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THE CODE ROADMAP

The public comment phase of the 2018 IECC hearings has passed, and final decisions will be made as this issue is going to print. Here's what you need to know about key building code changes that will affect the industry.

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EDITOR'S NOTE

The Inside Scoop

By Matt Power
Editor-in-Chief

Energy Codes: Should the U.S. Switch to Europe's 'Agnostic' Model?

Performance-based construction could alleviate inconsistent standards, improve quality

IT'S NO SECRET that Europe does building differently. Compared to the United States, our friends overseas have had several hundred years of higher-density living in which to figure things out. The way they handle energy codes, in particular, bears closer study. European energy codes are less prescriptive about the materials and products used, and more interested in how the finished product performs. There's a lot more freedom in how you build and what you build with. But the finished structure should meet or exceed energy expectations, and building officials are expected to enforce that standard.

As you can see by the map I've included below, the current status of U.S. energy codes is a quilt of inconsistency. States are free to choose which version of the International Energy Conservation Code (IECC) they want to adopt, and local municipalities can then tweak it to add upgrades applicable to their regions. Some states, such as California, go above and beyond standardized IECC models. Others, such as Colorado, are using older codes. The difference in performance is significant. Residents of a home built under Arizona's current 2006 IECC, for example, will waste $185 to $418 more in energy per year than one built under the 2012 IECC (BCAP). They'll also put a lot more CO_2 into our warming climate.

Prescriptive codes may be easier for small builders and residential contractors than Europe's "energy use intensity" (EUI) approach, but as writer Bill Millard argues in *Architectural Lighting* (**http://bit.ly/2fBt3X1**), prescriptive codes can stifle innovation. Any building system or product not specifically described by code becomes a wild card in the inspection and approval process. Organizations, such as Building America, continue to push for provisions in later versions of the IECC for alternative building methods and products. But with such inconsistent adoption of the code, it's easy to see why builders often fall back to traditional methods.

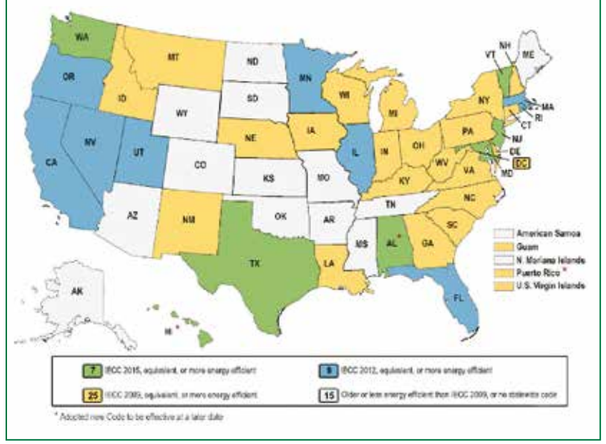
Shifting to performance-based construction would change manufacturing, as well. Millard suggests that with no prescriptive benchmarks for products, companies would just have to make exceptional products and win builders to their brands, instead of simply building to code.

In Europe, he notes, energy efficiency is "culturally expected," and codes are often administered from the top down. Such mandates might seem like a political impossibility in our divided states, but desperate times *could* call for desperate measures. If the severity of impacts from climate change continue—sea level rise, flooding, droughts—the code arena could shift rapidly to a model more like Europe's EUI approach. All the wrangling over individual products and compliance that we've covered in this special issue could become a footnote.

The IECC hearings are over as we go to print, and voting on the 2018 IECC is underway. If the status quo holds, it could be a decade before most states adopt this code. More-progressive cities may simply take matters into their own hands. For example, in Portland, Maine, a new rule requires owners of large buildings to report actual energy use after upgrades. The *Portland Press Herald* (**http://bit.ly/2eiNyvb**) quotes Mayor Ethan Strimling: "We just can no longer wait. We must take bold action. We must take this step forward."

Climate change is accelerating building code changes. While the incoming Trump administration is a wild card, it's feasible that the 2018 IECC could soon serve as the basis for a national energy code. **GB**

U.S. Residential Energy Code Adoption



Politics in play. It's no coincidence that adoption of energy codes looks a lot like a U.S. electoral map. Is it time for a uniform code?

An Invitation from Green Builder Media CEO, Sara Gutterman

Dear *Green Builder* magazine readers,

Given the results of the election, our work in the green building and sustainability arena has become more important than ever. It's paramount that we continue to spread the message that green building is not partisan, and that it is intelligent and cost-effective regardless of which side of the isle you're on.

Over the next few years, any meaningful progress that we're going to make relative to green building, energy efficiency, water conservation, healthy homes, and sustainable development will have to occur at the grassroots level. Strength comes in numbers, so, on behalf of Green Builder Media, I implore you to please join us as at our upcoming **Sustainability Symposium 2017: Ready for Anything** that we're hosting in conjunction with Mayor Dyer and the City of Orlando on January 9 at the Dr. Phillips Center for Performing Arts in downtown Orlando.

The Symposium, originally conceived to explore intelligent solutions for a resilient future, will now direct a laser focus on how cities, communities, business, building professionals and homeowners can work together to viably move sustainability activities, policies, and initiatives forward in what will presumably be a challenging political environment.

Along with some of today's most forward-thinking sustainability leaders, including Governor Martin O'Malley, Philippe Cousteau, carbon-neutral NASCAR driver Leilani Münter, Mayor Dyer (Orlando), Mayor Stoddard (South Miami), and senior NASA scientist Carlton Hall, we plan to use the Symposium to reinforce our collective optimism and confidence that our work does—and needs to more than ever—make a difference.

If you're comfortable sitting sit back and letting others make decisions about how and where we should build, what kind of energy we should use, what we drive, and what kind of connected technology should be incorporated into our homes, this event probably isn't for you. **But, if you want to take an active part in the transition to a sustainable future, don't miss the opportunity to join Green Builder Media and other sustainability advocates at the Sustainability Symposium 2017: Ready for Anything.**

It's more important than ever that we take a bold stance to challenge conventional development models and inspire continued progress. By joining together, we will show anyone who would try to squash the fruits of our labor that we are inexorable. See you at the **Sustainability Symposium 2017: Ready for Anything** on January 9, 2017 in Orlando!

Yours truly,
Sara Gutterman
CEO, Green Builder Media

Space is limited, so register todat at http://www.greenbuildermedia.com/ready-for-anything-2017.
Early Bird registration fees are $175, available until December 1, 2016 (enter code EarlyBird).
Full registration fees after December 1, 2016 are $250.

Our Presenters

Buddy Dyer has served as Mayor of the City of Orlando since 2003. Mayor Dyer is an advocate for the expansion of public transit and for creating an environmentally sustainable city. Through recycling, composting, energy efficiency and the planting of thousands of trees, the City is conserving more and wasting less in order to create a better future for generations to come.

Martin O'Malley served the people of Maryland as governor from 2007 to 2015. Prior to becoming governor, O'Malley served as mayor of the city of Baltimore from 1999 until 2007. Governor O'Malley took strong action to restore the health of the Chesapeake Bay and reduce greenhouse gas emissions in Maryland.

Philippe Cousteau has established himself as a prominent leader in the environmental movement. An Emmy nominated TV host, author, speaker, and social entrepreneur Philippe is the son of Philippe Cousteau Sr. and grandson of Jacques Cousteau.

Leilani Münter is a biology graduate, race car driver and environmental activist. Discovery's Planet Green named her the #1 eco athlete in the world, ELLE Magazine awarded her their Genius Award, and Sports Illustrated named her one of the top ten female race car drivers in the world. Leilani's motto is: never underestimate a vegan hippie chick with a race car.

Dr. Philip K. Stoddard has been a professor of biology at Florida International University since 1992. He is in his fourth term as Mayor of South Miami. In 2015 Mayor Stoddard was appointed by the White House to the Governance Coordinating Committee of the National Ocean Council where has developed national policy for sea level rise.

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Questions? Email Sara Gutterman at sara.gutterman@greenbuildermedia.com.

Green Building NEWS

The latest on sustainability and renewable energy

The State of Building Energy Code Enforcement

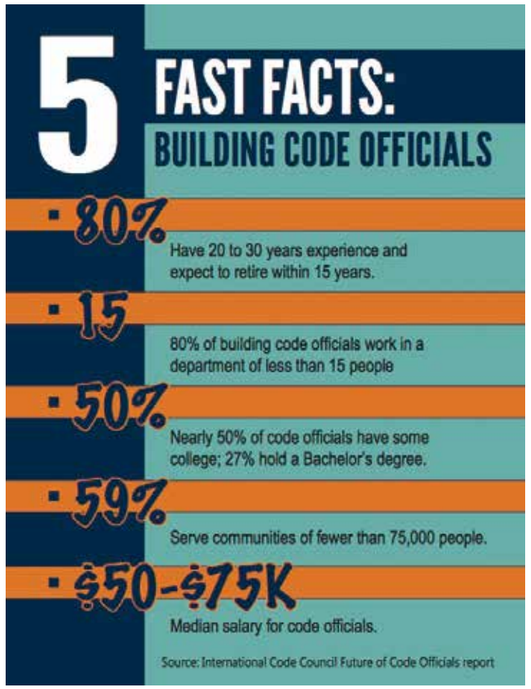
Is the level of code enforcement waning even as model energy codes tighten?

IN A RECENT BLOG, the North American Insulation Manufacturers Association (NAIMA) asked: Is code enforcement, verified by on-site inspections at key periods during construction, becoming more lenient? The organization produced this graphic to show what professionals in the code arena will be grappling with in the foreseeable future.

Here are some points to ponder:

- Most state and local jurisdictions dramatically reduced the number of building code inspectors during the housing crash in 2007, and it's been a slow recovery since then.
- From 2014-2015, the Bureau of Labor Statistics reported (**http://bit.ly/2dHbBCQ**) a 3.5 percent increase in the number of building inspectors, yet the increase has not kept pace with construction. To keep up with the sheer volume of assessments, it's not uncommon for building inspectors to select a "reference home" to inspect and assign the same pass/fail result to similar homes in the development. For states who have adopted IECC 2012 or 2015—which each require RESNET Grade 1 installation of insulation for residential homes, as an example—the question arises: How can anyone certify it's been built to Grade 1 standards if the house hasn't been visually inspected?
- Some jurisdictions allow third-party inspectors versus state or local inspectors. The most prominent example of this approach is the use of HERS raters. While this outsourced approach can certainly benefit governments and builders, it is important for consumers that all home inspectors operate on a level playing field.

Read the full blog at **http://bit.ly/2drFjZZ**.



WE Stand: Call for Public Comments

International Association of Plumbing and Mechanical Officials (IAPMO) is calling for public comments on formal proposals toward the development of the 2017 Water Efficiency and Sanitation Standard (WE Stand). The comment form, with instructions and background on IAPMO's ANSI-accredited consensus process, as well as the WE Stand draft document, Report on Proposals, Monograph, and a development timeline, can be found here: **http://bit.ly/2eHvGaa**.

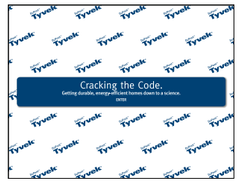
Code Compliant

Manufacturers continue to innovate when it comes to products and services that help builders meet code.

