive requirement for coastal low-rise residential.	Is, and appears, irrational, and in some cases results in higher energy usage due to reductions in solar heating.	Govern glass SHGC requirements more closely to a building's need for space heating and space cooling.
3. Low-rise residential glazing is governed as percent of CFA, high-rise residential glazing is governed as percent of GWA.	There is no particular rational for a three story building with central heat to have much different glazing requirements than a four story building with individual unit space heating.	Eliminate residential building distinctions based on number of floors (see more at next item below). Ideally, govern glazing based on CFA formula that also accounts for relationship of wall to CFA for various size buildings (see Appendix A).
4. Something as energy-innocuous as whether or not a ground-level apartment lobby is heated could make the difference as to whether a building is classified as low-rise residential or high-rise residential.	Is, and appears, irrational.	Eliminate residential building distinctions based on number of floors. Instead, base it on whether building is served by a central space heating system, or whether apartments have individual space heating systems.
5. Residential and nonresidential areas are sometimes served by the same space conditioning system. Many apartment buildings have A and B occupancy common	It can be awkward to divide HVAC system modeling between different occupancies subject to different Title 24 rules. Conversely, there doesn't seem to be	Increase the mixed occupancy 10% exception to 30% or possibly more. Also allow any mixed occupancy served by a single HVAC unit to meet the envelope and mechanical requirements of the larger

areas that exceed 10% of the building area.	a good rationale to not allow even a large minority occupancy to meet the majority occupancy's envelope and mechanical requirements.	occupancy, even if the total area of the minority occupancy exceeds 30%. There would be **no** exceptions to lighting always meeting the requirements for its own occupancy, regardless of what standard the envelope and mechanical system meet.
6. Performance compliance often relies on solar heat contribution through glazing (and prescriptive compliance assumes a certain amount of solar heat contribution).	There is nothing in the code to mandate that buildings achieve the solar heat contribution.	Residential and small nonresidential buildings in heating dominant climate zones should have limits on how much lower the installed glazing SHGC can be than the calculated SHGC. Also, structural shading of SE, south and SW-facing glazing should be required to be modeled in heating dominant climate zones.
7. Current low-rise residential glazing and insulation requirements don't accommodate common construction that is not quite efficient enough.	By not accommodating some typical construction practice that would have a very tiny impact on overall efficiency, prescriptive compliance becomes much less practical.	Allow a few square feet of single pane skylight to accommodate tubular skylights. Allow a few square feet of single-pane glazing to accommodate a door vision panel. Allow bay windows to have R-19 roofs and R-13 floors.
8. Electric resistance space heating does not have to be calculated if it occurs in a room with a vent from a non-electric resistance heating system.	Energy waste. With no control requirements on the electric heating, it could be on much of the winter.	Whether or not a electrically heated room also has a vent from a central furnace should be irrelevant. Instead, exempt electric heating systems that are operated by limited-time twist timers. Otherwise, spaces served by electric heaters, regardless of what other system serves the same space, should be modeled as electrically-heated spaces.
9. Energy improvements to existing low-rise residential buildings that don't meet prescriptive	Discourages some improvements where meeting prescriptive is not practical, encourages	Treat improvements that don't meet prescriptive requirements as energy neutral instead of penalizing them. This could

requirements are penalized (in previous code, they earned an energy "credit" under performance compliance)	"bending" the rules.	lead to greater energy savings because owners will not be discouraged to make upgrades.

ADDITIONAL RECOMMENDED CHANGES, INCLUDING ELABORATION ON SOME ISSUES RAISED IN TABLE ABOVE:

- LOW-RISE RESIDENTIAL FENESTRATION AREA: Develop method for reducing the prescriptive fenestration area allowance for larger buildings (single-family as well as multi-family). Under the current fenestration allowance approach, based solely on floor area, very small buildings are penalized, and larger buildings get an undue credit (i.e. there design fenestration area is usually lower than the prescriptive fenestration area allowance).

  One possible remedy is to restructure the basic package glazing area allowance to reflect a combination of floor area and perimeter. APPENDIX A explains a proposal for a single formula to determine allowed fenestration area for all low-rise residential building types. This formula results in similar glazing allowances for average size homes as the current formula, reduces the allowed fenestration area of very large homes, and brings the glazing allowance of multi-unit buildings in line with actual design practice, without having to justify various formulas for different sizes or types of residential buildings.

