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NRDC
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NATURAL RESOURCES DEFENSE COUNCIL

NRDC Comments on Proposed Measures for the 2016 Title 24 Building Energy Standards
Pre-Rulemaking Workshops
August 6, 2014

On behalf of our 1.4 million members and online activists, 250,000 of whom are in California, the Natural Resources Defense Council respectfully submits the following comments on the proposed measures for the 2016 Title 24 Building Energy Standards presented during the summer 2014 pre-rulemaking workshops. The Title 24 Building Energy Standards assure that all new buildings and renovations in California meet minimum levels of efficiency, providing cost-effective energy savings for Californians, reducing energy demand, and cutting greenhouse gas emissions. NRDC has participated in the proceedings to develop Title 24 since their inception because of these important consumer and environmental benefits. Title 24 has saved Californians over $30 billion on their energy bills since the first standards were adopted in 1975, in addition to cutting the associated pollution emissions.[1] These benefits do not even include the value of increased comfort in new homes, nor the benefits of decreases in gas and electricity prices that result from reducing demand.

NRDC offers the following comments on the proposed measures and methodologies discussed during the pre-rulemaking workshops and other issues related to the 2016 Standards.

1. Introduction and Importance of 2016 Standards in Reaching Zero Net Energy Goals

The current standard update is particularly important as it will lay the groundwork for meeting California's Zero Net Energy (ZNE) goals. The CEC should ensure that the 2016 standards are on track to meet the residential ZNE goal by 2020 and nonresidential ZNE goal by 2030. For residential buildings, significant progress needs to be made during this cycle in order to reach ZNE in the 2019 edition of the standards. At a high level, given that the 2013 standards are equivalent to about a 90 on the CA HERS scale and CA HERS value of approximately 30 (before renewables) is needed to meet ZNE, the CEC should set a 2016 standard that gets at least halfway to this goal. In other words, the CEC should be targeting a level of efficiency in the prescriptive path that is roughly equivalent to a 60 on the CA HERS scale.

For commercial buildings, the CEC should look beyond ASHRAE and adopt other cost-effective measures where appropriate. For almost 40 years, the Commission has led the way with advanced energy efficiency requirements for commercial buildings. ASHRAE and the ICC have followed. So it is especially disappointing that in 2014, when the state has an ambitious ZNE goal for 2030, that it should be content to merely keep us with last year's ASHRAE standard.

It is particularly disappointing given that the ASHRAE standard is mainly met through the prescriptive path. Title 24 is primarily met through the performance path which allows for deeper energy savings to be

[1] http://www.energy.ca.gov/releases/2013_releases/2012_Accomplishments.pdf

achieved cost-effectively. The prevalence of the performance path in CA is due in large part to the fact that the CEC has had a workable performance-based compliance path for 30 years, based on the ACM and the consequent compliant software. In contrast, ASHRAE has been dependent on modeler expertise and has also been limited by the lack of software that automatically describes the reference building and flags likely input errors.

It is only now that ASHRAE can start to use a method comparable to the ACM, namely COMNET, which CEC officials helped to develop to maximize harmonization between Title 24 simulation methods and ASHRAE methods. ASHRAE is only now proposing an Addendum to Standard 90.1 that uses the COMNET methodology and establishes a criterion comparable to the HERS score for performance compliance with automated development of the reference building. COMNET-compliant software is still months in the future.

Experts in the energy efficiency field agree that we are near the end of the road for establishing additional prescriptive requirements that can get us close to net zero energy. Further progress will require that the performance method be used preferentially and that the prescriptive method be limited to those buildings that are ordinary enough in their design constraints that a prescriptive approach still makes sense for them. Therefore, the CEC should look beyond the prescriptive measures in ASHRAE to levels of energy savings that would be cost-effective using the performance approach, but not necessarily cost-effective on a measure by measure basis for all building types.

California is well positioned to do this in 2014. Not only does it have the compliance methods, but it has investor-owned utilities who are eager to share their information on additional efficiency steps that can be taken for nonresidential buildings. The Commission should move forward on these ideas, lest we find that we are running out of time to meet the zero-net goal in 2030 because we deferred action this triennium.

2. Comments on Proposed Nonresidential and High-rise Residential HVAC and Envelope Requirements – June 12, 2014 Staff Workshop

a. Opaque Envelope U-Factors

In general, NRDC supports the proposal to update the nonresidential and high-rise residential opaque envelope requirements and specifically supports the proposed requirements for metal and wood framed roofs. Increasing building envelope efficiency is a critical step towards meeting California's net-zero goals. Highly insulating building envelopes reduce heating and cooling loads, which allows for smaller equipment (or the complete elimination of mechanical heating and cooling in some cases) as well as innovative heating and cooling technologies, which will likely be necessary to reach net-zero. In the future, the CEC should consider a single U-factor requirement for each building component (walls, roof, floor), rather than specifying the U-factor for each assembly type, which will encourage competition between construction types to meet these efficiency levels and will guarantee the same level of efficiency regardless of construction type.