LP: *FlameBlock*

LP *FlameBlock* fire-rated OSB sheathing is specified for fire-rated exterior walls, interior walls, and roof decks in multifamily and single-family construction projects. The product is ICC-certified (ESR-1365), Class A and 30-Minute Flame Spread Rating (ASTM E84, UL 723), combines flame-spread resistance and burn-through resistance, provides a 15-Minute Thermal Barrier Protection (UBC 26-2), and is a component of fire-rated interior and exterior wall assemblies and roof decks. Get more information at **http://bit.ly/1IKUDHS**.

DuPont: *CodeSense*



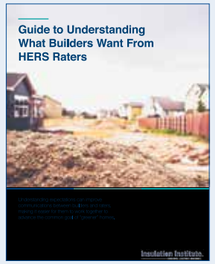
DuPont's new *CodeSense* durable wall builder tool helps builders understand changing codes and learn how to integrate DuPont weatherization technologies into residential walls to meet or exceed code. Register for a free custom code report or download the e-brochure at **http://bit.ly/2dOiap3**.

SmartLam: Cross-Laminated Timber

SmartLam's cross-laminated timber (CLT) is certified under the American National Standards Institute approved ANSI/APA PRG 320-2012 Standard for Performance-rated Cross-Laminated Timber. The product is an engineered wood building system made from several layers of solid lumber boards, stacked crosswise to each other and bonded together with a non-VOC and formaldehyde free adhesive. The product is a viable alternative to concrete, masonry and steel in many applications. The standard adopted by ANSI details the manufacturing and performance requirements for quality assurance. The use of CLT was incorporated into the 2015 edition of the International Building Code (IBC) as well as the 2015 edition of the National Fire Protection Association (NFPA) 5000 Building Construction and Safety Code. Get more information at **www.smartlam.com**.

HERS Rater Report Card

This new free guide details what builders love (and don't love) about HERS raters.



Over the first half of 2016, the North American Insulation Manufacturers Association's (NAIMA) Insulation Institute conducted two rounds of qualitative research with a diverse set of builders who have significant experience working with HERS raters. The results of the research shed light on their perspective of raters, including:

- Why builders choose to work with them
- What frustrates them about working with raters
- The value they expect raters to provide
- What raters can do to exceed builders' expectations and deliver added value

Download this free guide at **http://bit.ly/2dv50uU**.

Modern Commercial Building Design

This e-book highlights the use of spray foam products in continuous insulation applications.

Discover new information about the benefits of Icynene *ProSeal* and Icynene *ProSeal Eco* spray foam products in continuous insulation applications and how these high performance products can help you design and build code-compliant, durable, efficient commercial buildings. These high-performance closed-cell spray foam products offer four functions in one:

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- Continuous air barrier
- Water-resistive barrier
- Vapor barrier

Download this free resource at **http://bit.ly/1RTVdd8**.

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"The market is not static, and codes will continue to evolve to appropriately account for advancements in products, technologies, materials and building science. Some of this knowledge is adopted from local, regional and national green building programs that have years of proof points as new approaches are tried, tested and transformed into best practices."

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ON THE COVER

THE CODE ROADMAP

Artist: Green Builder Staff

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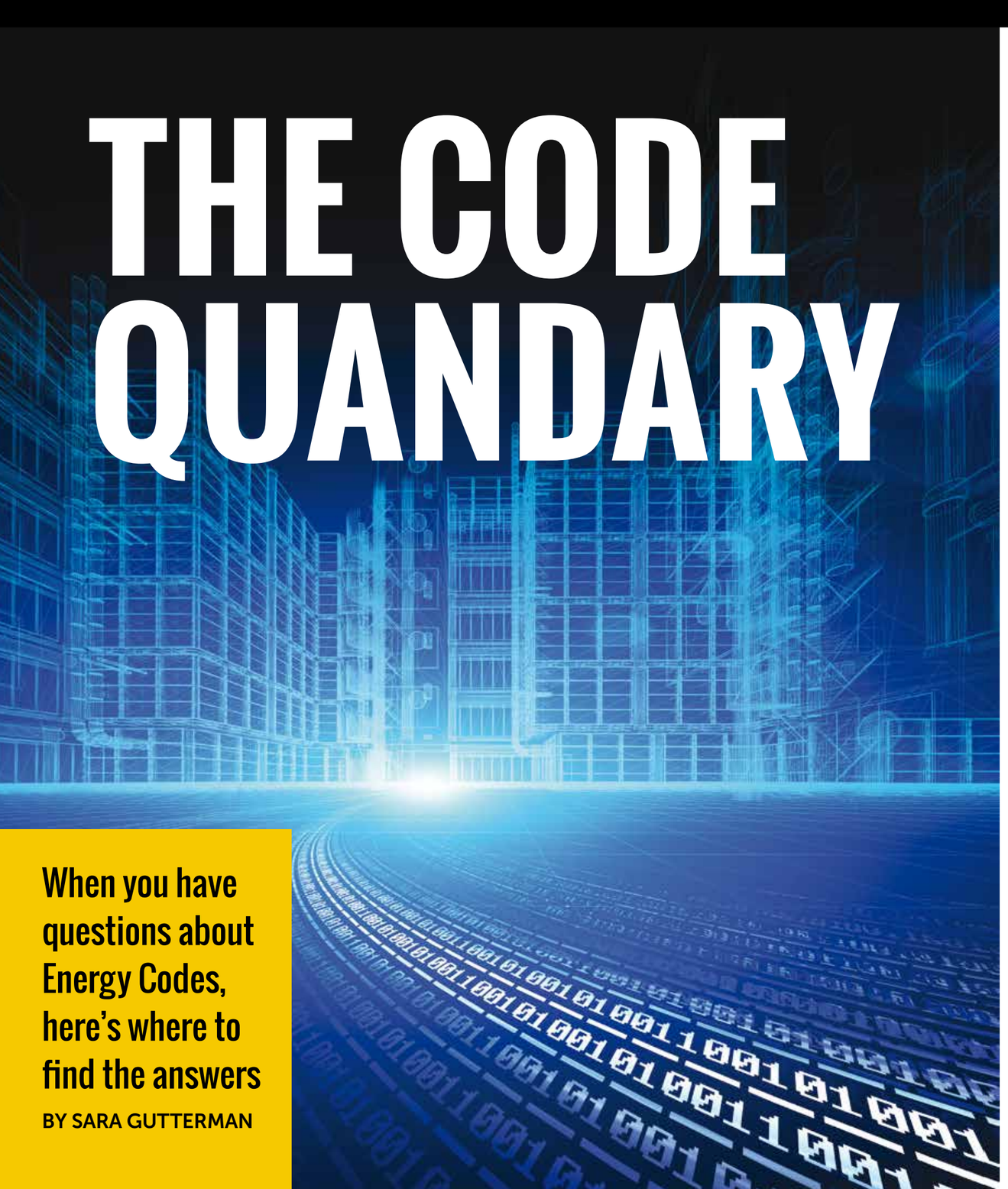
Codes: The Road Ahead

Despite the change in federal leadership, the multi-tiered adoption of energy codes suggests that the new administration is more likely to act as a speed bump than a major detour.

Building codes, particularly those aimed at energy efficiency, play an increasingly important role in the building industry. You might think that with the election of an anti-regulatory President and Congress, code upgrades will slow to a crawl. This is not necessarily the case. Building codes are adopted at the state level, then morphed into something else at the local level. Local jurisdictions (and local politicians) have a lot of control. The question then, is whether the administration selected by about one-fourth of the electorate are the prevailing views of local politicians and citizens. In our view, fiscal prudence will continue to drive the code discussion. Efforts to reduce energy waste are likely to continue, driven on by utilities and cities that can't afford to build more infrastructure. In our special report on the 2018 IECC hearings and their likely impact, you'll learn about the many types of code changes being suggested in the newest version. Homes will be built more efficiently, and as more states adopt the new codes, the bar will be raised. The only real wild card is how quickly states will adopt newer versions of the IECC. That timeline may be slightly impacted by what happens in Washington, but that's par for the course.

THE CODE QUANDARY



When you have questions about Energy Codes, here's where to find the answers

BY SARA GUTTERMAN

ENERGY CODES ARE BECOMING INCREASINGLY more complex as alternative compliance paths are developed, higher-performance products are introduced into the market, and advanced testing and data collection practices are implemented. How do building professionals navigate the evolving code landscape, and how do homeowners even know what questions to ask to ensure that their homes are efficient, resilient, safe and healthy?

There is a growing awareness about the importance of codes—particularly energy codes—as climate change shifts from a theory to a harsh reality. Codes have the ability not only to substantially decrease the amount of natural resources that our buildings consume, but also to enhance the resiliency, efficiency, durability, and safety of said structures.

Green Builder Media is dedicated to helping building professionals and homeowners stay abreast of changing codes. To that end, we recently launched *CodeWatcher*, a new website (**www.codewatcher.us**) and publication that brings together some of the industry's brightest minds and most astute code experts to explain code developments.

We're also hosting a series of webinars to help builders and homeowners understand the nuances of codes. Our first webinar in the series featured code expert Jim Meyers from the Southwest Energy Efficiency Project (SWEEP), an organization dedicated to advancing energy efficiency.

SLOW TO CHANGE, THEN GAME CHANGING

Meyers began the webinar by explaining that the energy code was created in the 1970s in the face of the oil embargo, which brought a discussion about energy efficiency and conservation to the international stage. In response, Congress developed the ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) national standard for commercial buildings, which spawned modern day commercial and residential energy codes.

Between the 1970s and 2006, there were only small, incremental changes in energy efficiency in buildings. Thereafter, the game changed—there was a marked 15 percent improvement in energy savings from 2006 to 2009 due to a ratcheted energy code, and then another 15 percent improvement from 2009 to 2012. After that, it seems we took a step backwards, achieving only a 1 percent improvement from the 2012 code to 2015 version.

Meyers speculates that the plateau is a result of the desire from building professionals—builders and code officials—to "catch up" to current codes, with the goal of driving increased adoption, compliance and enforcement of codes from the last two cycles.

Fortunately, cost effectiveness studies, which measure upfront costs against long-term savings from energy efficiency, clearly show that energy-efficient homes yield fast and meaningful returns. For example, a homeowner in Nevada will reap, on average, $1,500 in life-cycle cost savings if their home is built to the 2009 code, and $5,500 if built to the 2012 code.

The message is clear: reduction in energy use translates into a positive cash flow.

As Meyers points out, the market is not static, and codes will continue to evolve to appropriately account for advancements in products, technologies, materials and building science. Some of this knowledge is adopted from local, regional, and national green building programs that have years of proof points as new approaches are tried, tested and transformed into best practices.

CODES AND COMPLIANCE PATHS

Today, some of the biggest changes in codes have to do with compliance paths, or ways that builders can meet or even exceed code. There used to be two main compliance paths (Prescriptive and Performance). Now, in many jurisdictions, there are four. These four compliance paths, ranging from most to least restrictive, are:

- Prescriptive, which requires strict adherence to specific performance numbers.
- U Factor Alternative, which permits the U-Factor of high performance wall assemblies to be considered as an alternative to R-Values.
- Performance, in which an energy rater inputs information into sophisticated software, allowing for some tradeoffs, although not in mechanical systems or appliances.
- Energy Rating Index, or ERI, which provides the most flexibility in terms of available tradeoffs, including mechanical systems and appliances, and is similar to the HERS index, in which a lower score indicates greater energy efficiency.

