2013 Energy Code: Real Effects on Multifamily Housing

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The Road to Net Zero

VCA Green presents our findings on the impacts of the current Energy Code to multifamily home projects and highlights strategies that will help developers comply with those requirements.

The California Energy Commission has a lofty goal to achieve net zero for newly constructed buildings. New residences permitted under the 2020 energy code and new nonresidential buildings permitted under the 2030 code will have to meet the Energy Commission's definition of net zero, which means that buildings will produce as much energy as they consumes.

To achieve net zero, each iteration of the Energy Code, which is updated every three years, will adopt stricter energy compliance standards.

The cost to build multifamily housing has increased significantly since the implementation of the 2013 Energy Code. Due to recent mandatory and Prescriptive Requirements, developers have already reported cost increases of $500 to $2,000 per unit.

New Mandatory and Prescriptive Requirements

Mandatory Requirements must be met by every project in California. In contrast, Prescriptive Requirements are those to which a project is compared. Project designers and owners can choose to meet, not meet, or exceed the project-specific Prescriptive Requirements.

The sum of these decisions is the basis of the whole building energy model from which the energy score is derived. If too many Prescriptive Requirements are unmet, the energy score will fall, and other components or systems will need to be improved to obtain a passing score.

For example, if a cool roof is prescriptively required but not taken, the designers will need to specify better insulation, higher efficient water heaters, or another trade-off to be brought into compliance.

Low-rise (three stories and fewer, as defined by the Energy Commission) and high-rise residential (four or more stories) have both been impacted by the new code requirements. Low-rise now has mandatory HERS measures including duct testing and fan efficacy watt draw. In addition, the updated Federal Efficiency Requirements for

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***Note: A glossary of terms and abbreviations used in this whitepaper can be found on page 6.**

HVAC and domestic water heating equipment have added costs to all projects.

Both low-rise and high-rise projects have increased Prescriptive Requirements for attics/roofs and walls. The new prescriptive u-factors for walls, in most cases, cannot be achieved with standard construction practices.

To achieve the new prescriptive u-factors, builders would have to add a layer of rigid insulation to exterior wall assemblies, a non-standard construction practice for the majority of California. Another compliance path is to use closed-cell spray foam insulation, which can be eight times the cost of traditional batt insulation. Projects that do not comply with these measures are penalized in the energy model, which means efficiencies in other areas will need to be better than code.

The same challenges to achieving compliance apply to new multifamily buildings installing central boilers instead of individual water heaters. Domestic hot water boilers face additional Prescriptive Requirements new to the 2013 Energy Code.

Boilers serving domestic hot water needs for more than eight units are now prescriptively required to have two separate distribution loops. Additionally, these projects will be compared prescriptively against a system with solar preheat in the energy model.

Depending on the climate zone, the solar water heater must account for either 20% or 35% of the project's domestic hot water needs.

Fan Power in Mid-rise Multifamily

For mid-rise residential projects of four to eight stories, fan efficiency is being held to noticeably higher standards in split air conditioning systems. Some of the resulting developer-borne costs can be minimized with careful modeling and diligent handling of job specific factors; however the challenge to minimize costs is significant.

Here is an overview of the challenge: Fan power efficiency requirements have significantly risen since the 2008 code. Under the previous 2008 code, the Standard Design Fan Power Index (FPI), in Watts per cubic feet per minute (W/cfm) for split systems was lesser of 0.80 or proposed design FPI. This means that systems with an FPI of 0.80 or less were not penalized. Under the 2013 code, split systems in mid-rise projects are treated as four-pipe fan coils, which are compared to 0.35 W/cfm.

In comparison, low-rise projects with the same split system air conditioner have their fan power compared to 0.58 W/cfm. The goal of 0.35 W/cfm is a problem since the most efficient commercially available ECM fan coil motors do not meet the 0.35 W/cfm requirement.

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FIG. 1	2008 Code	2013 Code
Low-Rise	0.58 W/cfm	0.58 W/cfm
Residential 4+ Stories	Lower of 0.80 W/cfm or proposed FPI	0.35 W/cfm

Standard Design Fan Power Comparison

FIG. 2	2008 Code	2013 Code
Projects Where Proposed Fan Energy Exceeded Standard Design	8%	85%
Proposed Fan Power Compared to Standard Fan Power	-11.9%	+17.6%
Proposed Fan TDV Energy Compared to Total Overall Standard TDV	13.9%	23.1%

Fan Power Effects on Multifamily Mid-rise Energy Models

Fan Power Index

To see the differences in fan power between the two code cycles (Fig 1), VCA Green conducted an informal study of multifamily midrise projects in California Climate Zones 4, 6, 8 and 9. The results show that projects permitted under the 2008 Energy Code proposed fan power exceeded prescriptively allowed fan power in less than 8% of projects. But for projects permitted under the 2013 code, 85% were over the allotted fan power. Proposed Time Dependent Valuation (TDV) fan energy for 2008 projects were below the standard design by an average of 11.9%, while 2013 projects exceeded standard design TDV by an average 17.6%.

