CABEC Position on Residential Alterations/Additions and Nonresidential Envelope Alterations Under the 2013 Standards

Low-rise Residential Standards

Fenestration Replacement Rules and Credits in the Performance Approach

The clear and positive message that the Standards sent for more than three decades prior to the 2008 standards was that a homeowner received energy performance credit for any improvements to the envelope of the building. The 2008 standards significantly changed that policy by requiring that replacement windows meet both applicable prescriptive U-factor and SHGC values for the Existing + Alteration + Addition calculation to provide any energy credit from the existing window conditions. In practice, this more stringent procedure has been generally offset by credit for alterations to existing opaque surfaces, HVAC systems, ducts, water heaters and other measures. This is the case in the use of the so-called Vintage Tables and what are in practice relatively lax requirements for documenting existing or previously existing conditions which undergo (or have undergone) alterations claimed on the Certificate of Compliance.

Because the proposed 2013 residential fenestration values are quite aggressive, we believe that maintaining the current performance approach for envelope alterations is not appropriate for several important reasons:

- The current performance rules as applied to the 2013 standards will not reward the installation of many replacement windows which are enormously better than typical existing (e.g., single clear wood or metal) windows, but which are not quite at the 2013 standards fenestration values.

- Homeowners will accurately -- and understandably -- experience the 2013 rules to be unfair and actually punitive if their replacement windows fall somewhat short of the new 2013 prescriptive values as they try to aesthetically match the replacement windows to the existing ones. A homeowner is likely to ask “If we’re installing much better windows than existing, why is this considered a penalty?” As energy consultants, we are hard pressed to defend this particular illogic of the standards.

- Current performance rules for window alterations are punitive as compared with new construction regarding shaded existing windows. In new construction, the Standard Design fenestration assumes no exterior shading. A well-shaded new window with a worse-than-prescriptive SHGC value is compared to the

prescriptive SHGC value with no shading. In this scenario, the new window with shading may do much better in reducing solar gain than the Standard Design window. But under the 2008 Residential ACM existing + alteration rules, the existing window is modeled with the same overhang as the replacement window. If the replacement window has a worse-than-prescriptive SHGC value, it is therefore less able to comply with the performance alterations requirements than if it were new construction. So the current Standards impose an extra burden on replacement windows even beyond meeting the prescriptive requirements.

Fenestration is unique as an energy measure in the standards in that glazing is an integral functional and aesthetic feature of the building. Insulation in opaque surfaces – roofs, exterior walls and floors – is hidden from view. Occupants don't take notice of HVAC equipment or water heaters unless something goes wrong. Windows, glass doors and skylights are integral to the experience of being in a home or other building type. Fenestration replacement has to simultaneously meet other important needs aside from energy efficiency. In addition, fenestration is often only partially replaced under a single permit, and this can create complications in getting replacement windows to be reasonably consistent in their appearance with existing ones that remain.

We strongly advocate that the 2013 standards be more flexible in allowing replacement windows which fall somewhat short of the new requirements for new construction without penalizing these windows. In conjunction with this approach, and to offset the modest energy increase this recommendation may cause, we also propose an overall tightening of the rules by which a permit applicant gets credit for all upgrades to existing buildings, as discussed below.

Note that the 2013 standards will also tighten several measures that will significantly improve energy efficiency in residential alterations:

- New NAECA appliance standards for air conditioners and water heaters;
- Mandatory duct sealing and HERS testing in every climate zone whenever any new HVAC equipment is installed or ducts are extended at least 40';
- More stringent mandatory insulation levels; and
- More stringent cool roof requirements.

Recommendations

(1) To make the performance analysis more fair: separate the U-factor and the SHGC values in how the ACMs evaluate whether to penalize replacement windows or give compliance credit. In other words, evaluate the penalty or credit of the U-factor separate from the penalty or credit of the SHGC. A window with a prescriptively compliant U-factor but a somewhat non-compliant SHGC value should at least get credit for the compliant U-factor.

(2) Use the 2008 standards fenestration values as the threshold value beyond which credit is allowed (with a slight fix in the threshold values for skylights and garden windows). This would mean that fenestration that isn't at least Low-E and NFRC-rated would remain a penalty. Readily available (e.g. Home Depot) windows with U < 0.40 and SHGC < 0.40 would still be acceptable as replacements. "New" fenestration openings in an existing house would still have to exceed the 2013 Standards fenestration values for any credit; but, as in any new construction, exterior shading of new fenestration openings would receive credit.

To be more specific: replacement windows which meet or exceed the 2008 fenestration requirements would be compared to the Standard Design which would model the existing windows. However, there would be new requirements to verify all existing conditions for which alterations receive credit.

(3) Maintain the current ACM rules that give credit to any new insulation which meets the new construction mandatory minimum insulation levels installed in existing opaque surfaces.