Meyers suggests that, regardless of your preferred compliance path, there are eight must-know requirements in the energy code:

- Air barriers and insulation
- Ceilings
- Duct leakage
- Envelope air leakage
- Foundations
- Walls
- Windows
- Lighting

As our knowledge of the built environment evolves, so too will the energy code. Building industry professionals are working on developing the 2018 code, which will surely incorporate improved insights into building science, installation practices, and high-performance products.

In the future, Meyers predicts that building codes will advance incrementally. He forecasts that in the next few code cycles, we likely won't see the large 15 percent energy savings increases that we saw in 2009 and 2012. However, the verdict is still out, as states like California and New York set aggressive targets to reach net zero in the not-too-distant future. **GB**

First published in www.codewatcher.us.

2018 IECC Public Comment Hearing

BY MIKE COLLIGNON

CREDIT: ARGUS

There are more than 200 code change proposals for the 2018 IECC. Here are topics that will continue to receive attention.

Solar Tradeoff

THE TOPIC OF SOLAR TRADEOFFS is a new branch of an old debate. Some would like to see solar receive unlimited credit, and in exchange, the thermal envelope requirements can be lessened to a certain degree. They argue that when evaluating the net power usage (from the grid), these homes perform even better than homes built to code. Furthermore, creating quasi-incentives for solar usage in the code will decrease our overall emissions output and make for healthier air for all.

Opponents point out the limited service life of solar panels, as well as their proven decreases in productivity over time. If the panels are not replaced at the end of their life, or if they are removed (by Mother Nature or by choice), that can occur without any disruption to the safety and/or comfort of the occupants (compared to an HVAC system or windows), yet the home is left with a weakened envelope.

Others claim it's in the self-interest of some vertically integrated production builders, because solar installations have become a notable revenue generator. In these instances, the panels might not be owned by the homeowner, but the solar division of the homebuilder. This presents a number of questions about the status of the panels if rates unfavorably change, net metering rules change or the homeowner wants to change energy providers.

Since the solar tradeoff is being discussed in the context of the ERI path, one has to wonder about solar panels with the sole purpose of providing power to heat and operate pools. The energy use of a pool falls outside the scope of the ERI path, so a home could get credit for having solar, but then use it in a way that is not reflected in the home's ERI.

One HERS provider we spoke with said the IECC is about conserving energy, not producing it differently. "Solar has its uses, but leave the solar out. As soon as you put it in, loopholes will be created and exploited. Houses will have problems because they overlooked basic building science in favor of solar."

One way to look at this is the treatment of solar as a fuel source. Since solar is a renewable energy, will the code allow unlimited usage, even if it means the building envelope is less efficient? Or, will solar be treated the same as traditional fuel sources, in which case its use should also be conserved, even though it is both clean and abundant?

CREDIT: SLAVUN

Where Does It Stop?

The ERI path currently has a backstop of the 2009 IECC prescriptive requirements. That could change, depending on the outcome of this round of development. Florida is considering a 2015 IECC prescriptive backstop when on-site generation is used in the ERI path. As of press time, the State had not made a final decision.

ERI Path

AT THE HEARINGS FOR the 2015 IECC, the ERI path was introduced. It couldn't reference any standard, since none existed at that time. Nonetheless, the alternative compliance path was admitted into the code. Since the 2015 IECC was published, a number of states have adopted the code with the ERI path. Some of those jurisdictions have adjusted the ERI levels higher than the model code. Some have eschewed the ERI path, but substituted a HERS rating in its place. While on the surface they might seem the same, there are subtle differences, and that's where this topic gets really tricky.

The summary goes like this: The baseline home for the original HERS rating was based on the 2004 IECC supplement. The RESNET/ANSI/ICC Standard 301 is based on the 2006 IECC. Subtle difference, but enough that in some climate zones, an identical house going through the old and new rating methodologies could see a difference of 1-7 points, according to one HERS provider. Also, because of the base code change, all the software had to be updated. That update was supposed to be completed by July 1, 2016. That means that technically, prior to the software update, no home was able to comply with the ERI path.

CREDIT: JIRI HERA

There is a proposal to reference the formal RESNET 301 standard in the IECC-R, instead of the informal ERI path as constituted. Typically, the code will only reference standards, and those can come from a variety of standard development organizations. On the surface, it makes sense to go in this direction.

The number of detractors, and their reasons, are copious. A well-known building scientist pointed out that there is a "small house penalty" and that a 60 on a large house is not equal to a 60 on a small house. He went on to say that within the building science community, the lower ventilation rates in ASHRAE 62.2-2010 are not only favored over the higher rates in ASHRAE 62.2-2013, they are back in the 2018 IRC. This is in direct conflict to the 2013 rates used in RESNET 301. Depending on the outcome of RE-166, there could be a divergence between the IRC and whatever the 2018 ERI path looks like.

Two people interviewed felt that moving to RESNET 301 would shift an entire path of the code outside the control of the ICC and its governmental voting member reps. Also mentioned was the fact that RESNET 301 includes facets that aren't currently in the code, such as on-site generation. Since HERS is currently the most widely used energy rating system, some are hesitant to give RESNET a monopoly in the energy code. Finally, it's no secret that RESNET has struggled with quality assurance and consistency of ratings. In fact, the 2014 PNNL/DOE report *Identification of RESNET HERS Index Values Corresponding to Minimal Compliance with the IECC Performance Path* found that:

"When no building characteristics are accounted for, the range of corresponding HERS indexes spans 19 to 26 points, depending on climate zone. This finding is significant, suggesting that two homes that minimally comply with the 2012 (or 2015) IECC Performance Path can have HERS index ratings that differ by as much as 26 points, which ostensibly represents a 26 percent difference in energy performance.

When the most significant building characteristics are accounted for, the range of corresponding HERS indexes spans 5 to 11 points, depending on climate zone."

In addition to all of that, there are proposals to increase and decrease the ERI levels in the model code. Those in favor of raising the ERI levels state that it just gets them in line with the change noted above, and that it may not represent a decrease in efficiency. Others feel the current levels are too low to begin with, and point to utility rebate programs where the target HERS rating is in the 70s. Meanwhile, those who would like to see the ERI levels lowered cite the 2015 national average HERS rating of 62, the relatively small gap between that and the model code levels, and don't see a problem increasing the efficiency of the code. (It should be pointed out that an ERI level is not equal to a HERS rating.)

Once the impact of solar trade-offs is piled on to this debate, you can see how it gets very complex... very quickly.

Mechanical Equipment Tradeoff

THIS DEBATE HAS BECOME a triennial tradition. This particular tradeoff was first removed from the 2009 IECC, but this argument has returned for every code cycle since. Each time, governmental members voted to keep it out of the model code. At this year's code development hearing, the committee approved the proposal. But there was an assembly motion to disapprove, an action agreed to by 57 percent of participants in an online vote.

In RE-134, NAHB is taking a slightly different approach than in its past three attempts to reinstate this tradeoff: a UA backstop. Using a 115 percent multiplier, this would not allow a thermal envelope less than (approximately) a home built to the 2009 IECC. (In some climate zones, it would be more stringent than the 2009 IECC, while in others it would be less stringent.) There are also seven public comments attached to this proposal, though most are seeking disapproval.

According to one executive we spoke with, the problem resides with the NAECA standard. Because 80 AFUE is the lowest allowable (new) furnace rating, and nearly all furnaces installed in cold climates are 90 AFUE (or higher), a lot of credit would be given for something that's already viewed as necessary or commonplace in the market. Therefore, if an inordinate amount of credit is given, insulation levels could be lessened. That would lead to less-efficient thermal envelopes, which would in turn make the efficient equipment run more often than would otherwise be needed.


CREDIT: CHRISTIAN DELBERT

Other proponents of RE-134 point out that such a tradeoff is allowed in the commercial energy code, as well as the ERI path of the residential energy code. One executive we spoke with called it "disingenuous" for proponents of the ERI path to also oppose an equipment tradeoff. Another person noted that window tradeoffs are already allowed, some states have chosen to amend their energy codes to allow equipment tradeoffs, and many above-code programs also allow an equipment tradeoff.

Both sides of this debate would probably agree that changing the NAECA standard would go a long way towards ending this seemingly never-ending argument. But to get the NAECA standard changed takes an act of Congress! (Seriously; it needs their approval.) The Department of Energy could have spearheaded the update long ago, but faced resistance from the gas industry. It appears as though something may finally change on this front, but not for at least four or five years. **GB**

The topics above, plus many other proposals, will get sorted out online throughout November. It is our hope that the governmental voting member reps take in as much information as possible before casting their votes.

Mike Collignon is the executive director and co-founder of the Green Builder Coalition.

CREDIT: LITTLENY

The ICC's Nightmare on Elm Street

The trade-off loophole in the proposed 2018 IECC may earn first-ever "negative" determination from DOE.

BY BILL FAY

IN THE 2009 IECC, the ICC's Governmental Member Voting Representatives (GMVRs) closed the equipment trade-off (ETO) loophole once and for all. This was good news: An analysis by ICF International, one of the world's leading energy analytics firms found that stopping equipment trade-offs added at least 6-9 percent to the 2009 IECC's already historic 12 percent boost in new home efficiency. Furthermore, the analysis found that an individual home built using all available equipment trade-offs could have consumed as much as 22 percent more energy than a home that didn't use them.

Did I say "once and for all?"

Actually, efficiency opponents have forced the GMVRs to vote three more times on the ETO loophole – twice during consideration of the 2012 IECC and again during hearings on the 2015 IECC.

Like Freddy Kruger, the ETO is the loophole that just won't die.

This year, a builder-stacked and builder-dominated Residential Energy Committee once again recommended reinstating the ETO (RE134), then added its support for two other trade-off loopholes for windows and lighting.

Not only are trade-offs a zero-sum game at best, but with very few proposals that boost efficiency, these three trade-offs could end up sinking the 2018 IECC, itself.

RE134 will add at least 6-9 percent to new home energy use. The ETO allows a builder to weaken a new home's envelope features—most of which will perform for the 80- to 100-year life of the home—in exchange for installing more efficient equipment that may last 20-25 years. In other words, when the equipment is replaced after a few years, the trade-off home with the weaker envelope will continue to waste energy for decades. Adding insult to injury, the efficient equipment has to work harder (less efficiently) in the leakier envelope.

Federal law preempts energy codes from addressing the efficiency of HVAC systems and hot water heaters. And here's the rub: Uncle Sam doesn't update equipment efficiency standards very frequently, and when he does, the updates often end up in multiyear court battles, further delaying efficiency progress for years on end. In fact, builders would be hard pressed to even find furnaces as inefficient as the current federal standard.

Data from both DOE and ICF show that in half of today's new homes, builders are already installing the same high-efficiency equipment without weakening building envelopes. What kind of trade-off lets builders increase homeowner energy bills to compensate for something they're already doing?

Builders argue that the ETO is "energy neutral," but the ETO can only be neutral if you ignore the facts that:

- Since most state energy codes haven't allowed equipment trade-offs for a number of years now, hundreds of thousands of homes have been successfully constructed across America with great envelopes.
- Since the market penetration of efficient equipment continues to grow, there is no evidence the ETO has had any adverse effect on the sales of high-efficiency furnaces, air conditioners or water heaters.

"Not only are trade-offs a zero-sum game at best, but with very few proposals that boost efficiency, these three trade-offs could end up sinking the 2018 IECC, itself."