While we generally support the proposal to increase envelope efficiency requirements, we anticipate that higher levels than those proposed will be cost-effective for some assembly types. This anticipation is based not only on current prices but on the likely effect of competition for increased insulating levels once the standards are implemented. In general, we recommend that CEC choose the maximum levels that are cost effective compared to historic practice, rather than the most recent edition of the code (see further discussion in Section 5 below). Specifically, it appears as though the CEC may not have proposed the highest cost effective levels compared to historic practice for metal framed walls. Figure 1 shows the life cycle cost of improved steel frame wall insulation in Climate Zones 1 and 6. The 2013 standards include a U-factor requirement of 0.098 in both climate zones, whereas the 2005 standards included requirements of 0.217 and 0.224 in climate zones 1 and 6, respectively. Compared to the 2013 standards only one value, U-factor of 0.069, appears to be cost effective. However, when compared to historic practice (2005 standard level), a U-factor of 0.048 is cost-effective. CEC should set standards at the highest level that is cost-effective compared to historic practice, which in the example below would be a U-factor of 0.048.

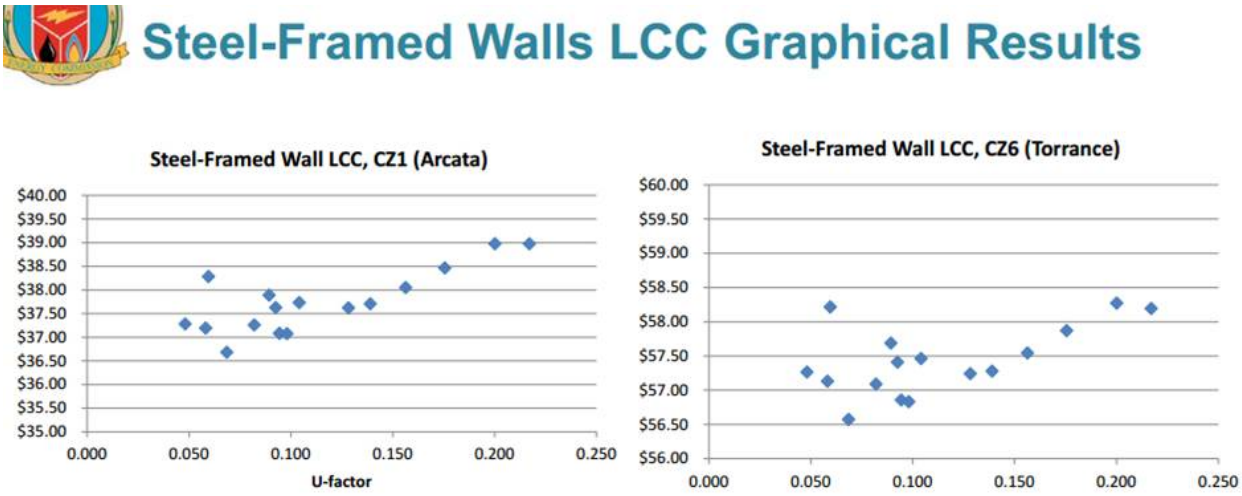


Figure 1: Steel-framed Wall LCC Results[2]

We also recommend that the CEC take into account the cost savings of non-energy benefits, such as increased comfort, in its analysis. Properly accounting for these additional benefits would also increase the cost-effectiveness of measures while providing a more accurate picture of total benefits.

Finally, there are several values in Table 140.3-B that are less stringent than the requirements in other climate zones. While it is not immediately clear from the information presented in the draft CASE report whether or not updating the requirements would be cost-effective compared to historic practice, we recommend the CEC evaluate the criteria in these climate zones and determine if an update is warranted:

[2] Presented June 12, 2014; http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-06-12_workshop/presentations/NR_Envelope.pdf

- Wood-framed and other Roofs – Climate Zone 8
- Metal Building Walls – Climate Zones 1, 3, 6, and 7
- Wood-framed Walls – Climate zones 3, 6, and 7

			California Climate Zone															
TABLE 140.3-B Prescriptive Envelope Criteria for Nonresidential Buildings			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Roofs	Metal Building	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**	**0.041**
		Wood-Framed and Other	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.049**	**0.049**	0.067	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**
	Walls	Metal Building	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
		Metal Framed	**0.069**	0.062	0.082	0.062	0.098	**0.069**	**0.069**	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.057	0.062
		Mass Light	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170
		Mass Heavy	0.160	0.160	0.160	0.184	0.211	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160
		Wood-Framed	0.095	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	**0.045**	0.059	0.059	0.059	0.042	0.059
	Floors	Mass	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.058
		Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039
	Other*																	

** Roof reflectance requirements, fenestration and door requirements are not shown in the table above, and are unchanged from the 2013 Title 24 Standard.*

Figure 2: Proposed Changes to Table 140.3-B[3]

b. HVAC and Water Heating Equipment

NRDC supports updating the Title 24 HVAC and water heating equipment levels to those adopted in ASHRAE 90.1-2013. DOE is currently reviewing its standards for ASHRAE equipment and will consider whether to update the standards to the ASHRAE levels or higher levels if warranted. NRDC, ASAP, NEEA and ACEEE submitted comments to DOE arguing that higher levels than those adopted in ASHRAE 90.1-2013 would lead to significant energy savings.[4] If DOE adopts higher efficiency levels in its final rule, CEC should update the requirements in Title 24 accordingly, as soon as possible.

c. Fan Efficiency

It is our understanding that the CEC is no longer considering the fan efficiency proposal presented during the June 12, 2014 Staff Workshop due to its limited energy savings. We urge the CEC to reconsider this decision and to evaluate potential fan efficiency measures for the 2016 standards. Specifically, we recommend that the CEC evaluate whether cost-effective energy savings could be achieved through an efficiency requirement for non-ducted fans.