Credits for Improving Residential Existing Conditions

Section 8.7.3 of the *2008 Residential Compliance Manual* outline general rules for gaining credit in upgrading various components of an existing residential building. Current practice is that permit applicants claim all sorts of alteration credits relative to existing conditions that are virtually never confirmed by the building department.

There should definitely be energy credit for making efficiency upgrades. However, the *Residential Compliance Manual* language is confusing, not well understood, and not enforced by building departments. Under the current standards, energy upgrade credit can be “earned” by improving on Vintage Table conditions which may be less efficient than actual conditions. And upgrade credit is sometimes claimed for improvements made many years previous to the current permit – when establishing the previous condition is difficult to impossible to confirm. Therefore, Vintage Table values are used

to establish previous conditions, right or wrong. We believe there is an opportunity to tighten up the standards and the compliance manual on this, including highlighting sanctioned upgrade credits in the ACM programs and compliance forms, and educating building departments to enforce these new requirements.

Recommendations

In exchange for some flexibility on the replacement fenestration values necessary to receive an efficiency credit, and continue allowing current insulation improvements to receive a credit, we suggest that the Vintage Table values be used only where no credit is to be taken for an improvement (i.e. to establish neutral efficiency values within ACM calculations). Or perhaps instead of a Vintage Table, the ACM rules may simply dictate that any features modeled as existing will be matched for the proposed condition, unless the energy analyst flags an upgrade, which will always be a special condition.

Where an efficiency improvement credit is proposed, the building owner would be required to document the existing condition – fenestration, insulation, water heater efficiency, and so on. A new performance form would be created to document existing conditions where credit for an efficiency upgrade is desired. This new form would require the building owner's signature and perhaps the attachment of dated photos under specified conditions. Where credit is proposed for previous work, for example, dated photos of the current measures and of conditions prior to the current improvements might be required. ACM programs would be required to note all custom efficiency conditions on the CF-1R form, as well as include the special existing conditions form in the compliance report.

Furthermore, credit should not be given to previous efficiency improvements unless they meet all the following criteria:

1. Previous work done with a building permit.
2. Work completed not more than three years from new permit application date.
3. Previous work has not been used as a Title 24 efficiency credit for previous alterations or additions.

The 2013 compliance forms would be designed to highlight for the permit applicant, the plan checker and field inspector that *"Energy compliance of the proposed alterations is based on the verification of all existing conditions claimed by the permit applicant; and/or that previous energy improvements claimed in this report have been made no more than three years prior to the permit submittal date."*

The idea is to allow building department to press permit applicants about proving the existing conditions for any efficiency improvement for which credit is claimed. And the threat of that is likely to make permit applicants and energy consultants more cautious about claiming all sorts of upgrade credits that now go unchecked.

Note that these proposed procedures can be a first step toward a future set of standards (e.g., 2017 or 2020) in which, potentially, credit for energy efficiency upgrades – and the verification of pre- and post-alteration conditions – might be granted only through the on-site inspection of a HERS rater.

Miscellaneous Residential Issues

- SKYLIGHTS: For additions and alterations, the skylight U should be 0.6 or 0.58, not 0.4. There are very few skylights available with U's lower than 0.5. There is no reason to force a simple addition or alteration to meet *performance* compliance instead of *prescriptive* compliance for such a minor efficiency difference.
- COOL ROOFS: Additions up to 300 or 400 square feet conditioned floor area ought to be exempt from Cool Roof requirements. Small additions are often added to homes that do not need new roofing, and it is reasonable that the homeowner would like the addition roofing to match the existing roofing.
- BAY WINDOWS: Bay windows often cannot meet *prescriptive* insulation and radiant barrier requirements. Under *prescriptive* compliance, exempt bay windows from the radiant barrier requirement, and allow bay windows to meet only the mandatory minimum insulation requirements.
- VINTAGE TABLE ASSEMBLIES: Add existing masonry walls. Currently, modeling existing masonry to remain always yields a performance CF-1R that notes this as an exceptional feature.
- ADDITIONAL WATER HEATERS WHERE THERE IS NO ADDITION: For additions, the prescriptive standards limit water heating system changes to one additional "standard" system. However, the standards for building alterations that do not include an addition allow any number and any size water heaters to be added. Perhaps alterations should have the same prescriptive limit of one additional "standard" system, as additions are now subject to. Or perhaps when there is no building addition, or a very small one, adding an additional water heater should be stricter than the prescriptive requirements for additions. In that case, an addition size threshold should be established, below which the water heater requirements would be the same as for alterations that do not include an addition.