Both of the other two trade-off proposals–RE146 and RE130–will also weaken the efficiency of the 2018 IECC and boost homeowner energy costs:

- By using a fixed 15 percent fenestration area in the standard reference design, RE146 will let homes with lower glazing trade off the efficiency of the rest of the home with a "free credit" created by the difference in efficiency between the fenestration and wall requirements.
- Like RE134, this proposal is not "energy neutral;" it will increase wasted energy in homes with less than 15 percent fenestration area.
- And finally, there's a good reason that the IECC's performance path has never allowed lighting to be traded off for other efficiency features, and yet that's exactly what RE130 does. Just like equipment, federal law prohibits the IECC from setting lighting efficiency. If incorporated into the 2018 IECC, RE130's trade-off will increase new home energy use nationwide by as much 5.7 percent!

Will 2016 be a wasted year for IECC code development? Because the inclusion of any one of these trade-off loopholes will waste so much more energy, it will produce a 2018 IECC that cannot be determined by DOE to "save more energy" than the 2015 IECC it updates.

If code officials believe that builders should get credit for installing equipment that exceeds federal minimum efficiency standards, they can adopt RE179, the EECC "Flex Points" proposal, which awards credit not only for heating, cooling and water heating efficiency, but also other new innovative technologies—all without reducing the efficiency of the existing code. Unlike RE134, RE179 builds upon the solid energy conservation foundation of the 2015 IECC, rather than simply trading it away for artificial credit. GB

Bill Fay leads the broad-based Energy Efficient Codes Coalition (EECC).

The New ERI Path

Section R406 of the 2015 IECC is a dramatic shift from public ownership to privatizing building energy code enforcement. Should we care?

BY BILL FAY

CREDIT: ANDRII SALMON

FOR SOME CODE OFFICIALS, IT WAS A RELIEF. The idea that building energy code compliance could be determined largely by looking at a single 0-100 Energy Rating Index (ERI) score, instead of assessing the litany of prescriptive measures one by one, may have seemed a godsend. This seeming relief came after years of rapid advances in energy codes, tightened government budgets and a growth in the number of code officials (up 3.5 percent from 2014-2015) that has not kept pace with the growth in construction (residential permits increased 13 percent from 2014-2015, according to U.S. Census data). **Other code officials were skeptical, because the preeminent ERI score-HERS-considers measures that aren't allowed in the IECC. They responded by adopting ERI scores that took those measures into account. Sentiments aside, does ERI present any downside for code officials?**

ERI AND THE HERS INDEX

To answer the question, we first need to understand what ERI can be versus what it actually is today.

Section R406 of the 2015 IECC spells out the requirements of the ERI path. In theory, multiple software products could be used to determine ERI compliance. However, a basic reading of R406 shows the requirements are essentially tailored to the current HERS system. As a result, while HERS is technically one of many potential ERIs, in reality they are practically one in the same.

Why does that matter? Well, first of all, intent: The HERS score began as a green marketing designation for builders who wanted to distinguish their homes from those of competitors or existing homes. HERS was not designed for code compliance; it was designed for "green" marketing.

RESNET, a private sector entity, controls the HERS score and either approves or disapproves the software tools that can provide them. There are currently only five approved software programs for providing a HERS score.

But while code has long referenced private sector standards, developed through consensus (typically ANSI and ISO) based processes, this is not what we are talking about with the HERS/ERI relationship. In this case, code is not referencing private sector standards; code is being supplanted by a private sector code substitute. Understood this way, Section R406 is not continuation of the status quo—the public-private code—it is a dramatic shift from public ownership to private.

PRIVATIZATION ON THE RISE

In the article *What Is the Future of Code Enforcement?*, EfficientGov.com wrote about the future of building code enforcement and the growing trend of public-private partnership. Unsurprisingly, it asserts the "Silver Tsunami," or the aging code official workforce, is spurring many local governments to consider outsourced options for future code enforcement.

The article includes an interview with a representative of SAFEbuilt, a company whose business model is performing building and zoning services for governments on a contract basis. The company currently boasts over 250 communities nationwide as customers.

The article pins the growing popularity of outsourcing on costs, cost recovery and ability to deliver services in a sufficiently timely manner. These are important goals, to be sure, but they are not the only ones.

Some academic work exists on this subject, including the 2010 report, *Privatisation of Building Code Enforcement: A Comparative Study of Regimes in Australia and Canada*, that examines examples of privatization of building code enforcement in Canada and Australia. The authors summarized the impacts observed as follows: "Overall, PSI [private sector involvement] delivers an increase in effectiveness and efficiency, but at a particular cost of public accountability. A competitive, rather than a complementary, relationship between the private and public sectors in a privatized regime is also found to be more likely to generate problems related to the equity of the service being provided."

In short, the private sector may be more efficient, but it may not be as adept at actually serving the public good. Of course, this is the very reason why code enforcement has always been the purview of the public sector and not the private in the first place. This research is not the final word, but it does serve as a reminder that an assessment of the relative merits of a public or private approach to code enforcement cannot consider efficiency alone, it must also consider the public benefit derived from either approach.

FACING THE TRUTH

Because ERI today *means* a HERS score, HERS raters will be the parties relied upon to assess code compliance. In other words, in areas where ERI becomes the norm, private sector HERS raters will perform the function long reserved for code officials.

As local government leaders look more closely at privatization in the future, they will surely consider the extent to which it is already happening. Where it is, they will likely be emboldened by it, saying, "Well, we are already moving in this direction anyway, so it is probably a good idea."

In this way, privatization of building energy codes will serve as part of local officials' rationale for further privatization of an array of building code activities beyond energy. The point here is not that ERI is wholly good or wholly bad, but rather that it should be recognized for what it is: a sea change in energy code compliance, one which will have implications for building code enforcement writ large. **GB**

Bill Fay leads the broad-based Energy Efficient Codes Coalition (EECC).

Better Than Code

PASSIVE POWERHOUSE

BY CATI O'KEEFE

The largest PHIUS-certified project in New England is also affordable.

THE 54,000-SQUARE-FOOT VILLAGE CENTRE APARTMENTS in Brewer, Maine—developed and owned by Community Housing of Maine (CHOM)—was just awarded its final PHIUS (Passive House Institute U.S.) certification after opening its doors in May. And the best news? It's an affordable project. And it's emblematic of a trend that's growing among progressive architects and builders: building better than required by code.

The 48-unit building—designed by CWS Architects with sustainability consulting by Thornton Tomasetti and constructed by Wright-Ryan Construction—had to be the epitome of energy efficiency. Wright-Ryan developed cost-benefit analysis and detailed estimates to support challenging decisions between various window details, five wall section alternatives and more than 10 different HVAC options to help the team select and install the highest-performing, most cost-effective systems possible.

This affordable 48-unit apartment project in Brewer, Maine, was just awarded its final PHIUS (Passive House Institute U.S.) certification.

It also leveraged progressive methodologies in project management, including lean construction, to ensure the achievement of the stringent results set forth by PHIUS. The project is estimated to be over 60 percent more energy efficient than a code building and is targeting a site energy use intensity of 22 kbtu/sf/yr. These results were achieved within the fixed cost of construction (roughly $139/sf) defined by requirements for a publicly funded project under the Maine State Housing Authority.

Cordelia Pitman, director of preconstruction services for Wright-Ryan, is thrilled with how the project turned out and credits a collaborative relationship with all parties for the results. "These [affordable] projects are severely budget challenged," she points out. "Maine sets aggressive targets for cost per unit of housing. We are not a wealthy state, and we don't think low-income housing should cost hundreds of thousands of dollars."

"Passive House means comfort and efficiency," notes CHOM Executive Director, Cullen Ryan. "This building is super insulated, and the development team carefully ensured that the building envelope was completely tight."


COMMUNITY HOUSING OF MAINE

COMMUNITY HOUSING OF MAINE

Power play. Photovoltaic panels and rooftop HVAC units helping make Village Centre Apartments 60 percent more energy efficient than a typical code building.

Let Models Inform Choices

Once it was determined Passive House was the route, the team used 3-D energy modeling to figure out what systems and products to use. "The beauty of Passive House is that it is basically a performance goal," Pitman explains. "The building has to consume a limited amount of energy, and occupant comfort is a critical metric. It's not based on how far you schlepped your drywall or where you bought your brick."

Because human comfort is a main driver in the Passive House program, the team had to pay careful attention to product choices. "The temperature and humidity of the units needs to stay near constant. You can see how different choices would affect the occupants. For example, inside the window can't be 32 °F; it has to be comfortable to the extent that you'd want to sit by the window year-round," Pitman says.

Like all projects, trade-offs had to be made. With a tight budget, the team consulted the modeling and opted to move insulation from under the slab to the walls and to amp up air sealing. The group also explored a large number of window options and ultimately chose to invest in a more energy-efficient window because it reduced the HVAC load appreciably.

Hold Feet to the Fire

When it came to air sealing, the team got down and dirty. "Air sealing is a challenge on the exterior shell," Pitman says. "We used a spray-applied air vapor barrier, lapping it into windows and door openings. There was specialized tape at windows and doors, and caulking at electrical and plumbing penetrations. We asked ourselves, 'Who is responsible for air sealing these penetrations properly in the field?'"

These results were achieved within the fixed cost of construction (roughly $139/sf) defined by requirements for a publicly funded project under the Maine State Housing Authority.

During construction, the team checked their work as they went. "Several people on our staff are trained to use the blower door apparatus we have in-house," Pitman says. "And we found and corrected leaks: 'No one put the ring around the plumbing.' 'No one caulked this.' You really need to do your work to make sure

these things get done."

Horizon Residential Energy Services Maine served as the PHIUS rater and conducted readings to verify compliance as well.

Flexibility Wins the Day

Because of the high R-Value of the envelope, the team was able to downsize the HVAC and leverage ERVs over traditional systems. The team also received a waiver from the State of Maine for an exception to use electric (instead of hot water) baseboard heat. "The state has legislation in place to shelter occupants from potentially high electric rates. However, with today's more efficient heat pumps, the tight envelope, ERVs tempering air, and human heat and cooking heat, the demand for heat from electric is low."

According to Cullen Ryan, CHOM's executive director, subtracting a heating system counterbalanced most of the cost of the improvements. "For very cold winter days, there is some electric heat—about the equivalent of a third of a hairdryer in each apartment. That's very minimal, and it is quite possible it will never be used, even in this climate. Imagine not needing any heat in Maine for most of the winter."

Overall, the design and construction costs were approximately 3 percent higher than a typical building, but Erin Cooperrider, development director for CHOM, states, "we think that was worth the effort and investment, and we are pleased to be a pioneer in this area."

Although AC is not required, Wright-Ryan priced split systems as an add-alternate, which CHOM was able to select during construction. (Window units were not an option, because casement or tilt-turn windows were spec'd for their higher efficiency compared with double hung.)

"What surprised me was the ERVs," Pitman says. "One product offered tiny ERV tubes in the wall that would draw in fresh air and recover heat. That would have been the cheapest option, but we needed two for every living, dining and bedroom—that's over 300 holes in the building!" Shuddering at the thought of potential air infiltration, the team spec'd one ERV for each stack of 12 units.