In the June 12, 2014 Staff Workshop, the CASE team proposed the 90.1-2013 requirements for ducted fans, which would require a minimum Fan Efficiency Grade (FEG) of 67 and selection within 15 percent

[3] Draft CASE Report
[4] See ASAP et al comments: http://www.regulations.gov/#!documentDetail;D=EERE-2014-BT-STD-0015-0021

of peak efficiency. The CASE analysis showed that this measure would lead to minimal energy savings. NRDC recommended that the CEC consider the IGCC requirement of an FEG of 71 and selection within 10 percent of peak efficiency to determine if this would lead energy savings. Our understanding is that the CEC has dropped this proposal due to uncertainty around the use of the FEG metric combined with the limited energy savings. We continue to recommend that CEC evaluate whether savings could be achieved through the IGCC requirements.

The CEC did not propose any requirements for non-ducted fans in the June 12, 2014 Staff Workshop. However, non-ducted fans represent a significant portion of connected load and present an opportunity for energy savings. The Performance Based Efficiency Requirement (PBER) was developed specifically to address efficiency of non-ducted fans which are not adequately represented by the FEG plus selection window construct. A PBER requirement at the 60 percent efficiency level currently under discussion could lead to energy savings on the order of 10 percent per fan, which would add up to significant savings across the state. The PBER metric for non-ducted fans is fully developed and data exists to estimate potential energy savings for California and cost-effectiveness. Furthermore, we think that there is potential for agreement amongst stakeholders on a PBER metric, making this a low controversy addition to the standards. We recommend that the CEC consider adopting a PBER requirement for non-ducted fans in the 2016 standards and encourage further discussion amongst stakeholders on this issue.

d. Elevator Ventilation and Cab Lighting, Escalator and Moving Walkway Speed Controls, Direct Digital Controls, and Operable Window/Door Switch Requirements

NRDC supports the proposed requirements for elevator ventilation and cab lighting, speed controls for escalators and moving walkways, direct digital controls, and the HVAC switch requirements for operable doors and windows.

3. Comments on Proposed Residential Lighting Requirements – June 24, 2014 Staff Workshop

In general, NRDC supports the draft proposal for residential lighting presented during the June 24, 2014 Staff Workshop. The proposal will simplify the requirements for residential lighting, making it easier to comply with the standards, while ensuring that there is an energy efficiency light source in every socket. Most importantly, the residential lighting proposal will yield significant energy savings compare to the 2013 standard: The IOU's estimate that in total the proposed changes will save 625 kilowatt-hours per year per new home and have a benefit-cost ratio of over 6 to 1.

The proposal simplifies the current residential lighting requirements by requiring all light fixtures to be high-efficacy; it also provides greater flexibility by allowing screw-based fixtures to qualify as high efficacy. Currently, the standards only require certain fixtures to be high efficacy. For most sockets, low efficacy fixtures can be installed if they are installed with a dimmer or vacancy sensor and this option is widely utilized today. The proposal adds screw based bulbs that meet the efficacy and quality requirements in JA-8 to the list of high efficacy fixtures. The efficacy and quality requirements in

Appendix JA-8 ensure that consumers get a screw-based bulb that is not only efficient but that also performs well. This is essential to the success of this proposal, as a homeowner who is not satisfied will simply unscrew these bulbs and may replace them with lower efficiency alternatives, negating the energy savings.

The proposed modifications to require all fixtures to be high-efficacy will simplify compliance for builders and code officials, who will no longer have to do calculations on what percentage of bulbs are high efficacy. It will also deliver significant incremental energy and utility bill savings to homeowners, who are not necessarily realizing savings today with dimmers combined with low efficacy fixtures.

We offer the following specific comments on the details of the proposed revisions:

i. Requirements for Non-Directional Light Sources

As indicated above, we support the addition of screw-based luminaires that meet Appendix JA-8 requirements to the list of high efficacy light sources in Table 150.0A and the proposed requirement that all light sources meet the high efficacy requirements of Table 150.0A. In the past, the concern with allowing high efficiency screw-based bulbs was that they could be easily replaced by the builder after the time of inspection or the homeowner after occupancy with a lower efficiency bulb. The builder would be motivated to replace the bulb with a cheaper option and a consumer may replace the bulb if dissatisfied with the light quality. While the former concern will be addressed through requiring the disclosure of installed lighting to the homeowner (see below), the latter is addressed by ensuring that there is a good bulb in every socket, both in terms of efficiency and performance. The progress in both the quality and decreasing costs of LEDs makes this requirement feasible. Furthermore, with the implementation of the Energy Independence and Security Act (EISA) standards in 2018, the lost savings will be minimal in the case the consumer does choose to remove the bulb (these cases are likely to be limited, thanks to the performance requirements of JA-8).