- LOW-RISE RESIDENTIAL MULTI-FAMILY PRESCRIPTIVE GLASS AREA: Should a restructuring of the fenestration allowance for all residential buildings, as suggested above, not be found acceptable, consider reducing the fenestration allowance for larger multi-family residential buildings. I have found that larger multi-family buildings often have glass areas of around 10 to 13 percent of the C.F.A. This change would eliminate the real rationale for eliminating the credit for reduced glazing area.

- RESIDENTIAL ADDITION FENESTRATION AREA: Should a restructuring of the fenestration allowance for all residential buildings, as suggested above, not be found acceptable, additions should be allowed a prescriptive glazing area that allows the greater of 15% CFA plus glazing removed, and 30% CFA without accounting for glazing removed. Reasons: 1) Additions are often living space; the 20% prescriptive rule is based on entire house; 2) Some additions do not involve deletion of existing glazing; 3) With greater efficiency requirements and stricter rules on getting credit in performance, this is only fair.

- HIGH-RISE VS. LOW-RISE RESIDENTIAL: Using the number of stories as the break point between two different residential standards should be reconsidered. The current low-rise standards are based on dwelling units with individual space conditioning systems, while the high-rise residential standards are based on buildings utilizing central heating systems. Of course, some low-rise buildings are served by central systems, and some high-rise buildings are served by individual dwelling unit systems.

Using the number of floors to differentiate building requirements, including glazing and insulation standards (metal frame walls are not penalized in high-rise residential buildings), as well as in modeling requirements for HVAC systems, cannot be supported by real-world building energy use. The current requirements result in awkward and wasteful modeling exercises for high-rise buildings, such as having to divide the residential areas into various zones served by different heat pump models[2].

The Standards would fit proposed buildings better if there was one standard for buildings with individual dwelling unit conditioning systems, and a second standard for residential buildings with central conditioning systems for dwelling units. These new standards would also apply to hotel/motel occupancies. If a building has both types of systems, each area would meet it's own standard, unless one type of system did not exceed 30% of the building, in which case the building could meet the standards for the major occupancy.

- RESTORE CREDIT FOR REDUCED GLAZING AREAS: The small glazing area credit should be reinstated, as less glazing is a legitimate energy saving feature. Eliminating this credit made the 2005 Standards appear to be less rational, and will likely create less respect for the Standards (I have already heard this type of response to this change).

  Another problem with eliminating the small glazing area credit is that under performance compliance, buildings with larger areas of high-performance glazing get better results than do buildings with smaller areas of high-performance glazing, because buildings with larger areas of glazing (that don't exceed 20% of the CFA) get a higher allowed energy budget. This didn't happen under the 2001 code, when smaller glazing areas receive a credit.

- HIGH-RISE RESIDENTIAL ENVELOPE ALTERATIONS. Section 149 allows envelope alterations as long as heat loss and heat gain do not become worse. This is entirely appropriate for nonresidential buildings, given their use and wide range of existing conditions to be found. However, it would be appropriate to require that new glazing in high-rise residential structures be dual-pane.

- NONRESIDENTIAL WATER HEATING: Regulate nonresidential service hot water systems. Perhaps <u>any</u> gas-fired system should be acceptable. And perhaps any in-line electric water heating system should be acceptable. However, whenever an electric storage-type system is proposed, performance compliance would be required. The Standard water heater energy budget would be based on a gas-fired system of the same capacity.

- LOW-RISE RESIDENTIAL FENESTRATION THERMAL EFFICIENCY: Reevaluate the fenestration U-Value requirement. Nonmetal frames and Low E glass prices have gone down since the previous economic evaluation of residential fenestration efficiency requirements.

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[2] While Low-Rise standards treat all heat pumps with the same efficiency identically, the high-rise standards require systems with different capacities, fan motors, etc., to be modeled as unique systems serving unique zones.

- EXTEND NONRESIDENTIAL ENVELOPE REQUIREMENTS BUILDINGS MAINTAINED OUTSIDE THE HUMAN COMFORT RANGE.

- REQUIRE MINIMUM ROOF & FLOOR INSULATION FOR HIGH-RISE RESIDENTIAL OCCUPANCIES (i.e. mandatory requirement): Adequate insulation is necessary to create equity in multi-unit residential settings (i.e. while building as a whole may meet the minimum efficiency test without enough roof or floor insulation, residents who live in units directly on an uninsulated floor, or below an under-insulated ceiling, will pay higher fuel bills and experience less comfort).

