DOCKETED	
Docket Number:	19-BSTD-03
Project Title:	2022 Energy Code Pre-Rulemaking
TN #:	235492
Document Title:	Nonresidential High Performance Envelope Roof Alterations and Roof (New Construction) R-Values
Description:	Nonresidential High Performance Envelope: Roof Alterations and Roof (New Construction) R-Values, 2022 Building Energy Efficiency Standards (Title 24, Part 6), Docket No. 19-BSTD-03
Filer:	Cody Goldthrite
Organization:	Polyisocyanurate Insulation Manufacturers Association
Submitter Role:	Public
Submission Date:	11/3/2020 10:29:14 AM
Docketed Date:	11/3/2020

PIMA
POLYISOCYANURATE INSULATION MANUFACTURERS ASSOCIATION

3330 Washington Blvd. / Suite 200 / Arlington, VA 22201 / p: 703.258.0093 / www.polyiso.org

Sent via Electronic Mail

November 3, 2020

California Energy Commission
Docket Unit, MS-4
Docket No. 19-BSTD-03
1516 Ninth Street
Sacramento, CA 95814-5512
docket@energy.ca.gov

Re: Nonresidential High Performance Envelope: Roof Alterations and Roof (New Construction) R-Values, 2022 Building Energy Efficiency Standards (Title 24, Part 6), Docket No. 19-BSTD-03

Dear Energy Commission,

Thank you for the opportunity to comment on the proposed changes to California's Building Energy Efficiency Standards (Title 24, Part 6) presented in the Statewide CASE Team's October 2020 final report: Nonresidential High Performance Envelope. Our comments below, submitted on behalf of the Polyisocyanurate Insulation Manufacturers Association,[1] focus on the proposals related to nonresidential roof alterations and thermal requirements for new roofs.

I. Background

Application of energy codes to building alterations and renovations is an important policy that has been in place nationally under the model codes since 2000. The intent of this policy is to leverage the natural cycle of building upgrades and component replacements in order to improve energy efficiency in existing buildings. The most cost-effective time to improve a building's energy performance is when it is renovated or when components and systems are replaced. This process is particularly important for envelope improvements, which reduce building HVAC loads and create the potential for even greater improvement in equipment efficiencies in the future. Additionally, energy-efficiency upgrades to the envelope increase an existing building's ability to achieve net-zero energy status more cost-effectively by reducing the amount of renewable energy required to offset energy use.

The CASE Team's recommendations regarding the insulation standards for roof alterations will have a much greater impact on California's energy and climate goals than the roof standards for new construction because 75% of the low-slope roof market is for re-roofing (i.e., 3 out of every 4 roofs installed each year is

[1] More information available at: www.polyiso.org.

installed on an existing building). The facts below illustrate why roof replacements are an excellent example of the energy-efficiency opportunities in existing buildings.[2]

- More than 2.5 billion square feet of commercial, low-slope roofs are replaced or re-covered each year on existing buildings nationally.
- Replacing a roof on a typical existing building with a roof system that complies with either the 2015 or 2018 International Energy Conservation Code (IECC) has the following nationwide benefits:
    - Reduces whole building energy use by an average of 5.7%;
    - Saves $12 billion over ten years (assuming the current rate of reroofing activity); and
    - Reduces CO_2 emissions by more than 100 million metric tons over ten years.
        - This reduction in CO_2 emissions is equal to the annual emissions of 24.8 coal-fired power plants or 21.4 million cars.

Beginning in 2020, the national model energy codes adopted minimum "upgrade" requirements for building alterations, including roof replacements; however, California did not adopt similar requirements until the implementation of the State's 2008 Building Energy Efficiency Standards (Title 24, Part 6) (effective January 1, 2010). Not only was California late in adopting requirements for roof alterations, there are several aspects of the State's current Building Energy Efficiency Standards (i.e., the 2019 version of Title 24, Part 6) that prevent widespread improvement of existing roof thermal performance, which are in need of reform.

