*2016 Title 24 Code Change Advocacy*

# Request for Input:

## High Performance Walls Requirements for Residential Buildings

2016 Title 24 Code Change Advocacy April 2014

## Email Introduction

The California Investor Owned Utilities (IOUs) are actively supporting the California Energy Commission in updating the California Building Energy Efficiency Standards (Title 24). Their joint intent is to achieve significant energy savings through the development of reasonable, responsible, and cost-effective code change proposals for the 2016 code update and beyond. Through Codes and Standards Enhancement (CASE) Reports, the IOUs will provide the Energy Commission with the technical and cost-effectiveness information required to make informed judgments on proposed standards for promising energy efficiency design practices and technologies. This Request for Input provides an opportunity for stakeholders to help inform the development of these codes change proposals. The IOUs encourage participation in this step of the process through the submission of data— both primary sources and references to existing data, e.g., reports, spreadsheets, etc. Further opportunities to provide feedback regarding these code change proposals will follow this Request for Input.

**How to submit responses:**

Please submit responses to the questions presented below by Friday, May 2, 2014 to: info@title24stakeholders.com.

## Summary of Potential Code Change Proposal

The Residential High Performance Walls measure is intended to increase the performance of the residential envelope, reducing the amount of heat transfer through walls and thus reduce HVAC loads. The CASE Team is investigating two changes to the Standards: mandatory Quality Insulation Installation (QII) for fiberglass batt insulation; and improved prescriptive wall insulation requirements.

### *QII Mandatory for Batt Insulation*

The IOU C&S team intends to add mandatory requirements for QII when fiberglass batt insulation is installed, which will require verification by a HERS rater or Building Performance Institute (BPI) Building Analyst to ensure proper insulation installation within the entire thermal envelope. Currently, a compliance credit is awarded for installations that verify QII. This proposal would require QII for batt insulation, while still allowing a compliance credit for QII with other types of insulation. Field surveys have found that the most commonly used wall insulation in California are fiberglass batts. Requiring QII for batt insulation would ensure that the majority of insulation installations are properly implemented, increasing the effective U-factor of these wall assemblies.

This measure would modify the mandatory requirements, remove the current compliance credit for QII with batt insulation, and revise the corresponding standard energy budget in the prototype model. The measure would also update Joint and Residential Appendices language, and compliance forms, as related to QII requirements. This measure modifies existing code language, but does not modify the scope of the Standards.

Advantages

- Allows the insulation to more closely approach its rated value
- Minimizes gaps in the insulated shell
- Increases quality assurance for the builder and customer

Barriers

- Will require training and experience for installers to become proficient
- HERS verification required
- More time needed to install insulation (possible increased labor cost)

***Wall Assembly Strategies***

This measure also lowers the prescriptive whole wall insulation U-factor requirements for wood framed walls in residential and low-rise multifamily buildings. The CASE team is investigating the feasibility of lowering U-factor requirements while considering the variety of framing and cavity insulation strategies available to reach lower U-factors. These strategies include:

A. 2x6 -inch studs
    i. At 16" on center (OC)
    ii. At 24" OC
B. Advanced Framing techniques
C. Structurally Insulated Panels (SIPs)
D. Staggered studs
E. Double walls

These wall designs allow for greater R-values for cavity insulation, quality installation that fills all gaps and does not compress insulation, and, in some cases, reduced thermal bridging. Currently, these types of framing techniques are compliance options in the performance approach for the 2013 Title 24 Standards. The use of batt, blown-in, spray foam, flash-and-batt, and continuous (rigid) insulation with these wall types were assessed. This measure affects the prescriptive requirements and related modeling algorithms for standard walls. This measure modifies existing code language, but does not modify the scope of the Standards.

Details of the wall assembly strategies are provided below.

# Questions for Interested Parties

The CASE Team is requesting responses to the specific questions listed below regarding High Performance Walls in California. Answers to these questions will inform the cost-effectiveness analysis, energy savings estimates, environmental impacts, and market impacts that will be presented in CASE Reports.