Another important requirement for non-directional luminaires is to ensure that bulbs in enclosed fixtures, such as surface-mounted ceiling lights or "jelly jars," meet elevated temperature requirements. We recommend that bulbs for use in these enclosed fixtures pass elevated temperature requirements and be labeled as eligible to be installed in enclosed fixtures.

ii. Requirements for Directional Light Sources

We support the proposal not to allow screw-based lamps in recessed luminaires and to require that only bulbs in compliance with Appendix JA-8 be installed in recessed fixtures. Recessed luminaires are commonly installed today and so it is important to ensure that efficient bulbs are being installed and maintained in these fixtures. Unlike other screw-based bulbs, the EISA 2018 requirements that will require more efficient screw based every day light bulbs to be dramatically more efficient in California, don't apply to directional bulbs like those installed in recessed cans and track lighting. As such, there is a risk of larger lost energy savings if these bulbs are switched out by either the builder or the consumer.

Furthermore, there is potentially greater motivation to switch out these bulbs from the builders' perspective, as there is a larger differential in first cost between high and low-efficacy screw based directional light bulbs and the large number of recessed cans being installed today. Heat management is also a bigger issue in recessed luminaires, given the high temperature environment, which can be better managed with a dedicated fixture and bulb. For all these reasons, we recommend against allowing screw-based bulbs in recessed luminaires.

iii. Dimming and Vacancy Requirements

We support the proposal to require that at least one luminaire be controlled by a vacancy sensor in bathrooms, laundry rooms, utility rooms, and garages. Vacancy sensors make sense in these low use areas where the energy penalty of forgetting to turn the lights off is high as they may remain unoccupied for very long periods of time.

When dimmers are required, we recommend that dimmers meet SSL-7 to help ensure compatibility with the installed high efficacy fixtures and reduce potential consumer dissatisfaction from poorly matched dimmers and fixtures. This requirement is important because poor dimmer performance could lead consumers to switch out bulbs and replace them with lower efficacy alternatives.

iv. Circuitry Requirements

For kitchens, we recommend adding a requirement that under cabinet lights be controlled by a separate switch. Homeowners often leave kitchen lights on even when the kitchen is not in use, sometimes as a form of night light or to indicate someone is present in the house. Given this tendency, it is important to allow consumers the flexibility to only leave some of the kitchen lights on by putting the under cabinet lighting on a separate switch, as under cabinet lighting is not likely needed for these purposes. This separate switching requirement will result in energy savings by allowing consumers to better control the level of lighting in the kitchen to meet specific needs.

v. Disclosure Requirements

We strongly support the requirement that builders provide a room by room inventory of the bulbs installed at time of sale. This inventory should include the make, model number and wattage of all bulbs installed. This list should be should be present at the time of code inspection and should be given to the homeowner when they purchase the home. Providing this inventory to the homeowner will discourage builders from switching out bulbs to cheaper, low efficacy alternatives after the time of inspection.

More than half the new homes outside California now carry HERS ratings, which the builder chooses to make available to the customer. These ratings include estimates of future utility bills, and some home warranty companies offer assurances that metered energy use will not exceed the rating. Since lighting energy is a part of the RESNET HERS rating, disclosure is already a part of the rating: thus if the buyer experiences electric bills that exceed those of the rating and the reason is that the builder has removed the efficient bulbs, the disclosure sets up liability suit risk. This helps ensure that the bulbs remain in their

fixtures. This observation argues for closer harmonization in how lighting energy is handled between California HERS and RESNET.

vi. Comments on JA-8 Requirements

Consumer satisfaction is key to the success of the proposed requirement to allow screw-based fixtures to qualify as high-efficacy. As discussed previously, a consumer can easily remove a screw-based bulb that they are dissatisfied with and may replace it with a lower efficacy alternative. The color quality of light produced by the bulb is a very important element of consumer satisfaction. We support the proposed requirement for lamps to provide an R9 value (red) of at least 50, given that this has been shown to be the most important color value to consumer. We also support CEC setting a minimum CRI to help ensure consumers are satisfied with the color rendering of objects that appear under the light. We support a minimum CRI of at least 80 and welcome further data and dialogue between stakeholders to explore whether the Commission should select a higher CRI value of up to 90.

4. Comments on Proposed Nonresidential and Outdoor Lighting Requirements – June 24, 2014 Staff Workshop

a. Nonresidential Lighting Requirements

NRDC supports the proposal to update the nonresidential indoor lighting requirements. In general, the CEC is proposing to bring the lighting requirements up to the levels required by ASHRAE 90.1-2013. However, for certain space types, CEC is proposing less stringent requirements than ASHRAE; specifically: auditoriums, electrical, mechanical, and telephone rooms, laundry areas, library reading areas, and waiting areas (all under the area category method, Table 140.6-C). The CEC should examine the proposals for these space types and update to the levels required by ASHRAE 90.1-2013. Additionally, there are certain space types that do not align with the ASHRAE categories for which LPD values have not been updated since at least the 2001 Title 24 Standards. Specifically, the values for general commercial/industrial work buildings, grocery stores, and theaters under the complete building method (Table 140.6-B) and commercial and industrial storage, corridors, restrooms, stairs and support areas, exercise centers and gymnasiums, library stacks, and theaters (motion picture and performance) under the area category method (Table 140.6-C) have not been updated since 2001. The CEC should evaluate the requirements for these space types and ensure that they represent the use of current lighting technology (high performance T-8s/LEDs).

b. Outdoor Lighting Requirements

NRDC supports the proposed update to the outdoor lighting power allowance requirements. Given the advancements in lighting technology, in particular the progress in LEDs, the lighting power allowances are due for an update. The proposed values are feasible, cost-effective and will result in significant energy savings.