- California's requirements for roof alterations are relatively weak when compared to the national model code (ASHRAE 90.1 and IECC) and compared to California's current requirements for new construction. The California Building Energy Efficiency Standards requires U-0.055 to U-0.082 for roof replacements vs. 0.034 to 0.049 for new construction. ASHRAE 90.1 and IECC require U-0.032 to U-0.039 in similar climate zones for both new construction and roof alterations.

- Although the U-factors for new construction were improved by 13% to 33% during California's 2016 Code development cycle, the requirements for roof alterations have not been updated since the adoption of the 2008 Building Energy Efficiency Standards (Title 24, Part 6).

- California's requirements for roof alterations have a number of unnecessarily broad exceptions that have prevented any real improvement in roof thermal performance. These include exceptions for: (1) roofs that already have R-7 (effectively establishing R-7 as the ceiling for performance); (2) roofs where the equipment is not otherwise going to be moved/lifted and the flashing heights (in combination with the equipment) do not permit the addition of insulation; and (3) roofs where the cladding on parapet and penthouse walls has to be altered in order to accommodate proper flashing heights. Addressing these exceptions is critical. <u>It is of little value to strengthen the U-factors/R-values while allowing such broad exceptions that result in few actual roof improvements</u>.

In summary, the measures recommended by the CASE Team for strengthening the reroofing requirements are important for meeting California's climate goals and these changes are well overdue. Many

[2] Jerry Phelan, George Pavlovich, and Eric Ma, <u>Energy and Environmental Impact Reduction Opportunities for Existing Buildings with Low-Slope Roofs</u>, Bayer Materials Science, April 2009. https://cdn.ymaws.com/www.polyiso.org/resource/resmgr/report/bayer_report.pdf.

of the CASE Team proposals have already been implemented without major issues in most every jurisdiction outside of California. PIMA strongly supports all of the CASE Team's proposals, including:

- Updating the U-factors/R-values;
- Modifying and/or limiting the exceptions;
- Improving enforcement/compliance;
- Adding a new requirement for roof recovers; and
- The R-10 backstop for reroofing projects.

PIMA notes that between the draft and final recommendations, the CASE Team lowered the R-value requirements for roof replacements to address concerns expressed by California roofing contractors. Viewed holistically with other recommendations, this reduction in cost-effective R-values could be offset if the Energy Commission implements the CASE Team's recommendations for improved enforcement and compliance, which PIMA strongly supports. Also, as described in more detail below, the CASE Team used very conservative assumptions in its cost-effectiveness analysis, so the actual costs of the roof alteration measures will likely be lower and the actual energy-saving benefits higher than what is reflected in the estimates. All of these considerations reinforce the reasonableness of the CASE Team's recommended measures.

II. Roof Replacement R-Values

One of the more significant changes between the CASE Team's draft and final recommendations is the lowering of the R-value requirements for roof replacements (*see* table below). Although the CASE Team determined that meeting the higher R-values proposed in the draft report would be cost-effective and are required in the rest of the country, they explained that this change would represent a significant jump for the California market and pointed to a number of uncertainties highlighted by California contractors that could not be accurately evaluated with energy modeling and cost-effectiveness tools. While PIMA would prefer to see California's minimum requirements mirror the rest of the country with respect to these standards, we believe the CASE Team's final recommendation is still a significant change in the right direction. We also believe that incremental improvements combined with the CASE Team's recommendations for improved enforcement discussed below could offset these lower standards and represent a fair balance.

CASE Team Recommendations for Roof Replacement R-Values

Climate Zones	Current T24 Stnds.	Draft Report	Final Report
6-8	R-8	R-20	R-17
1-5, 9-16	R-14	R-29	R-23

III. Roof Recover R-Values (R-10ci)

The CASE Team's recommendation that at least R-10 of continuous insulation be added during a roof recover (or achieve the R-17/23 minimum, whichever is less) is an effective and achievable policy for accelerating the needed improvement in envelope efficiency across a larger universe of buildings. The option to recover an existing roof is an attractive and comparatively less expensive option to a full roof replacement in part because recovers do not currently have any requirements under the California's Building Energy Efficiency Standards (Title 24, Part 6) or under the national model energy codes. This proposal would help create parity between the two reroofing options (i.e., recover vs. replacement) and ensure both reroofing practices contribute toward improved energy efficiency.