Pitman also notes that the results are tougher to achieve in Maine than in more temperate Europe, where the Passive House program originated. "PHIUS developed the PHIUS+ 2015 pilot program to define climate-specific standards. To achieve the aggressive results here, you need to crush your energy use with an efficient envelope and offset with solar or wind." Village Centre features a 100-panel, roof-mounted 26kW photovoltaic array that is grid connected

Katrin Klingenberg, co-counder and executive director of PHIUS, is excited about the exponential growth of PHIUS+ certification for affordable multifamily projects in recent years. "Hats off to CHOM and the entire development team on going the extra mile to achieve PHIUS+ certification for this outstanding project and working collaboratively to achieve the health, comfort, safety, resiliency and efficiency benefits that are the hallmarks of the passive building standard," she says. "The success of projects like Village Centre sends a powerful message to the industry that these levels of comfort and performance are possible and affordable, and serves as an inspiration and model for what is achievable for future building projects in North America." GB

"PHIUS developed the PHIUS+ 2015 pilot program to define climate-specific standards. To achieve the aggressive results here, you need to crush your energy use with an efficient envelope and offset with solar or wind."

Cordelia Pitman

Director of Preconstruction Services, Wright-Ryan

Better Than Code

Ranch Style REDUX

Visible changes blended with hidden additions make this home sustainable from top to bottom

This remodeled ranch-style home includes LED lighting and low- or no-volatile organic compounds on walls.

CREDIT: ROBERT M. CAIN, ARCHITECT

GREEN BUILDER STAFF
PHOTOS BY ROBERT M. CAIN, ARCHITECT

CALL IT A CASE OF AGE BEFORE BEAUTY. When a 1950s ranch-style home just outside of downtown Atlanta began to show its years, the owners decided it was time for a "redux." The 2,100-square-foot dwelling was completely gutted and renovated to include several sustainable features and eye-catching design work on the interior and exterior.

The remodeling—a combined effort of local architecture firm Robert M. Cain and contractor Pinnacle Custom Builders Inc.—transformed a bland, outdated house into a dignified work of modern architecture.

The front of the home features additions of a garage and master bedroom, which creates a distinct entrance courtyard that is further defined by low stone walls. The home's original eaves wrap horizontally around the exterior of the house seven feet above the floors, a thoughtful homage to the horizontal design of traditional 1950s homes. Garapa decking, warm-toned stucco, natural stone and landscaping stone help the remodeled components of the outdoor space blend almost seamlessly into the property's natural elements.

"This [renovation] satisfies the owners' desires to bring order to a chaotic plan and open the home to the beauty of the deep-wooded lot," the Robert M. Cain firm notes on its website. "[It respects] the style and contributes a highly visible example to the community of how similar ranches can remain true to their roots and yet be adapted to current lifestyles."

WELCOME TO YOUR NEW (EARTHCRAFT) HOME

With all renovations completed, the structure is now an EarthCraft-certified home (**www.earthcraft.org**). Such properties typically feature energy-efficient appliances and lighting, resource-efficient building materials, high-quality indoor air and an emphasis on water conservation. Homes are required to pass diagnostic tests for air infiltration and duct leakage standards. Meanwhile, homeowners are educated on all of the home's sustainable features to ensure proper use and maintenance.

This home's new sustainable components include insulating and de-venting a crawl space to allow a vapor barrier, radon venting and

CREDIT: ROBERT M. CAIN, ARCHITECT

Renovations included a new deck near the main living area for visual appeal.

installation of insulated ducts. Spray foam insulation in the roof and exterior crawl space walls and blow-in spider insulation in the exterior walls makes the home airtight. ClimateMaster's *TEV038* geothermal heat pumps and an energy recovery ventilator were added to the crawl space to improve ventilation.

Additionally, three 200-foot-deep vertical geothermal wells were installed below the driveway and front yard for more-efficient HVAC and hot water heating. This ground-source heat pump system connects to the basement and utilizes the Earth's temperature to provide consistent heating and cooling, with minimal energy needed from the machines. During the winter, heat from the ground is extracted and pumped into the house. In the summer, heat from the home is removed and absorbed back into the earth.

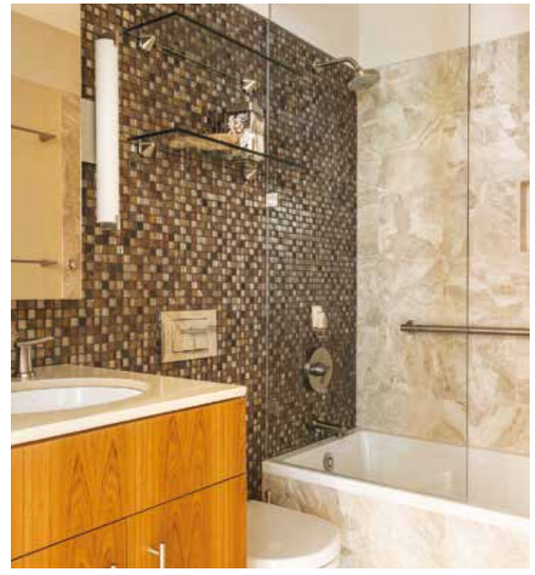
WASTE NOT, WANT MORE

The homeowners demonstrated their dedication to sustainability and conservation in several other ways. While their home was gutted during renovation, original oak flooring and brick veneer were salvaged for reuse in the project. High albedo (reflective) metal roofing was installed to reflect solar rays away from the home, helping to keep the interior cool. In addition, materials with low- or no-volatile organic compounds (VOCs) were used in the renovations and finishes throughout the house.

At the homeowners' request, extensive glass was added to the house wherever possible to allow maximum amounts of natural light in, reducing the need for electric lighting during daytime. When the sun sets and natural lighting is no longer an option, the homeowners illuminate their interior with LED lamps.

The windows also offer unique views of the large, wooded property's unusually deep slope. As avid gardeners, the homeowners wanted to highlight their gardens, so a deck was added off of the main living area facing the landscape to provide the best views possible.

Thanks to Atlanta's mild climate, the deck also serves as a functional expansion of the living space. After dark, LED lights in the eaves brighten the driveway at floor level. **GB**



CREDIT: ROBERT M. CAIN, ARCHITECT

Water for locales such as the bathrooms is more-efficiently heated by geothermal wells below the driveway and front yard.

*More information about this project from Robert M. Cain (**www.robertmcain.com**) and Pinnacle Custom Builders (**pinnacle-custom-builders.com**) is available at **www.robertmcain.com/ranch-style-redux**.*

PROJECT TEAM

Architect: Robert Cain, Carmen Stan and Juliann Tompkins with Robert M. Cain, Architect
Builder: Marlin Brackett, Pinnacle Custom Builders

PRODUCTS SPECIFIED

Appliances: Energy efficient
Cabinets, Shelves, Millwork: custom teak veneer
Building Envelope: Zip Wall, vapor barrier and 3-coat system stucco
Waterproofing: cold-applied, water based, liquid waterproofing membrane with no VOC content
Countertops: quartz and downstyle materials that are not brand names
Decks: Garapa decking
Door/Windows/Hardware: YKK thermally broken storefront system with low-E coating and solar heat gain coefficient; custom solid wood teak veneer pivot front door
Electrical: LED fixtures throughout the home
Exterior Finishes: Garapa horizontal boards garage door, 3-coat system stucco and stone
Flooring: reused existing oak wood floors; new oak floor to match existing in the addition
Furniture: owner's mid-century existing furniture
Garage Doors: DoorSmith (**www.doorsmith.com**); is 20 feet wide, with 2-by-6 garapa boards finish
HVAC/Ducts: geothermal heat pumps with 200-foot-deep vertical wells and an energy recovery ventilator
Insulation: spray foam insulation in the roof and exterior crawl space walls, and blow-in spider insulation in the exterior walls
Lighting: LED fixtures
Paints and Stains: low- or no-V.O.C. materials and finishes throughout.
Pavers: Reused existing salvaged brick
Renewable Energy System: ERV system
Roof: high-albedo metal roofing was installed to reflect solar rays away from the home
Water Heating: geothermal

A Resilient Prototype

BY JULIET GRABLE

GREEN BUILDER BUILDING A BETTER WORLD

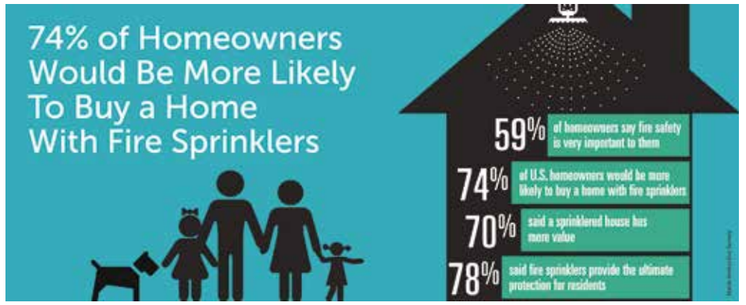
THE ARC HOUSE

By Shelter Dynamics

Part 3 of The Arc House Focus Series

From urban-infill residence to off-the-grid retreat, The Arc House is at home anywhere

JIM GREGORY, FOUNDER of Shelter Dynamics, likes to call The Arc House a "demonstration of a direction" in housing. Its small footprint, independence from the grid and versatile design make it an ideal solution for urban, suburban and rural settings. The Arc House can serve as a primary residence for a single person or a couple, or it can be used as a retreat, vacation home or "mother-in-law" unit. Clusters of Arc Houses can create small communities, based on the cooperative housing model, in which each household enjoys private space but also shares common areas such as courtyards and gardens.



THE FACTORY ADVANTAGE

The Arc House is factory built and transportable, giving it flexibility in its ultimate destination. Gregory envisions his product as a solution for West Coast states first.

> "As a business, we must make money to be sustainable—which, for many, is the ultimate scorecard. Our goal is to pass a higher test, and that is to only do things that will benefit the future of mankind."
>
> — Jim Gregory, Shelter Dynamics

"Shipping and logistics pretty much dictate that we stay west of the Rockies and south of Seattle," says Gregory. "However, we are looking at the potential for kits or partnerships that might help meet the demand in other areas."

Shipping requires a special permit and—depending on the jurisdiction—at least one pilot car, sometimes two. The buildings are set with a crane, which can drive up the cost if the site is remote.

Regardless of its destination, each Arc House must be built according to approved plans and meet the standards of the California Factory Built Housing Code. For his first prototype, Gregory made the curved beams that form the skeleton of the structure himself, using ⅜-inch strips of structurally rated Douglas fir glued together with marine epoxy. These "epoxy-lams" were so strong, they exceeded the testing machine's capacity. Now he is having glu-lams made by a third party, but they—and the structure—are still exceptionally strong.

Gregory plans to build Arc Houses in a "tent factory" near his home in Ridgefield, Calif. Each unit is inspected in the factory by a third-party inspection agency—in this case, RADCO Plan Review and Inspection Services. In addition, Gregory developed and must maintain a quality control program to ensure the process is replicated with each new unit. The dwellings must also meet the standards of local jurisdictions for snow and wind loading, fire resistance, setbacks and other criteria.

Compelling evidence. As this demonstration shows, a home equipped with fire sprinklers stands a much better chance of surviving a fire with minimal damage than one without such a system.

Building in the factory provides more control over the process, allows for specialized teams of workers and produces less waste. Gregory estimates that building in the factory can reduce to zero the eight pounds per square foot of material that is usually wasted in site-built construction. And for Gregory, this is as important as the finished product.

FIRE, WIND AND RAIN

The construction and durability of The Arc House also gives it an edge. Exterior materials were chosen carefully to ensure resistance to fire, wind and extreme weather. A combination of *Bayseal* spray foam and *Bayblock* acrylic roof coating from Covestro protect the curved portions of the structure from moisture, UV degradation and temperature fluctuations. The straight side and ends of The Arc House are clad with *Allura* fiber cement siding over DuPont *Tyvek* house wrap. Fiber cement siding is extremely durable, fireproof and resistant to insects. When used in combination with a weather-resistive barrier, this system also offers superior moisture protection.