5. Comments on Proposed Life Cycle Cost Effectiveness Methodology and Time Dependent Valuation – July 9, 2014 Lead Commissioner Workshop

a. Life Cycle Cost Effectiveness Methodology

CEC should evaluate life cycle cost-effectiveness compared to historic practice. The Warren-Alquist Act clearly states that, "the standards […] shall be cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historic practice. " (Public Resources Code § 25402(a)(3)). Given this directive, CEC should evaluate cost-effectiveness compared to historic practice, rather than the immediately previous code cycle. This becomes particularly important as the standards make incremental steps to improve efficiency, taking the most cost-effective savings first and making future measures look more costly in comparison. Past decisions not to increase standard levels further should not inhibit the CEC from adopting measures that are cost-effective compared to historic practice.

Furthermore, the Warren-Alquist Act states that the standards shall be cost-effective *in their entirety*. This indicates that not every individual measure needs to be cost-effective, but rather that when taken in whole the standard must be cost-effective. This will be particularly important as the standards move towards zero net energy, as it gives CEC the ability to evaluate packages of measures, each individual component of which need not be cost-effective.

Finally, CEC should adopt the highest level of efficiency that is cost-effective, rather than the level at which life cycle cost is minimized. Doing so will lead to the maximum overall societal benefits, while still providing significant consumer benefits, since a number of factors not included in the cost benefit analysis cause real benefit/cost ratios to be better than the ones projected. Key factors not in the current analysis include the value of increased comfort, the likelihood that lower loads will allow simpler and smaller HVAC systems to be installed, and the observation for appliances that realized costs are far lower than those projected by the regulators during the rulemaking.[5]

b. Time Dependent Valuation

While we recognize that at this point in the process the TDV values are close to final for the 2016 update, we offer the following comments for consideration for the development of subsequent TDV values as well as for how these TDV values are applied in the current code cycle.

TDV values should adequately account for the total societal value of energy use, taking into account long term greenhouse gas reduction targets. We are concerned that the current TDV values do not accurately reflect the long term societal costs of natural gas versus electricity, in particular as we move towards a target of 80 percent reduction in greenhouse gases by 2050.

The below graph shows the TDV values of electricity and gas for climate zone 12, adjusted to a common denominator of site Btu. The TDV value of electricity is roughly three times that of gas in off-peak hours and over 100 times that of gas in the highest peak hour. This is questionable, and may have material impacts. For example, it has the effect of highly favoring the use of gas over electricity, especially for

[5] ASAP and ACEEE, "Appliance Standards: Comparing Predicted and Observed Prices," July 2013, http://www.aceee.org/research-report/e13d

space and water heating equipment, where gas equipment is used in the reference design. This wasn't a material issue in the past due to the clear superiority of gas for heating. However, there are now updated heat pumps, and a growing capability for grid-interactive water heaters to dynamically avoid high-cost periods in real time. These developments offer a potentially significant benefit which requires further consideration.