1. Are there additional benefits beyond those listed for:
    a. 2x6" studs at 16" OC and 24" OC?
    b. Advanced Framing (including 2-stud corners, stacked framing to eliminate single top plates, and/or window and door planning to eliminate additional structural pieces)?
    c. Staggered Studs?
    d. Double Walls?
    e. SIPs?
2. Are there additional challenges or barriers beyond those identified for:
    a. 2x6" studs at 16" OC and 24" OC?
    b. Advanced Framing (including 2-stud corners, stacked framing to eliminate double top plates, and/or window and door planning to eliminate additional structural pieces)?
    c. Staggered Studs?
    d. Double Walls?
    e. SIPs?
3. Of these strategies, which is preferred by builders? Which is the least preferred? Why?
4. For each of these strategies, what would encourage builders to implement them?
5. Does the impact on usable conditioned floor space affect the utilization of any of these approaches? If so, which ones and how much does it affect the use of the approach? How much floor space as a percent of the total is lost? (Our calculations show that, for a house with 160 feet of exterior wall, removing 2 inches of floor space along the perimeter of the wall is approximately 27 $ft^2$ or ~2%).
6. How often are insulated headers used in typical construction?
7. A 2x6 wall allows for rigid insulation to be applied to a 4x12 header, would you do this and how much would it cost?
8. Which counties in California do you primarily work and in what role?
9. What thickness/R-value of exterior rigid insulation is commonly used in your geographic region?
    a. If rigid insulation is not used, what are the barriers to its use?
    b. If 1-inch or less, what are the barriers to using more than 1-inch? Please explain.
    c. If more than 1-inch, how often and why is this insulation technique used?
    d. If used what type or brand name is used?
10. What exterior wall material is commonly used in your region?
    a. 3 Coat Stucco?

b. Single coat stucco as part of an Exterior Insulating Finishing System (EIFS)?
c. Wood siding?
d. Manufactured wood/cellulose hard board product?
e. Plywood?

11. Do seismic zone requirements in California pose problems for any of the advanced framing techniques (i.e. single top plate, elimination of some support materials for non-load bearing walls, etc.)? If so what structural engineering solutions are used by structural engineers?
12. Which of the advanced framing techniques do builders currently use or would consider implementing?
13. How often do builders or framers use pre-cut studs for wall construction?
14. How often are manufactured exterior wall sections used?
15. Can 2x6 framing of manufactured exterior wall sections be ordered? Are both 16" and 24" O.C. versions available?
16. How often do you build using SIPs for exterior walls? If you use SIPs what types of connection between panels do you typically use and why?
17. What SIP wall thickness and cavity insulation R-values do you typically work with? Why?
18. What motivates you to use SIPs? Is additional training required to install SIPs? If so, what? If you do not currently build using SIPs, what are the reasons?
19. What is the cost per square foot of wall for each of these approaches compared to a standard 2x4 16" OC house meeting the prescriptive performance values of U-0.065 (R-15+4 or R-13+5)?
20. Does this include additional costs, such as training and design/planning? (Please indicate whether it is total cost or incremental cost).
21. For each of these strategies, what are the biggest contributors to additional costs (labor, materials, or something else)?
22. For each of these strategies, if they were to become common practice due to a code change for higher performing walls, how do you expect incremental costs to change – increase or decrease?
23. What source of cost information for high performance walls do you recommend in California?
24. What is the highest density (R-value per inch) batt or rigid insulation currently available?
25. Have you built framing with 24" on center? Did you encounter any complications or issues? Is exterior sheathing necessary with 24" on center construction?
26. Assuming the HERS rater is already visiting to verify the duct sealing, what is the incremental cost for HERS verification of Quality Insulation Installation?

# Detailed Wall Assembly Descriptions

### A. 2x6 studs

2x6 studs for the entire exterior frame are not generally implemented in California residential construction. Currently, 2x6 studs are used in specific parts of walls where plumbing or flue installation necessitates the increased wall size. Very tall walls also require 2x6 studs. Increasing stud size to 2x6 can allow for increasing stud spacing to 24" on center as long as attention is paid to structural details; this can reduce the number of studs in the exterior walls and offset the increased material costs from moving to larger studs. However, spacing studs at 24" OC requires a change in the typical design of a home, and some may resist this change. Additionally, if windows and doors are not strategically placed (i.e., within the 24" on center layout), the additional support lumber can offset the savings (both thermal and cost) of the increased spacing. This study will explore both 16" and 24" OC spacing.