Inside, a fire sprinkler system protects The Arc House. In California, home fire sprinklers are required in all new factory-built homes, and in one- and two-family site-built homes and townhomes. According to the National Fire Protection Association (NFPA), home fire sprinklers save lives and property. Automatic fire sprinkler systems cut the risk of dying by about 80 percent and reduce the average property loss by about 70 percent.

In The Arc House, fire sprinklers will protect not only the occupants, but also the high-quality interior casework, flooring, appliances and finishes. The dwelling was built for longevity, inside and out.

After all, says Gregory, "Sustainability starts with building something that lasts for a long time." GB

Resilient Features:

- Wildfire resistance
- Grid independence (Solar PV, inverter and battery system)
- Rainwater harvesting and graywater reuse systems
- Water-conserving fixtures
- Factory-built construction and mobility
- Repairable and modular components
- Fire protection system

Built to last. Fiber cement siding is extremely durable, fireproof, and resistant to insects and Mother Nature.

Soaking it up. The ECO Rain subsurface irrigation mat can save up to 70 percent of the water used in conventional irrigation. Even more water is saved if graywater is used as the source. www.ecorainusa.com

Demonstrating Water Security

A solar array and integrated battery storage give The Arc House extreme flexibility in where it can be located, and allow it to operate on or off the grid. This kind of "energy security" makes the Arc House resilient in the face of changing energy infrastructure.

But the dwelling is also moving toward water security. It is pre-plumbed for graywater reuse. Water from both the shower and washing machine are drained separately from the rest of the home's wastewater and can be routed into a graywater storage tank or irrigation system.

The Arc House has demonstrated graywater solutions such as the *ECO Rain* irrigation mat, which utilizes graywater to efficiently irrigate plants at the root level. Developed in Germany, a geotextile mat with integrated driplines called the *iMat* uniformly disperses water throughout the entire surface area, storing and releasing it slowly over time.

Solutions such as these will only become more urgent, especially in drought-prone regions where climate change threatens the security of water supplies and drives up costs.

Selling point. Most homeowners favor homes that are equipped with fire sprinklers.

The Home Fire Sprinkler Advantage

Installing residential fire sprinklers not only makes for a more resilient, sustainable structure, there are also compelling business reasons for installing them. Builders and developers can take advantage of several attractive "trade-ups" when they make home fire sprinklers a standard offering in their new homes:

- **Slimmer roads.** Traffic lanes may be narrowed, reducing the amount of pavement in every linear foot of street in the development.
- **Longer dead-end streets.** Dead-end streets can be longer, which translates into additional building lots.
- **Tee turnarounds.** The permitted use of tee turnarounds in sprinklered developments can create at least one additional lot per cul-de-sac.
- **Development flexibility.** Steeper street grades and building sites farther from paved fire vehicle access may be permitted.
- **Additional units.** Although the actual percentage may vary, increases up to 20 percent are not uncommon.
- **Water supply.** Required fire flows for fully sprinklered developments can be greatly reduced compared to non-sprinklered developments.
- **Hydrant spacing.** Supply mains may be reduced and hydrant spacing can be increased.
- **Life and property.** Over time, communities with fully sprinklered developments should see a decrease in fire death rates and property loss.

In addition, some states or municipalities offer incentives for residential fire sprinklers. For example, the state of New Jersey has a law that eliminates the standby fees for stand-alone fire service water lines of two inches or less, and the city of Altamonte Springs, Florida, allows a 40 percent credit against the water connection charge for residences with sprinklers.

*For more information, visit the National Fire Protection Association (http://www.nfpa.org) and Home Fire Sprinkler Coalition (***http://homefiresprinkler.org/***) websites.*

The Arc House

SMART + SOLAR

GREEN BUILDER BUILDING A BETTER WORLD

THE ARC HOUSE

By Shelter Dynamics

Green Builder Media has a decade-long history of identifying and investigating the most topical, cutting-edge issues of our time.

Lately, we've been focusing on the evolution of the smart home, which converges smart home and solar technologies to provide homeowners with the ultimate control over their energy future.

To bring this concept to life, Green Builder Media has partnered with specialty modular builder Shelter Dynamics to showcase their prototype of next-generation living, The Arc House, a hand-crafted tiny home that is simultaneously net zero, resilient, intelligent, and sustainably designed. The Arc House offers ideas for independent, self-sufficient, and sustainable living.

To learn more about The Arc House, visit www.greenbuildermedia.com/vision-house-arc-house or contact Cati O'Keefe at cati.okeefe@greenbuildermedia.com

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Saving Water

Tips, Technology and Common Sense Solutions for a Thirsty World

Opening the Graywater Spigot

Building codes are the last obstacle to extensive use of graywater in homes

CREDIT: KB HOME

It just makes WaterSense. KB Homes' Double ZeroHouse models in Northern and Central California are designed to achieve net-zero energy usage and conserve as much as 70 percent of the freshwater that would traditionally be used in a typical resale home.

BY CATI O'KEEFE

TODAY, THE TECHNOLOGY AND KNOW-HOW exists to take graywater from washing machines and showers—as well as rainwater collected from roofs—and use that water to flush toilets and irrigate landscapes. That same water can be brought back into the house, treated, and used yet again. It makes a lot of sense and saves a lot of water, so why isn't it happening, or even mandated, everywhere?

"All water reuse scenarios are doable, and most of them are covered by the current code," says Doug Pushard, founder of HarvestH2o (http://www.harvesth2o.com/) and a designer of residential water management systems. "However, there are some holes—the codes have not been integrated. The rainwater code was driven by the American Rainwater Catchment Systems Association, and the graywater code came from states doing it and publishing best practices."

STRICT MESSAGES

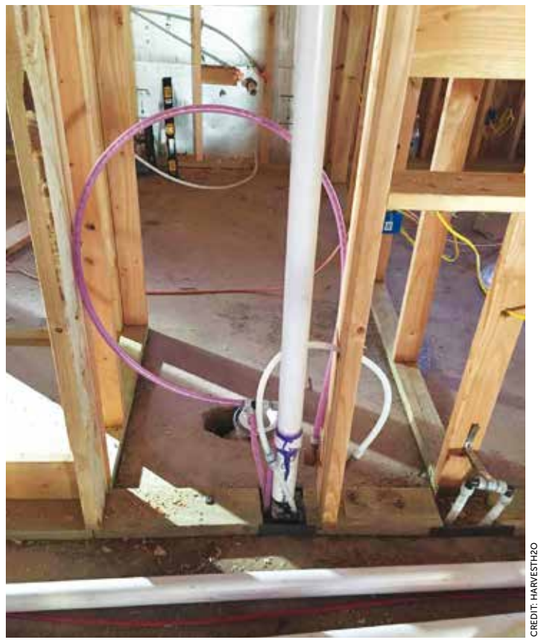
Builder Kim Shanahan, executive officer of the Santa Fe Area Home Builders Association (**www.sfahba.com**), is at the forefront of conservation efforts in the water-conscious city. "Santa Fe area home builders recognized years ago that our community's future growth was tied to the water supply," Shanahan says. "If we can't stretch our limited supply of water, we can't continue to grow and the building industry would suffer."

Because Santa Fe adopted certain codes, the municipality is poised to take advantage of water-saving reuse. "We are going to be allowed to bring water back into the house," he says. "We adopted 2012 UPC and UMC Building Codes, as well as some chapters of the code that the State of New Mexico hasn't even adopted."

The upshot is that the municipality can bring water back into the house and reuse that water for toilet flushing and washing. "It's not unique to Santa Fe," Shanahan reminds. "Anyone using 2012 UPC and UMC Codes in their entirety can do this."

The code is quite strict. It stipulates, for example, that the water being brought back in the house, even for use in toilets, be "potable," ostensibly to protect pets or kids who happen to dip into that toilet water.

Shanahan believes even this high bar can be reached. "We know we can treat water that has come back in the house to this higher standard than the required level, and we have the filtration and UV technology to do this," he says. "It is the future for homes: net zero energy, net zero water."



CREDIT: HARVESTH2O

A loyal flush. Using graywater to flush water is a big water saver. This purple pipe system from HarvestH2o directs water for a house in Santa Fe. The 2012 UPC and UMC codes that permit this stipulate that the water be brought back into the house.

"Few people had indoor bathrooms 100 years ago. A hundred years from now, we will all be harvesting water and sending it back into the system, potable and non-potable. It just makes good sense."

Santa Fe Gets 'More Efficient' With Water Building Code

BY CATI O'KEEFE

SANTA FE HAS become the first municipality in the nation to integrate a performance-based water efficiency requirement in its building code.

Santa Fe's bill, which adopts the Water Effiency Rating Score (WERS) (**www.wers.us/**), is part of a larger update to the city's residential green building code. "Santa Fe area home builders recognized years ago that our community's future growth was tied to the water supply," says Kim Shanahan, executive o fficer of the Santa Fe Area Home Builders Association. "If we can't stretch our limited supply of water, we can't continue to grow and the building industry would suffer."

For the past year, these changes have been reviewed and discussed at multiple public hearings. The Sustainable Santa Fe Commission was the first to approve residential green building code updates, followed by the Santa Fe Planning Commission, the Public Works Committee, the Water Conservation Committee, the Finance Committee and the Public Utilities Committee.

"Santa Fe is taking an unprecedented step in adopting a performance-based requirement and should be commended for it," says Green Builder Coalition Executive Director Mike Collignon. "By going with [this] approach instead of a prescriptive requirement, Santa Fe is giving its design/build community greater design and product flexibility than any other city in the country."

BURDEN OF PROOF

Right now, Shanahan is battling codes and, therefore, costs. "It could be expensive to convince an engineer and building code officials that a water reuse system is foolproof," he says. "You need a filtration and UV system, and have a failsafe delivery system and a backflow preventer." Without all of this codified, it could be challenging for building officials to approve on a project-by-project basis.

While codes catch up to what innovative designers and builders can do, Pushard thinks it's best to use rainwater in the house, as it is the highest quality. "Often, rainwater is better quality than the source water for most municipal water companies," he notes. "It doesn't take much treatment to get to flushing quality, nor to potable quality."

WATER RIGHTS COMPLEXITIES

The issue of downstream water rights has hampered code adoption in many areas. Colorado is a well-publicized example of the tricky business of water reuse. Because of water compacts with downstream users, the state outlaws capturing of roof water. But in reality, simply using water twice or three times before letting it go downstream shouldn't reduce the amount of downstream water and in fact could actually increase it while making it more manageable, according to Pushard.

"Capturing rainwater reduces stormwater. Using it inside actually increases the amount going into the sewer system, but on a slower, more-manageable basis."

"Capturing rainwater reduces stormwater," Pushard explains. "Using it inside actually increases the amount of water going into the sewer system, but on a slower, more-manageable basis. For cities, with or without combined sewer/stormwater systems, this is an easier, less-costly approach, which can reduce or eliminate the need for expensive system-wide upgrades."

But population sweeps aside that benefit. "Almost everyone is downstream of someone else upstream," Pushard points out. "The loop is just getting smaller."

It's not as big an issue in Santa Fe. "The plumbing code chapters we've adopted address roofwater and runoff, which opens things up, especially in the West, which has limited water resources," says Shanahan. "Water is a limit to growth, and with more people coming here and fewer resources, the only solution is to wring more water out of the available building lots."