While a new requirement, the practice of adding insulation during a recover is common and is an accepted industry practice. Outside of the issues that are already addressed by the proposed exceptions (i.e., lifting mechanical equipment), PIMA members are not aware of any technical reasons that would prevent the addition of R-10 continuous insulation (or more) during a roof recover. In fact, information from the RoofNav database of Factory Mutual (FM) approved roof assemblies demonstrates that there are many combinations of roof coverings, insulation, and methods of attachment that are available to meet the proposed R-10 roof recover requirement and comply with all of the other California Building Code requirements. The large number of available roof recover assemblies strongly supports the conclusion that the CASE Team recover proposal is reasonable and consistent with current reroofing practices.

Based on our search results (conducted 10/29/20) there are **60,739 different FM Approved roof assemblies**, including both Class 1 rated assemblies and assemblies with noncombustible decks, listed in the RoofNav database that permit at least 4 inches (equal to at least R-22.8 of polyiso insulation) of polyiso or polyurethane insulation in a recover application (and that meet the necessary wind uplift, hail, external fire ratings, and internal fire ratings). The same search of recover systems without the addition of insulation found 165,182 assemblies. Therefore, 37 percent of the available recover assemblies already in the database would easily qualify under the CASE Team's proposed R-10 continuous insulation roof recover requirement. Also, roof component manufacturers are likely to seek additional FM approvals for more recover systems with added insulation if this requirement is adopted.

IV. Enforcement

PIMA strongly agrees that enforcement of the requirements for roof alterations needs to be improved in order to create a level playing field for the marketplace. The current compliance mechanism relies on a contractor properly filling out and submitting Form NRCC-ENV-E, which covers all of the envelope requirements for new construction, additions, and alterations. The form is difficult to understand and use, which may contribute to its ineffectiveness and the noncompliance. Also, we understand that there are no plan reviews and/or inspections related to roof alterations. As a result, there is no verification of the roof R-values or of the exceptions that are being claimed to avoid the R-value requirements.

The CASE Team's recommendation for a new requirement that would verify the amount and condition of insulation below the deck is essential for an accurate accounting of the roof assembly's total U-factor/R-value. It is very common for the insulation installed below-deck decades ago to be compromised in a way that reduces its effectiveness (i.e., removed during other renovations, water damage, air gaps from settling), so if a building owner wishes to take credit for that insulation it should be verified. Furthermore, given reasonable conclusions associated with the deterioration of decades old below-deck insulation, the inability to verify its presence or condition should not be used as an excuse to avoid compliance with the proposed requirements for adding above-deck continuous insulation.

A final inspection, either by a building official or 3rd party, to verify that the proper amount of insulation has been installed, is also important. If the Energy Commission determines that this is too expensive or difficult to accomplish, we would urge serious consideration of the option for remote video building inspections using mobile digital or video technology, which has become much more common recently. However, if this option is used, we would suggest that it be supplemented with some type of "sampling," were the building department has contracted with a 3rd party ahead of time (perhaps an annual contract between a 3rd party and a group of jurisdictions) to conduct site visits for 10% of the roof replacement projects in a particular jurisdiction. This would keep costs down (which could be covered by permit fees) and the possibility of a site visit will encourage better compliance.

California has plenty of professionals that could qualify as 3rd party inspectors. In addition to HERs raters, which already operate in this capacity, there are numerous professional organizations with a focus on commercial buildings that would also qualify, including the Certified Commercial Property Inspectors Association (CCPIA) and the International Institute of Building Enclosure Consultants (IIBEC) Registered Professional program (which includes the categories: Registered Roof Consultant and Registered Roof Observer).