Nonresidential Standards

Current Nonresidential Standards Envelope Alterations

NONRESIDENTIAL FENESTRATION: COMPLIANCE PATHS. Under current standards, there are two trade-off methods of showing compliance with Envelope Alterations, and these yield radically different results. Section 149(b)1.A.ii. says that the Nonresidential Overall TDV Energy of the building envelope shall not increase as a result of an alteration. The Nonresidential ACM Manual says that replacement and new fenestration must meet both prescriptive U-factor and SHGC values based on WWR and Climate Zone to take any credit (and not be penalized). In the former case, one can now replace single clear metal frame windows with the same type and not increase the Overall TDV Energy of the building envelope. Using this approach, single clear metal frame windows will comply if replacing the same type. In the performance approach, replacement windows that fall short of either prescriptive U-factor or SHGC value will not comply -- and they are penalized in the Existing + Alteration performance calculation. So there is an enormous discontinuity between these two 2008 standards compliance paths; and to a large extent, the Overall TDV Energy method has allowed permit applicants to do almost nothing toward high-performance fenestration.

Recommendations

To substantially improve the specification of replacement fenestration over current practice, we propose a new prescriptive path for replacement vertical glazing that would line up with a 2013 Nonresidential ACM performance version of the same requirement.

(1) We propose the following Prescriptive requirements for vertical replacement fenestration only:

U-factor: 0.57 or less
[i.e., a thermally broken metal frame, or an overall U-factor when COG U=0.29]

VT: Same as for new construction

SHGC: For CZs 1, 3, 4, 5, 16: Center-of-Glass SHGC = 0.38 or less
For CZs 6, 7, 8, 9: Center-of-Glass SHGC = 0.31
For CZs 2, 10, 11, 12, 13, 14, 15: Center-of-Glass SHGC = 0.27

[Note: Some real analysis can be done to better calibrate the above values and CZs using a currently available beta version of Energy Pro which is running the 2013 TDV energy multipliers and 2013 weather files.]

(2) The 2013 Nonresidential ACM performance rules then track the same requirements. Replacement fenestration that does not meet or exceed the above values is compared to the 2013 new construction fenestration values. Replacement fenestration that meets or exceeds the above values is compared to the existing fenestration values. "New" fenestration openings in an existing building still have to exceed the 2013 Standards fenestration values for any credit; but, as in any new construction, exterior shading of new fenestration openings will receive credit.

(3) The 2008 Overall TDV Energy calculation will not be updated for the 2013 standards, but the 2005 Overall Heat Gain and Heat Loss calculations may be successfully resurrected and modified for use with the 2013 standards. We recommend the prescriptive envelope trade-off method not be allowed for new construction or alterations with fenestration; and perhaps be allowed only with roofs to trade roof insulation vs. cool roof. Then Table 143-A and 143-B would read “SHGC” not “RSHG”.

(4) MINOR FENESTRATION ADDITIONS. Allow new glass doors to be added to a building without necessitating calculations, the code should allow the addition of up to 50 sq. ft. of single-pane clear glass doors, with the requirement of a fixed structural exterior shade of a minimum depth and maximum height above the doors.

NONRESIDENTIAL FENESTRATION: RETAINING CENTER-OF-GLASS ALGORITHM. Extremely aggressive 2013 fenestration values for U-factor and SHGC will significantly limit the use of Center-of-Glass (COG) algorithms for new site-built fenestration. The COG algorithms generate conservative overall U-factor and SHGC values for fenestration based COG values. The fenestration installed with those values is still required to have labels. There has been some discussion about eliminating the COG algorithms entirely to force the industry to use CMAST calculated values. Given the fact that the industry will not begin to use CMAST consistently until the new standards take effect, and many other practical considerations associated with implementation of a much more stringent code, we strongly recommend leaving the COG algorithm option in the 2013 standards for U-factor and SHGC.

Recommendation

Retain the 2008 Center-of-Glass U-factor and SHGC calculations for site-built fenestration in the 2013 Standards.

CONCLUSIONS. As the 2013 Prescriptive Standards for fenestration approach the limit of what is realistically achievable, it's important that requirements for Envelope Alterations address the fact that replacement fenestration has constraints that new glazing sometimes does not. Structural, fire safety, security and aesthetic considerations are often more difficult to resolve in retrofits. Furthermore, 2008 performance rules additionally penalize replacement fenestration by not fully crediting the presence of existing exterior shading as with new construction.

The Commission should encourage building owners to replace windows as an energy efficiency measure while respecting some additional constraints that these alterations impose. Rather than focus too heavily on what energy savings are being "left on the table", CEC Staff should rather consider current practice and how to substantially improve the efficiency of envelope alterations as compared with the 2008 standards. Rigid and/or "hard line" compliance rules will not work in the best interest of communicating the right message of energy efficiency and not enhance the credibility of the standards.

The CABEC Standards Committee would like to work with Commission staff in discussing and working through these and related issues, and any further ideas for standards language, compliance manual language and ACM rules that address the core concerns outlined here.

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