Advantages

- Greater depth for cavity insulation
- 24" OC spacing reduces the thermal bridging caused by studs
- 24" OC spacing will reduce material and labor cost in most cases
- Can foster progress on better engineering and framing practices especially for pre-fabricated framing sections

Barriers

- May require training and experience for framing crews and site superintendents
- 2x6 studs at conventional 16" OC could result in increased costs and materials
- May consume conditioned floor space

### B. Advanced Framing

Advanced framing, as it is commonly referred to, is a suite of construction options. This approach is also commonly called Optimum Value Engineering (OVE). In addition to 2x6 studs at 24" OC, this approach includes 2-stud corners, gypsum dry wall corner clips instead of wood backers, and stacked (a.k.a. in-line) framing. These techniques require fewer structural pieces and therefore reduce the framing factor and material costs. The main goal is to reduce the amount of lumber spanning from the exterior to the interior of a wall; therefore, reducing thermal bridging. Structural engineers specializing in residential wood frame construction have successfully designed structures that reduce the total amount of wood used in a dwelling. There are several variations and combinations of techniques that can be implemented to achieve Advanced Framing and reduce framing factor; not all techniques must be implemented.

Advantages

- Reduces the thermal bridging because of fewer framing pieces
- Greater depth for cavity insulation (compared to 2x4)
- May reduce material and labor costs
- May reduce occurrences of drywall cracking if drywall clips are used with 2-stud corners

Barriers

- Builders and building inspectors may require extensive structural engineering documentation
- Increased level of planning and coordination necessary amongst trades
- Requires training of framers and other trades

### C. Double Walls

Two 2x4 walls framed parallel are installed side by side. This allows for more insulation because the entire cavity can be filled. The parallel walls can be placed either on a single sill plate or on separate sill plates, and the walls can either be independently sealed on each side with an air gap between, or it can be sealed only to the interior and the exterior with cavity insulation filling the entirety.

Advantages

- Reduces thermal bridging from both the increased insulation value of 7" of wood at the sill and top plates and the gaps between the walls
- Greater cavity depth for insulation
- Familiar approach for framers (2x4 16" OC framed walls)
- Improves sound insulation

Barriers

- Increases material and labor costs
- Consumes conditioned floor space
- Requires alterations to conventional framing

### D. Staggered Studs

A staggered stud wall can be at any depth, as long as the top and sill plates are wider than the studs (i.e. 2x6 sill plate with 2x4 studs). This creates a single wall that has studs alternately flush with the interior and exterior side of the wall to accommodate gypsum dry wall and exterior siding, stucco and other materials.

Advantages

- Reduces the thermal bridging caused by studs
- Greater sill depth creates a larger cavity for insulation
- Framers can space studs at either 16" or 24" OC
- Structurally engineered plans
- Improves sound insulation

Barriers

- Increase in material costs and labor hours
- Consumes conditioned floor space
- Works best in conjunction with structural engineered plans which add cost
- Training of framers and site superintendents needed
- Increases planning for wall penetrations

### E. Structurally Insulated Panels (SIPs)

SIPs are prefabricated panels with an outside surface of sheet metal, or exterior-rated plywood or oriented strand board (OSB), and a rigid interior foam, typically expanded polystyrene, extruded polystyrene, or polyurethane. Structurally Insulated Panels are allowed as compliance options in the 2013 Title 24 Standards.

Advantages

- Factory fabricated and ready to install on-site.
- Reduces thermal bridging and provides high thermal performance
- Reduces construction time
- Reduces construction waste

Barriers

- Reduces flexibility for design alterations after field construction begins
- May require a crane to install heavy pieces, in addition to other special equipment to speed up installation
- May require minor training for site crew