V. Roof Insulation Backstop

A common description of building energy codes is that they represent, not the highest level of achievable performance, but the "lowest common denominator" or the "minimum" of what should be legal for typical construction. A "backstop" serves as a "minimum-to-the-minimum" and is intended for situations where the minimum code requirements can be avoided or traded-off to the detriment of long-term energy-efficiency. The CASE Team's proposed backstop of requiring installation of R-10 continuous insulation or a level required to meet R-17 or R-23 standard, whichever is less, is well justified. California's weak reroofing standards, overly-broad exceptions and poor compliance/enforcement have created an environment of extremely low expectations in this area. This simple and clear backstop (along with the other requirements) will help to combat noncompliance and excessive use of the exceptions.

VI. Above-Deck Insulation

PIMA supports the proposal for there to be an amount of insulation installed, or an existing amount verified to be present, above the roof deck equal to or greater than R-10 continuous insulation. As pointed out in the CASE Team's final report, there is ample evidence that the addition of above-deck roof insulation will help mitigate condensation issues that can occur in existing buildings where original roof membranes are replaced with reflective (i.e., "cool") roofs. The wood-deck, single-rafter roof assemblies common in California that contain below deck insulation that has been damaged or displaced over time are particularly prone to condensation problems. Similarly, other assembly types, such as steel decks, are adversely affected by condensation as well. Condensation present in the roof assembly affects not only the structural safety of the assembly (e.g., rust, rot), but it also impacts energy use by weakening the thermal value of the insulation that was installed below the deck and that comes into contact with the condensation. Adding continuous insulation above the roof deck when work is already underway to replace (or recover) the roof system is very cost effective and will help preserve the roof's thermal performance for a longer time period.

VII. Reroofing Definitions

The CASE Team's final proposal would add new definitions to California's Building Energy Efficiency Standards (Title 24, Part 6) for "roof replacement" and "roof recovers" that align with the definitions and requirements under section 1511.3 of the California Building Code. This coordination between the codes is important to add clarity to the code requirements and eliminate ambiguities, which can contribute to easier enforcement and better compliance. A similar alignment of definitions was accomplished at the model code level between the IECC and IBC during recent development cycles. Importantly, the proposed definitions for replacements and recovers will help to discourage the poor roofing practices of "partial tear-offs" or "partial replacements" where the top membrane is peeled off and replaced, but the older, second membrane (or other aged components) is left in place. This poor roofing practice is already not permitted under the California Building Code so the clarification in the definitions should help eliminate the potential for "partial replacements" to be used as a way to avoid compliance with increased insulation requirements for roof

replacements. This proposed change is aligned with the guidance that is already in the Nonresidential Compliance Manual (see page 3-76).

VIII. References to 8 Inch Base Flashing Height

Although minimum flashing heights of 8 inches are referenced in industry guidance and installation instructions as general rules, flashings of lesser heights are often permitted and installed. A casual survey of existing roofs will reveal many constructed with less than 8-inch flashing heights, especially along the perimeter of roofs. Additionally, the 8-inch minimum originates from installation instructions for more traditional roof system types (e.g., asphalt) and has been handed down year-over-year as a rule of thumb (not a minimum performance requirement). However, new roof covering technologies, installation practices and other system components (e.g., PMMA flashing systems) allow for greater flexibility when installing new roofs on existing buildings. California's Building Energy Efficiency Standards (Title 24, Part 6) is the only building code document or referenced standard that we are aware of that specifically references a minimum flashing height. Codes in every other jurisdiction simply direct the code user to comply with manufacturer's installation instructions.

The Nonresidential Compliance Manual (*see* pages 3-77 and 3-78) already provides helpful guidance on this point, but the current Building Energy Efficiency Standards (Title 24, Part 6) seems to conflict with this guidance by characterizing the 8-inch flashing height as a hard-and-fast rule. Conversely, the changes proposed by the CASE Team that instead reference Chapter 15 of the Building Code (Roof Assemblies) will allow additional flexibility in specific instances while ensuring code compliant roofs. Referencing Chapter 15 would be consistent with other requirements in the code. Chapter 15 of the Building Code has a number of requirements that have to be followed during a roof alteration in addition to how flashings are installed, including requirements for fire, wind uplift, compression strength, and the manufacturer's installation instructions. Chapter 15 should be familiar to all roofing contractors and building officials. Also, the Compliance Manual explanation of this issue could be updated if additional guidance is needed by stakeholders.