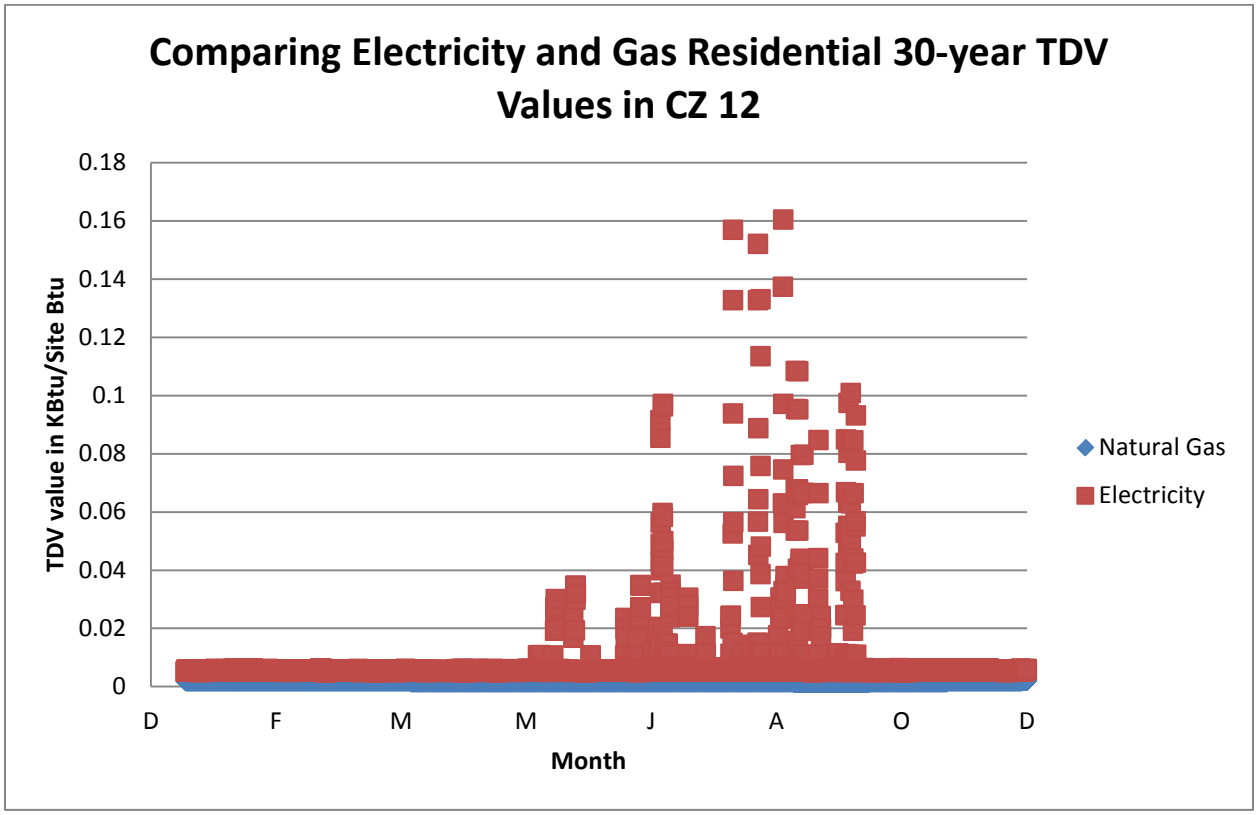


Figure 3: Comparison of Gas and Electric TDV values in Climate Zone 12[6]

This difference could set up a self-inconsistent process, in which the TDV values cause homebuilders to prefer end-use gas to electricity, and result in a shortfall in meeting 2050 emissions goals. The consequence of this shortfall will be a large increase in the cost of carbon, which will affect the cost of gas a lot more than the cost of electricity (since by 2030 or later, the electric system will be based mostly on renewables or very-high efficiency gas generation).

In the short term, *the CEC should address this issue this code cycle by using the same fuel type in the reference and proposed design, which would make the standards fuel neutral.* For residential, the CEC should use a large electric heat pump water heater in the reference design and a minimally compliant heat pump space heater. In the long term, the CEC should work to make sure that TDV better encompasses full

[6] Developed using data presented in July 9, 2014 workshop.

environmental costs and benefits, consistent with achieving the state's 2050 carbon emissions reduction goal, in next TDV update.

One reason for the large difference in current gas and electric TDV values is the method for valuing renewables in the electricity TDV calculations. Under the current methodology, renewables are considered as an additional avoided cost, calculated by multiplying the percentage RPS by the MWh avoided and the $/MWh factor for renewables (See Figure 4). This means that the higher the assumed penetration of renewables, the higher the value of avoided electricity and the higher the cost of electricity compared to gas. This is counter to the result that would lead to the best societal outcome: the more renewables are used to generate electricity for new homes, the more TDV encourages gas rather than the renewables-heavy electric option. Clearly, the outcome should be the reverse: the more renewables used to generate electricity, the more favored electricity should be as a fuel choice.

Furthermore, the current assumption that the marginal fuel is always a natural gas turbine is inaccurate and fails to take into account the increasing prevalence of zero marginal cost variable resources.

While we support the use of the TDV metric and evaluating the time-value of energy savings, we urge the CEC to fully evaluate the changing landscape of marginal and variable resources as well as the emergence of high efficiency electric space and water heating equipment in its future updates of TDV values.

In the past, this time variation within one fuel was the only factor that made a big difference. But now with the improvement in efficiency of heat pumps, the TDV values affect the fuel choice tradeoff. Some evidence suggests that electricity is a better choice for meeting California's climate goals. While more detailed analysis might refute this evidence, for the time being, Title 24 should be neutral between gas and electricity for water and space heating applications. This neutrality can easily be accomplished by establishing separate reference houses based on fuel choice. The IECC and the RESNET HERS Standard (currently ANSI/RESNET Standard 301-2014) have done this for years.

We urge the CEC to address this issue in the next TDV update. In doing so, CEC should use best available estimates for renewable penetration and efficiency. We think that the current estimates used for the 2016 TDV are conservative and that other assumptions would be more appropriate.

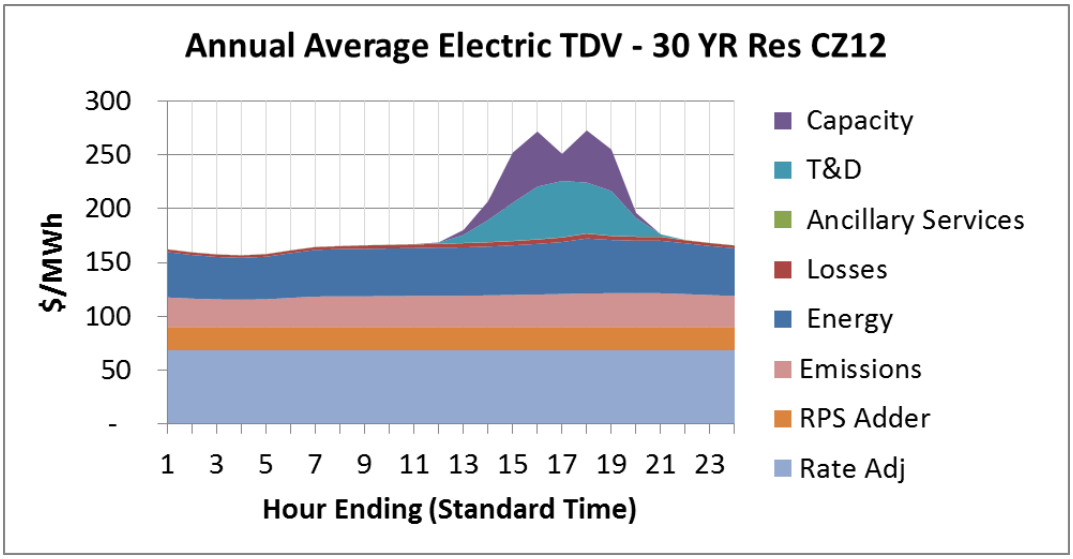


Figure 4: Average Annual Electric TDV Values for CZ12 show the constant RPS adder.[7]

6. Comments on Proposed Measures for Residential Buildings – July 21, 2014 Staff Workshop

a. Water Heating

We support the proposal to update the gas water heating requirement to an instantaneous gas water heater. Instantaneous gas water heaters are a fully commercialized and widely used technology and do not present any challenges for construction. As the CASE analysis shows, this proposal will result in gas savings compared to the current code and is cost effective.