Pushard thinks individual water treatment "plants" in homes are the answer to a water-smart future: "The projects that get the most press coverage are the big whole-system projects," he says. "That's one approach. Another is house-by-house, neighbor-by-neighbor, community-by-community, until it is just part of the invisible infrastructure."

Ultimately, all the arguments will pass and graywater use will be an accepted function, Pushard says. "Few people had indoor bathrooms 100 years ago," he notes. "A hundred years from now, we will all be harvesting water and sending it back into the system, potable and non-potable. It just makes good sense."

CREDIT: HARVESTH2O

It's a wash. HarvestH2o designed this purple pipe system for a house built by Modern Design + Construction to use graywater for clothes washing. An average U.S. household does nearly 400 laundry loads a year, so this system means big water savings.

TWICE AS NICE: KB HOME'S 'DOUBLE ZEROHOUSE'

National homebuilder KB Home has been challenging the status quo with its Double ZeroHouse projects.

Several demonstration homes, located in drought-prone Northern and Central California, are designed not only to achieve net-zero energy, but to demonstrate water conservation, both inside and outside the home. Double ZeroHouse 2.0 was built in Lancaster, California. More recently, Double ZeroHouse 3.0 was completed in KB Home's Fiora at Blackstone community in El Dorado Hills.

Both homes feature Nexus eWater graywater treatment systems. These combine the eWater Collector, the NEXtreater, which treats graywater to near-potable standards, and the NEXservoir, which stores treated graywater. The Double ZeroHouse in Lancaster uses treated graywater to irrigate landscaping, saving up to 40,000 gallons a year. The El Dorado Hills project uses the graywater to flush toilets and also features the NEXheater, which uses a heat pump to extract heat from graywater and uses it to heat incoming potable water.

"With drought conditions currently affecting every corner of California, KB Home recognizes the importance of embracing innovations like the advanced graywater recycling system demonstrated in the ZeroHouse projects," the company notes. "It's important to leverage the technology of the future to address the problems of today."

CREDIT: OREGONDOT

Mother Nature's share. Rainwater can be of higher quality than a water agency's source water, making it a more cost-effective choice for graywater. But legal red tape hampers its use in some states.

SIMPLE DOES IT

While others eager for more-sophisticated graywater/rainwater storage and filtration systems duke it out in the codes arena, builders can start with a simple, cost-effective landscape irrigation system.

Bill Roth, president of Modern Design + Construction in Santa Fe., N.M. (**www.moderndesignplu sconstructioninc.com**), has been working on graywater systems for 10 years. "We don't do capture systems, just distribution systems. You take the water out of the house and to various locations," he says. "These systems aren't bombproof, but they don't have any moving parts, and you aren't treating or storing it."

In one application, Roth collected water from all the fixtures of a home, and ran it via 2-inch pipe to two distribution areas (small leach fields) in the yard. He used the calculations provided by the 2012 plumbing codes for minimum side yard capture area.

Roth points out that the technology needed for graywater use is already part of the builder parlance. "It's taking PVC pipe, dual plumbing fixtures, backflow valves, a manhole and a bit of engineering," he says.

Selling clients on graywater is straightforward. "It's a case of sitting down with a client and introducing the concept of a passive gray system early in the game," he says. "In a lot of cases, they are interested because of the low cost."

He estimates a system may add $800 to $1,000 to the price of a 1,500-square-foot house, but that's not a deterrent. "It's a lot easier sell than rainwater catchment, and it's a lot of water," Roth says. "A *lot* of water."

DON'T FORGET THE 350

Regardless of a state's particular graywater code (if any), builders need to keep in mind that NSF/ANSI 350 certification is essential for on-site commercial and residential water reuse systems. NSF International tracks companies (**http://bit.ly/2gilRnR**) with this status; as of mid-November, four were certified: Bio-Microbics Inc. (**www.biomicrobics.com**) in Shawnee, Kans.; E-Z Treat Corp. (**www.eztreat.net**) in Rocky Mount, N.C.; INTEWA Ingenieur-Gesellschaft für Energie- und Wassertechnik GmbH (**http://bit.ly/2f1tWak**) in Aachen, Germany; and Nexus eWater Pty. Ltd. (**www.nexusewater.com**) in San Diego.

Companies can use one service to help acquire another for less. INTEWA's AQUALOOP system, for example, is part of WERS-Manufacturer, which gives it a 20 percent discount on the NSF-certified version, according to Green Builder Coalition Executive Director Mike Collignon.

"I think we're going to see more western cities and states consider allowing graywater systems in their codes," he says. "The combination of a finite amount of freshwater and an increasing population is a recipe for necessary change. Thankfully, the products already exist for us to make that transition to a more water-efficient society." GB

CALL FOR ENTRIES

Green Builder magazine is looking for the best green homes that include sustainable features, innovative design, whole home performance, and integration with the natural environment.

For more information on eligibility, FAQs, or to enter your project, visit
www.greenbuildermedia.com/2016-green-home-of-the-year-awards-call-for-entries

cdpACCESS: The Good, the Bad and the Uncertain

An online portal built for the ICC plus a policy change equals streamlined code voting, but is the technology ready for prime time?

BY MIKE COLLIGNON

THE INTERNATIONAL CODE COUNCIL has over 20,000 governmental voting member representatives. However, the ICC requires these officials to annually register in advance of a vote. Unfortunately, not all take that step, so the number of eligible voters will be quite a bit less than 20,000. But thanks to an online portal built for the ICC and a policy change, all eligible voters can cast their votes without incurring travel expenses and lengthy stays out of the office.

In 2014, the ICC unveiled cdpACCESS, their new online code development platform. Designed as a way to increase inclusiveness in the code development process, cdpACCESS allows any registered user to submit and comment on code change proposals, collaborate with peers and (for ICC governmental voting member reps) the opportunity to vote.

SO MUCH POTENTIAL

The voting function is its best feature.

For those who attended the final action hearings (as they were then called) in October 2014, they were able to use electronic voting devices to both cast their votes and have those votes logged in cdpACCESS. When the vote was opened to the rest of the governmental voting member reps, the remote voters were able to see the in-person results. Those who attended could also log in and change their vote, if they chose to do so. This portal, along with the addition of Section 8.0 to Council Policy 28, was going to usher ICC into a new era of code adoption.

While cdpACCESS had undergone the expected beta testing, the ICC wisely decided to roll it out during the Group C cycle, which was largely the International Green Construction Code (IgCC) development cycle. This gave ICC a trial period of sorts, since the IgCC was one of the newest I-codes, it was considered more manageable than the legacy codes, and it had yet to be widely adopted.

The combination of the electronic voting devices and cdpACCESS didn't go 100 percent smoothly, but everyone understood that cdpACCESS was a new system, and it wasn't going to be perfect on the first go-around. The participants were very civil and polite about any glitches that occurred.

REDUNDANCY TO THE RESCUE

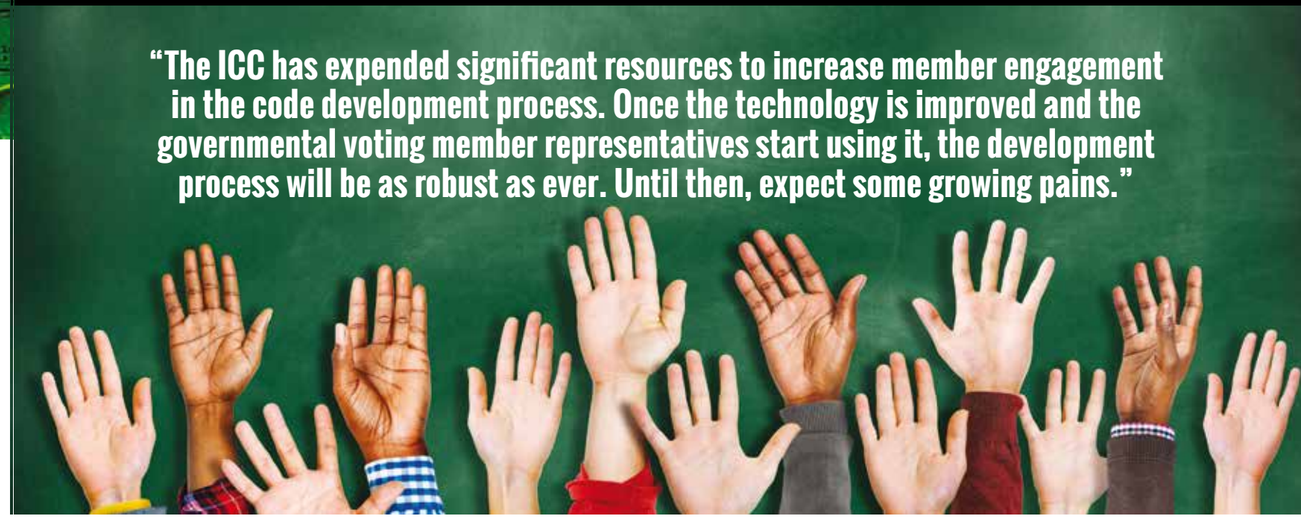
However, the stakes were much higher in the Group A cycle, as some of the more notable codes (plumbing, mechanical, building) were undergoing deliberations. This time, the technical difficulties weren't tolerated as well. ICC staff recognized that the in-person voters were losing trust in the electronic voting devices, so before the hearing concluded, they were scrapped in favor of hand/standing vote counts.

According to Dave Bowman, manager of codes at ICC, the electronic voting devices won't even make an appearance at the upcoming Group B public comment hearings. Vote tabulation will initially be done by a show of hands. "If we're not comfortable with that, then we'll actually take a standing count," Bowman says.

If you're at all familiar with professional sports, you know how easily teams request reviews of the officials' calls. With the significance of the proposals on the docket, it wouldn't be surprising to see vote counting on a number of proposals. This method of voting will probably lead to some long days (and nights) in the hearing room.

Because technology won't be used in the hearing room, it will cause a duplication of effort for those who attend in-person. The in-person vote will set the agenda for the online voting, but Bowman explained that "this year, because we're not using the electronic devices, the online governmental consensus vote will start at zero-zero. Those that are voting at the public comment hearing, we'll really need to encourage them to remember to go and participate in the online consensus vote".

Bowman said that ICC is working to remedy the problem with the electronic voting devices. They want to make sure the technology is "airtight and absolutely no way there will be a problem" in the future. But in the short-term, the time spent on hand/standing vote counts will create an extra burden on those voters who attend.



EXTENDING THE DEBATE

The other unintended consequence of online voting is that it opens a second lobbying period. The first lobbying period occurs during the weeks leading up to the public comment hearing. Special interest groups, from NAHB to regional energy efficiency organizations, produce and distribute voting guides. They encourage code officials to vote a certain way, and usually include rationales or reason statements. During the second lobbying period, these same groups will be reacting to the online voting agenda, making the final push for votes in their favor.

And that's where things get complicated. According to Section 8.1 of Council Policy 28, the following scenario is entirely plausible:

1. The code development committee votes to approve a code change proposal as submitted.
2. Voters in attendance at the public comment hearing reverse the committee action and overwhelmingly vote to disapprove the proposal.
3. The online voters obtain a simple majority and reverse the public comment hearing result, making the final action ... approval of the proposal as submitted.

WORRISOME OUTCOMES?

Believe it or not, it could get worse.