IX. Conservative Assumptions Used for Energy Modeling and Cost-Benefit Analysis

It should be noted that the assumptions used by the CASE Team for its energy modeling and cost-benefit analysis may be overly conservative in at least three areas:

- Evidence and the historical evolution of California's Building Energy Efficiency Standards (i.e., weak standards for roofs) suggests that there are greater numbers of under-insulated roofs in California than are accounted for in the CASE Team's analysis;

- Use of 2019 prototype buildings in the energy modeling underestimates the energy savings that would be expected from the proposed roof alteration measures (i.e., other, non-roof assumptions for new construction overestimate the energy-efficiency performance of existing buildings and discount the impacts of upgrades); and

- A recent change in federal tax law significantly lowers the cost of roof replacements for the majority of building owners in California.

For these reasons and as explained in more detail below, we believe that the CASE Team's cost-effectiveness estimates are, in certain instances, overly conservative. The actual costs of the roof alteration

measures will likely be lower and the actual energy-savings benefits higher than what is reflected in the estimates. Although we understand it may have been difficult to use less conservative assumptions, we believe this information reinforces the reasonableness of the roof alteration proposals recommended by the CASE Team.

a. R-Value Assumptions

The baseline R-value assumptions used by the CASE Team for assessing cost-effectiveness underestimates the effects of the State's historic and relatively weak requirements in this area and, therefore, does not account for the large number of roofs that may still be severely under-insulated. For all the reasons below, we believe that buildings with R-5 or even no insulation could still be common in California's warmer climate zones.

- The insulation requirements under California's first Building Energy Efficiency Standards, implemented in 1978, were in the range of R-8 for the majority of the state.[3]

- Nationally, approximately 44% of the current building stock was constructed prior to this time period and would not have been regulated by the State's first Building Energy Efficiency Standards.[4]

- According to the most recent Northwest Energy Efficiency Alliance's (NEEA) Commercial Building Stock Assessment of buildings in the Pacific Northwest states (Idaho, Montana, Oregon, and Washington), the number of commercial buildings with low-slope roofs and without any roof insulation represents 13% of conditioned floor space.[5] Therefore, the percentage of conditioned floor space without roof insulation in California, which has a significantly milder climate than the Pacific Northwest, is likely to be higher than 13%.

- The current requirements for roof alterations under the State's Building Energy Efficiency Standards (Title 24, Part 6), which have only been in place for 10 years, have likely affected only a small portion of these older, under-insulated buildings.

b. Use of New Buildings for Modeling Improvements in Existing Buildings

For the building energy modeling simulations conducted to evaluate the energy impacts of the roof alteration measures, the CASE Team used 2019 prototype buildings with modified roof insulation. However, the proposed measures apply to older, less energy-efficient buildings where an improvement in roof thermal performance would have a larger impact on whole-building energy use. As an example of a different approach, the Pacific Northwest National Laboratory (PNNL) used the U.S. DOE's pre-1980 vintage Commercial Reference Buildings for the modeling used in developing U.S. DOE's Advanced Energy Retrofit Guides (AERG) series (see: https://www.energy.gov/eere/buildings/advanced-energy-retrofit-guides).

---

[3] California Energy Commission, Conservation Division, Regulations Establishing Energy Conservation Standards for New Residential and New Nonresidential Buildings, As Amended July 26, 1978.

[4] DOE, Commercial Building Energy Consumption Survey (CBECS), 2012, Table B9, https://www.eia.gov/consumption/commercial/data/2012/bc/cfm/b9.php

[5] Northwest Energy Efficiency Alliance's (NEEA), Commercial Building Stock Assessment, May 2020. https://neea.org/data/commercial-building-stock-assessments.

c. Federal Tax Treatment of Roof Improvements and Impact on Benefit-to-Cost Ratio

The Tax Cut and Jobs Act (TCJA) (P.L. 115-97), enacted in 2017, made important changes to federal business tax law that significantly lowers the upfront costs of commercial building roof replacements for qualifying businesses, including the costs associated with improving the roof's thermal performance. The TCJA expanded the definition of "qualified real property" under the small business expensing provisions of Internal Revenue Code section 179 to include improvements to existing nonresidential building roofs.