In addition to updating the requirement for gas water heaters, we recommend that further modifications be made to the Title 24 standards to better allow for and encourage (or at least not discourage) the installation of heat pump water heaters. While in the past there was a significant difference in favor of gas, in terms of operating cost and environmental impact between gas and electric water heating, technological advances and the changing generation mix make the preferred choice of water heating fuel less clear. Given the advances in heat pump water heating technology, the updated federal standards that require large water heaters to use heat pump technology, and the potential benefits of grid-interactive heat pump water heaters, the standards should be updated so as not to be unfairly biased against this technology.

Specifically, we recommend that the CEC allow for the installation of a heat pump water heater under the prescriptive path even if gas is available. Furthermore, the CEC should clarify that heat pump water heaters can be installed under the prescriptive path in general (without a solar hot water system system), which does not currently seem to be the case.

[7] Title 24, 2016 TDV Methodology Report, Figure 7; July 9, 2014

The CEC should also update the baseline under the performance path for all electric homes to a heat pump water heater. For homes with gas available, the CEC should allow for the use of the same water heating fuel type in the reference and proposed design. That is to say that a builder would be required to use a heat pump water heater in the reference design if electricity was used for water heating in the proposed design.

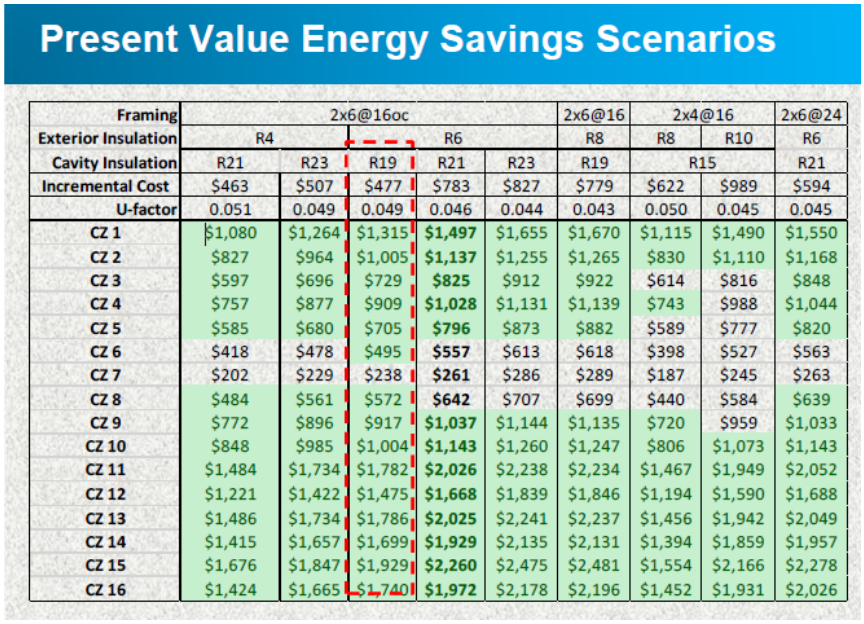
b. High Performance Attics/Ducts in Conditioned Space

NRDC supports the staff proposal to require high performance attics or ducts in conditioned space. The proposed measures are feasible, will provide flexibility to builders and will achieve significant energy savings. These measures are also key strategies for reaching ZNE goals and so it is very important to include them in the 2016 prescriptive requirements, while providing builders the flexibility to choose which of these measures to select.

c. High Performance Walls

NRDC supports the proposal to increase exterior wall insulation requirements and urges the CEC to adopt the highest level of efficiency that is cost-effective. As discussed in above comments on the nonresidential opaque envelope requirements, high performance envelopes are critical to achieving California's ZNE goals. High efficiency envelopes can allow for smaller equipment, innovative heating and cooling technologies, or entirely passive design. In order to be effective, insulation must be installed properly and so we support the proposal to mandate quality insulation installation (QII) verification. The increased insulation levels considered in the draft CASE report are feasible and would result in cost-effective energy savings. As the draft CASE report documents, 2x6 construction is becoming more common thanks to the emerging technology program and CA Advanced Home Program. Furthermore, builders have multiple options to meet insulation requirements including staggered 2x4 studs, increased rigid external insulation, structural insulated panels, and others.