Our study also showed that fan energy is a larger portion of the total energy usage (Fig 2). As overall standard energy is reduced in other areas due to increased code requirements, fan energy is becoming a larger portion of the standard energy design. This means that fan power is increasingly important in the overall calculation. In the study, proposed fan TDV for 2008 projects was 13.9% of the total standard TDV compare to 23.1% for projects under the 2013 code.

VCA Mid-rise Fan Power Study

A key design and cost challenge is that reasonably priced alternative systems are not widely available. Even when fan coils with higher-end, high-efficient ECM motors are specified, proposed fan energy is exceeding standard design in energy models. The hydronic heating and cooling system against which midrise systems are now being compared are significantly more expensive to implement.

For every other increased code requirement for mid-rise projects, cost effective solutions are available. For example, windows with lowered u-factors and Solar Heat Gain Coefficients are now comparably priced, and a growing number of roofing products have listed values for cool roof requirements. For the outdoor condensing units, SEER 14 compressors are now widely available, and increased production of these units has made them more affordable

Effects on Third Party Rating Systems and Utility Incentives

As Optional energy efficiency measures which were previously voluntary have become requirements

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of the Energy Code, cost effective opportunities to exceed T-24 standards have diminished. Solar domestic hot water preheat, high-efficient windows, cool roofs and improved insulation were strategies that multifamily projects permitted under the 2008 code could use to help exceed Energy Code requirements.

For low-rise residential under the 2008 code, HERS duct testing and Fan Efficacy testing could provide a few percentage points in the energy score when needed. However, under the 2013 code, these measures are now mandatory.

LEED for Homes and GreenPoint Rated both require projects to perform 10% above the 2013 energy code. The provisions of the new Energy Code and fan power requirements have made it increasingly costly for projects to pursue these certifications.

The California Advanced Homes Program (CAHP) incentives entry point is still 15% above the code. Under the 2008 code, it was fairly common for projects not pursuing LEED or GreenPoint Rated certification to qualify for utility rebates. Since CAHP started using the 2013 code as a baseline, there has been a sharp decline in qualified projects.

What Can Be Done

A Change in the Code – the California Energy Commission is aware that fan power negatively impacts the energy score, and there may be revisions in the modeling base files.

The code could also be changed to allow trade-offs with lighting. Currently, in California, all lighting codes are mandatory. Each code requirement must be met. Exceeding those requirements does not provide an offset in the same way that improvements over Prescriptive Requirements for heating, cooling, fan power and water heating do.

Design Modification – Other heating and cooling technologies are available for mid-rise projects. There is considerable expense with many of them, including the four-pipe fan coil system against which 2013 fan power is compared. Ductless mini-split systems may provide an alternative. In studio and one-bedroom apartments, this can be a less expensive alternative.

Size to the Load – The proposed TDV energy is increased with the size of the blower. Oversized systems create a greater disparity between standard and proposed TDV, necessitating compensation in envelope, cooling, heating or domestic hot water. Loads should be run at the beginning of design and whenever changes are made

North-facing units that receive minimal solar exposure require less cooling than west and south facing units; therefore, north-facing units could be sized with smaller equipment than identical units facing west, downsizing in some cases from 2 ton 1.5 ton systems

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Engage in Energy Modeling Early – Energy modeling can provide valuable feedback as early as the Design Development phase. Energy modeling can identify when additional measures are necessary and if system choices need to be reconsidered. This foresight can inform the design team when additional room and structural support is needed for solar hot water. Options can be identified early for better glazing or higher efficiency mechanical or water heating equipment.

Optional HERS Measures – Optional HERS measures can provide improvements to the energy model. For mid-rise projects, duct leakage testing is one of these measures. All of the projects in VCA Green's study that exceeded prescriptively allotted fan power took the duct testing HERS measure. This gives an option for an offset but has, by means of necessity, become a required measure.

Although many HERS measures are now mandatory or prescriptively required for low-rise, there are still some that are Optional. Low-rise projects that take Quality Insulation Installation (QII) can get a 5-7% increase in the energy score. Envelope Leakage Testing and High EER Verification can provide smaller increases. ■

More Information or Training in Your Office on This Topic

For further information or for a lunch & learn on this and other energy code related topics, please contact Moe Fakih at VCA Green:

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We would be happy to provide you an assessment on how to achieve your compliance and accreditation goals.

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Terms and Abbreviations

FPI – Fan Power Index. The value in W/cfm that energy compliance software uses as the baseline for comparisons when determining an energy score.

HERS – Home Energy Rating System. Third party verifications such as Duct Testing or Quality Insulation Installation. HERS measures can be mandatory, prescriptive or optional.

Low-rise residential – Multifamily residential buildings of three stories or less.

Mandatory measures – Minimum requirements to which all projects must comply.

Mid-rise residential – Multifamily residential buildings of four stories or more.

Net Zero – When energy generated on-site is greater than or equal to the energy consumed.

Prescriptive – Thresholds for energy systems (i.e., envelope, mechanical systems) specified in the California Energy Code and used in energy simulation modeling as the baseline against which energy models are compared when determining compliance.

Proposed – A project's energy use or features as designed and entered into energy compliance software

Standard – A project's energy use or features as designed to California Energy Code prescriptive standards.

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