For example, in 2020, Section 179 allows businesses to fully expense (deduct) up to $1,040,000 (indexed for inflation) in one year for qualified business expenses, such as equipment purchases and specific building improvements. This amount was raised from $500,000 by the TCJA and is now indexed, so it will keep pace with inflation. With this change, small businesses are now able to deduct – in the year completed – the full cost of replacing a roof on an existing non-residential building instead of depreciating that cost over a 39-year period, as was required under prior law. As a mechanism intended to limit the deduction to small businesses, the benefit is phased out for businesses that spend more than $2,590,000 million on qualified equipment and qualified real property (this was increased from $2 million under the TCJA and also indexed for inflation). Unlike some provisions of the TCJA, these changes are permanent.

This change reduces the upfront cost of a roof replacement along with the additional insulation in the first year by 25 to 30 percent, depending on a taxpayer's marginal tax rate. Also, because the net benefit from section 179 expensing depends on the length of a qualified asset's recovery period, there is an incentive for businesses to use section 179 expensing for long-lived qualified building improvements (such as roofs and HVAC equipment) instead of assets or equipment with shorter depreciation periods.

The frequency of use of section 179 expensing is very high. The U.S. Treasury quantified the universe of tax filers that typically use section 179 expensing in a 2016 analysis. Out of a potential population of 49.6 million business filers (i.e., C corps, S corps, partnerships, as well as farm and nonfarm sole proprietorships) in 2014, a total 5.9 million filers used section 179 expensing (about 12%) for a total of $86.9 billion in deductions.[6] The changes under the TCJA have likely increased the usage of section 179 expensing.

Although we agree with the CASE Team's conclusion that it may be difficult to apply the favorable tax treatment of roof replacements to their cost-effectiveness analysis, we believe the positive impacts on affordability should not be ignored. Although section 179 expensing is not available to every business, a large majority of businesses in California with roof replacement expenses will likely take advantage of these changes in the future.

X. Proposed Increase in Roof U-factors for New Construction

The CASE Team's final report contains a proposal for improving the opaque envelope requirements for new construction. This proposal includes more stringent U-factors for walls (metal-framed) and roofs/ceilings (wood framed and other). However, during the Energy Commission's October 20th Workshop, the Commission staff said that the part of this measure related to roofs would be dropped because it was not

[6] Department of Treasury, Office of Tax Analysis, Business Use of Section 179 Expensing and Bonus Depreciation, 2002-2014, Working Paper 110, October 2016, John Kitchen and Matthew Knittel. See Table 8 on page 25. https://home.treasury.gov/policy-issues/tax-policy/office-of-tax-analysis-working-papers-and-technical-papers

cost effective on its own. PIMA urges the Energy Commission to reconsider this decision. According to the CASE Team's final report, the wall and roof proposals together are clearly cost effective and have relatively high energy savings.

- Construction-weighted benefit-to-cost ratio is 1.37 (see Table 2, page 27).

- First-year energy savings for the opaque envelope measure is larger than the savings from the cool roofs and high performance windows measures combined (see Table 4, page 29).

The Energy Commission should exercise some flexibility and consider factors such as a measure's relative impact on the Commission's goals and its contribution to overall cost effectiveness when combined with other discrete measures. We believe this flexibility is permitted under section 25402 of the California Public Resources Code (also known as the Warren-Alquist Act), which directs the Energy Commission to develop and maintain a building energy code that is cost-effective "when taken in their entirety".

Information about the Polyisocyanurate Insulation Manufacturers Association

PIMA is the trade association for North American manufacturers of rigid polyiso foam insulation – a product that is used in most low-slope commercial roofs as well as in commercial and residential walls. Polyiso insulation products and the raw materials used to manufacture polyiso are produced in over 50 manufacturing facilities across North American.

Thank you for the opportunity to submit these comments.

Sincerely,

Justin Koscher
President