However, the draft CASE report does not propose the highest efficiency levels that are cost-effective. As discussed previously, achieving all cost-effective energy efficiency in this update of the standard is critical to stay on track to meet ZNE goals. Whereas the draft CASE report proposes a U-factor of 0.049 in all climate zones except 7, the analysis shows that a U-factor of 0.044 (R23+6) would be cost effective in all climate zones except for 6-8 (southern coast). CEC should select the highest efficiency levels that are cost-effective. For consistency, we recommend that the CEC require a U-factor of 0.044 in all climate zones. As discussed above, the Warren-Alquist Act requires that standards be cost-effective in their entirety, but does not require every individual measure to be cost-effective in every climate zone. Furthermore, the current analysis does not take into account any cost-savings from reduced equipment size or non-energy benefits of increased comfort, which would increase cost-effectiveness in all climate zones. It is particularly important not to suboptimize in mild climate zones such as the southern coast where completely passive design (and therefore large first cost-savings) is easiest to achieve.



Present Value Energy Savings Scenarios

Framing	2x6@16oc					2x6@16	2x4@16		2x6@24
Exterior Insulation	R4		R6			R8	R8	R10	R6
Cavity Insulation	R21	R23	R19	R21	R23	R19	R15		R21
Incremental Cost	$463	$507	$477	$783	$827	$779	$622	$989	$594
U-factor	0.051	0.049	0.049	0.046	0.044	0.043	0.050	0.045	0.045
CZ 1	$1,080	$1,264	$1,315	**$1,497**	$1,655	$1,670	$1,115	$1,490	$1,550
CZ 2	$827	$964	$1,005	**$1,137**	$1,255	$1,265	$830	$1,110	$1,168
CZ 3	$597	$696	$729	**$825**	$912	$922	$614	$816	$848
CZ 4	$757	$877	$909	**$1,028**	$1,131	$1,139	$743	$988	$1,044
CZ 5	$585	$680	$705	**$796**	$873	$882	$589	$777	$820
CZ 6	$418	$478	$495	**$557**	$613	$618	$398	$527	$563
CZ 7	$202	$229	$238	**$261**	$286	$289	$187	$245	$263
CZ 8	$484	$561	$572	**$642**	$707	$699	$440	$584	$639
CZ 9	$772	$896	$917	**$1,037**	$1,144	$1,135	$720	$959	$1,033
CZ 10	$848	$985	$1,004	**$1,143**	$1,260	$1,247	$806	$1,073	$1,143
CZ 11	$1,484	$1,734	$1,782	**$2,026**	$2,238	$2,234	$1,467	$1,949	$2,052
CZ 12	$1,221	$1,422	$1,475	**$1,668**	$1,839	$1,846	$1,194	$1,590	$1,688
CZ 13	$1,486	$1,734	$1,786	**$2,025**	$2,241	$2,237	$1,456	$1,942	$2,049
CZ 14	$1,415	$1,657	$1,699	**$1,929**	$2,135	$2,131	$1,394	$1,859	$1,957
CZ 15	$1,676	$1,847	$1,929	**$2,260**	$2,475	$2,481	$1,554	$2,166	$2,278
CZ 16	$1,424	$1,665	$1,740	**$1,972**	$2,178	$2,196	$1,452	$1,931	$2,026

Figure 5: Residential Wall Present Value of Energy Savings (green shading indicates cost-effectiveness).[8]

7. Comments on Proposed Modifications to ACM – July 23, 2014 Staff Workshop

As discussed in our comments on TDV, we recommend that the reference water and space heating fuel be modified so that it is equivalent in the reference and proposed designs, regardless of gas availability. This will remove the current bias towards gas water and space heating and make the standards fuel neutral.

We also recommend that the CEC evaluate the current water heater draw patterns and adjust these draw patterns to give credit to heat pump water heaters that have demand response capabilities. That is to say that the schedule for a grid enabled heat pump water heater would vary from that of a standard water heater so that it would only run during the lowest TDV value hours.

8. Comments on PV Credit – July 23, 2014 Staff Workshop

NRDC supports the proposed PV credit. The credit will provide builders flexibility while requiring a minimum level of efficiency. In particular, we support using the 2013 standards as the minimum mandatory baseline and requiring QII.

9. Comments on CalGreen – August 6, 2014 Staff Workshop

NRDC supports the proposal to develop CalGreen Tiers based on an energy rating index or HERS rating, as proposed in the August 6, 2014 workshop. These tiers should be carefully coordinated to support the

[8] July 21, 2014 Staff Workshop Presentation

ZNE goals. Specifically, we strongly support setting the highest tier at 0 on the California HERS scale and agree with the CEC that this tier is critical to achieving ZNE goals. We look forward to further information and discussion with the CEC and other stakeholders as the values for Tier 1 and 2 are further developed; specifically, how the energy rating values are determined and the role of PV in meeting the targets

NRDC also strongly supports harmonization between California HERS and RESNET and would welcome follow up conversations on how to achieve this.

10. Water Efficiency Measures

In light of the current drought and the extreme need for water conservation in California, we recommend that the CEC consider the inclusion of water efficiency measures in both Part 6 and Part 11 of the 2016 Title 24 standards. We would welcome further discussion with the CEC staff and CASE analysis teams on specific measures that should be included for analysis, for example, compact hot water distribution systems; many of these measures were outlined in our recent report: "The Untapped Potential of California's Water Supply - Efficiency, Reuse, and Stormwater".[9]

We appreciate the opportunity to submit these comments and welcome further discussion on any of these comments.

Sincerely,

Meg Waltner
Manager, Building Energy Policy
Natural Resources Defense Council

[9] http://www.nrdc.org/water/ca-water-supply-solutions.asp