- REQUIRE MINIMUM FLOOR INSULATION FOR LOW-RISE RESIDENTIAL OCCUPANCIES (i.e. mandatory requirement): Rescind the elimination of the mandatory R-8 minimum concrete floor insulation requirement for Low-Rise Residential that occurred in the '98 Standards. Eliminating this requirement did not address question of equity in multi-unit residential settings (i.e. while building as a whole may meet the minimum efficiency test without floor insulation, residents who live in units directly on an uninsulated floor will pay higher fuel bills and experience less comfort).

- NONRESIDENTIAL ENVELOPE ALTERATIONS: Consider allowing increases in fenestration (meeting certain efficiency requirements) without meeting current Sect. 149 envelope efficiency requirements, if lighting in defined "daylit" area adjacent to the new fenestration is on automatic daylighting controls.

- ADD MORE CLIMATE ZONES. At least some of the current climate zones cover too great a range of climate conditions. For example, the portion of climate zone 12 adjacent to climate zone 3 is much cooler than typical climate zone 12 areas, and yet is much warmer than typical climate zone 3 areas. More importantly, while there is a tremendous difference between the central valley climate zones (11, 12 & 13) and the climate zone of the Sierras (c.z. 16), there is currently no transitional climate zone(s) for the western Sierra foothills.

- HEAT TAPE: This is sold in California for use in new construction (especially hotel/motel), although not explicitly allowed by Title 24. Develop methods to account for use of heat tape in DHW systems.

- COMBINED HYDRONIC & RECIRCULATION CONTROLS: When imposing any mandatory controls on DHW recirculation loops, be sure that these are compatible with central combined hydronic systems (where a single hot water loop provides space heat and domestic hot water). Otherwise, exempt central combined hydronic recirculation loops from control requirements.

- RESIDENTIAL MANUAL: Restore 2001 manual format for the 2008 manual. For ease of use, Prescriptive package requirements need to be together and explanations about the Mandatory Measure need to be together.

APPENDIX A

PROPOSAL FOR REGULATING RESIDENTIAL FENESTRATION AREAS

The following proposal was developed as with the goal of reducing the prescriptive fenestration area allowance for larger buildings (single-family as well as multi-family), while at the same time providing a modest increase in allowed fenestration area for very small dwellings. It also becomes a more appropriate method of regulating glazing area in high-rise residential buildings than matching nonresidential area allowances (based strictly on wall area).

Conditioned floor area (CFA) would be determined identically to current rules. The CFA would be used to determine a "Basic Wall Area" (BWA), which is the wall area the building would have if it was a square building with 8 ft. high walls. This BWA wall area is the square root of the Conditioned Floor Area times 4 (for a perimeter) times 8 (for the wall height). The formula then is $\sqrt{C.F.A.}$ x 4 x 8, or $\sqrt{C.F.A.}$ x 32. 10% or 11% of this calculated wall area is a glazing allowance that is added to a second glazing allowance based a percentage of the C.F.A. (as in the current Standards). Below are two possible formulas for the prescriptive fenestration area:

$$(0.13 \text{ x C.F.A.}) + (\sqrt{C.F.A.} \text{ x } 32 \text{ x } 0.11).$$

or

$$(0.14 \text{ x C.F.A.}) + (\sqrt{C.F.A.} \text{ x } 32 \text{ x } 0.10).$$

The following chart compares the prescriptive low-rise residential fenestration areas under the current standards with two possible alternative fenestration allowances (all areas in square feet).

Building Area:	200	500	1,000	2,000	3,000	5,000	10,000	100,000
20% C.F.A.	40	100	200	400	600	1,000	2,000	20,000
13% C.F.A. + $\sqrt{C.F.A.}$ x 3.5	75	143	241	416	581	897	1,650	14,107
14% C.F.A. + $\sqrt{C.F.A.}$ x 3.2	73	141	241	423	595	926	1,720	15,012

The result is that small additions receive a small additional allowed glazing area, the glazing area for average size homes is approximately the same as under the current standards, the glazing area for very large homes is reduced about 10 to 15% compared to the current allowance, and the glazing area for a 100,000 square foot multi-family building is about 15% of the floor area, which is fairly typical for this building type. If the glazing allowance for small additions is deemed too generous, the ability to receive credit for glazing area removed could be eliminated under the prescriptive approach.