Council Policy 28 does not declare a minimum number of votes for a proposal's passage or disapproval. Because each proposal will start with a zero-zero vote total, if a proposal is deemed inconsequential, it's possible that fewer than 60 people could be deciding the fate of a proposal. (If you find that improbable, it happened on numerous occasions in Group B online voting.) Given the size of the voting membership, that is an alarming possibility.

(Note: On page 11 of the Group A results, it states: "In accordance with published procedures, this will require a minimum of 30 Online Governmental Consensus Vote (OGCV) votes cast for each code change proposal in order for the OGCV to be considered a successful voting measure. If the vote total is less than 30 for an individual proposal, the Final Action for that proposal will be the action taken at the hearing/two-step process, as applicable." However, this was a one-time decision on a handful of votes. This approach is also not 100 percent germane to the Group B cycle, since the in-person totals will not be reflected online.)

Finally, videos of all testimony are viewable through cdpACCESS. Bowman said he "would be surprised if we didn't know the number" of views a video receives. Conceivably, the ICC could compare the number of views with the number of votes, to get a sense of whether online voters are taking testimony into consideration. However, Bowman confirmed they are not able to correlate views to a specific voter.

The ICC has expended significant resources to increase member engagement in the code development process. Once the technology is improved and the governmental voting member representatives start using it, the development process will be as robust as ever. Until then, expect some growing pains.

FEEDBACK SOLICITED

ICC recently put out a "Call for Feedback" on the code development process. They are accepting additional rounds of feedback concluding on November 30, 2016 and February 15, 2017.

Visit **http://bit.ly/2cUzDei**. GB

Mike Collignon is the executive director of the Green Builder Coalition.

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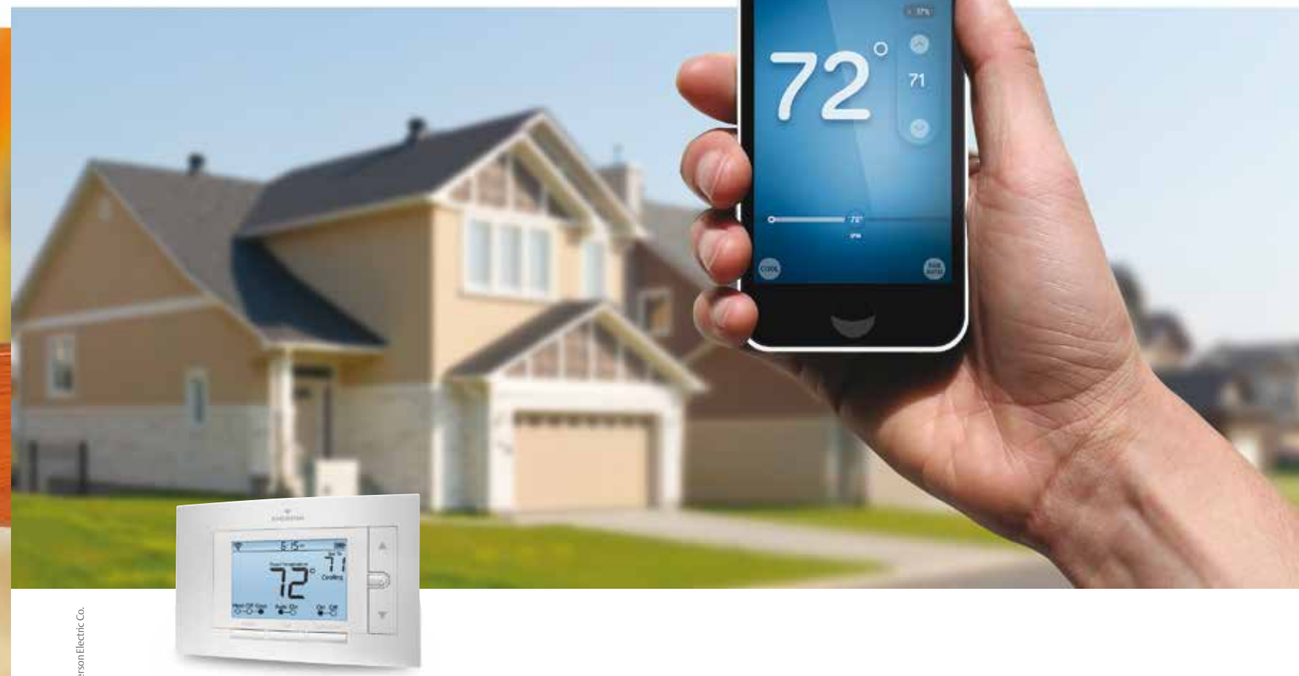

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High-Performance Plus Solar

For reducing dependence on fossil fuels, solar is everyone's darling—but when it comes to using it as a trade-off for a high-performance envelope, it loses its shine.

BY CATI O'KEEFE

BLAME IT ON THE SUCCESSFUL MARKETING CAMPAIGNS of the solar industry. Homeowners and builders alike have been taught: It's free! It's infinite! It's green! And, indeed, solar and other renewables are a huge game-changer in the bid to free ourselves from dependence on fossil fuels.

But now solar is strapped to the hot seat during the 2018 IECC debates. Energy efficiency advocates are lobbying heavily to make sure that the new code doesn't allow builders to weaken the building envelope simply by popping some solar panels on rooftops.

This issue became heated at the preliminary hearings in April, particularly over the inclusion of the RESNET/ICC Standard 301, which would make the HERS rating a path to code compliance. This worries energy efficiency advocates who point out that the HERS calculation offers the ability to factor on-site power production into the score, which in turn means that unless states put limits on solar being used as a trade-off for performance, builders would indeed be allowed to weaken the thermal envelope.

ERI VS. HERS: THE BACK STORY

The 2015 IECC established the Energy Rating Index (ERI) compliance alternative, which is modeled after RESNET's HERS. In order to comply with the IECC under the ERI path, the proposed home must have an ERI value equal to or less than the target established by the code. While the ERI compliance path has similarities to HERS (such as the similar 0-100 scale for setting the Index number), the HERS ratings have been used for green marketing of new homes and therefore offer the capability to include on-site power production in the calculation of the final HERS rating.

In contrast, the ERI number is intended to measure energy conservation to meet an energy efficiency compliance target, not energy purchased by the homeowner after conservation and self-generation are considered, and it sets climate zone-specific targets for ERI performance path compliance.

According to the Florida Building Commission in an April memo: "A plain reading of the 2015 IECC should suggest that if HERS software is used to produce [a calculation] for ERI compliance, the code user must omit the final step that would include on-site power. States adopting the 2015 IECC must provide specific guidance on this point to ensure that energy conservation requirements are implemented fully and are not substituted by on-site energy production."

If they don't omit the on-site power piece, says the organization, here's an example of the result: A typical Florida home with 5 kWh of solar PV and 2,400 square feet would be awarded in excess of 40 HERS compliance points. If this were permitted as a trade-off against energy efficiency, the home could be significantly less efficient than what the energy code would allow.

"The goal of our residential building code should be net-zero-energy-ready homes, and the ERI compliance path, adopted in the 2015 IECC, is the likely approach by which to measure that goal," says Curt Rich, president and CEO of the North American Insulation Manufacturers Association (NAIMA). "Unfortunately, the software tools used to calculate a home's ERI score exceed the scope of the energy code and allow on-site generation to substitute energy conservation when calculating a score. That's a fatal flaw in the ERI performance path, particularly when rooftop solar panels can generate upwards of 40 points toward a passing grade of 51-54, depending on climate zone."

RESNET stayed neutral on the renewables topic at the preliminary code hearings in April, primarily because its focus was lobbying for the inclusion of Standard 301 in future versions of the IECC, which RESNET's Executive Director Steve Baden, says "will simplify code language by striking duplicate provisions and ensures that the ERI approach is deployed using a standardized process from a consensus document."

According to Baden, the 2015 IECC's ERI isn't based on any recognized standard, while the proposed RESNET/ICC Standard 301 is an ANSI national consensus standard. "The provisions of standard 301 are consistent with the 2015 IECC Energy Rating Index provisions including the development of the Energy Rating Index, compliance software tool approval and the minimum capabilities of the software used to determine an ERI for a project."

The ANSI/RESNET/ICC Standard 301 is a whole-house assessment of a home, which includes on-site power production. "Standard 301 will continue to be a whole-house assessment because it drives HERS ratings," Baden continues. "You cannot get to net zero without on-site power production. As for on-site power production, there are reasonable arguments that there should be a limit on how much it can be credited for the ERI option." *(See "State Choices," left.)*

NO QUARTER

For some in the industry, though, any trade-off of the envelope for solar is taking energy efficiency backwards and should not be allowed at all.

"If you look at California in isolation, the requirement for performance for energy efficiency is higher than everyone else relative to 2015 codes," notes Ron Jones, president of Green Builder Media. "In order for us to reach the requirements of California, leave the building envelope alone, at worst, and then add renewables, instead of setting it up as either/or."

Jones believes that the only people manipulating the codes are the large production builders, such as Lennar, whose wholly owned subsidiary sells solar panels. "They put a deal in place that weakens the envelope and then have someone else [the homeowner] pay for the solar system. This isn't about solar versus the envelope; it's about the national builders."

Laura Urbanek of the National Resources Defense Council (NRDC) points out that a well-built envelope creates a resilient home, which is another reason renewables and high-performance shouldn't be an either/or proposition. "Hopefully, buildings will last for a 100 years. We need efficiency that can persist over that time," she says. "Efficiency is cost effective for the homeowner and can be combined with renewables, but there's no need to have one versus the other."

State Choices

Placing limits on power reduction is just one way states are grappling with the issue of onsite power production credits. To date, seven states—**Illinois, Maryland, Massachusetts, New Jersey, Texas, Vermont and Washington**—have finalized their adoption process. Some have also taken varied approaches to the question of renewables for ERI compliance:

- **Texas** prohibits the use of renewables for ERI compliance
- **Massachusetts** caps the value of renewables at 5 points toward ERI compliance
- **Washington** eliminates the ERI compliance path

CREDIT: MARIO BEAUREGARD

UNSURE FATE

301 made it through the first round of code hearings, but nothing is inked yet. "[301] had a lot of support on the floor," says Erik Makela of Cadmus, who consults for RESNET. "In the hearings, the discussion of renewables came up before the 301 discussion, and [taking renewables out of the code] got overturned. So ultimately when 301 came up, there was opposition from the groups who were against the renewable trade-off. We know there will be people at the hearings who will try to overturn the committee's decision on it, but from the RESNET perspective, 301 is a vetted standard. ICC even put their name on it."

It appears that, as Baden said, barring either side winning outright, the middle ground may lie in creating limits on how much on-site power production can be credited for the ERI option—though even that would be considered a loss by energy efficiency advocates.

"This is an issue where the old adage, 'let's not put the cart before the horse,' applies," Rich says. "While net-zero-energy homes necessarily require the use of renewables, it is the building energy code that ensures energy efficiency has been optimized to make that home net-zero-energy ready. It is our hope that the 2018 ICC residential code update process will put the focus back on the 'horse' of energy cost savings for the homeowner—that means focusing on energy efficiency." **GB**

Cati O'Keefe is the editorial director of Green Builder Media and the editor of CodeWatcher magazine.
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When You Trade a High-Performance Envelope for Solar...

- The homeowner gets a poorly performing, less comfortable, drafty home.
- The homeowner doesn't see the cost of solar as part of the true monthly cost of owning the home, because solar is often provided under a lease from a third party. This shifts the cost away from the home price and mortgage, which is good for builders, but it doesn't actually reduce costs for home buyers who may later opt out of the program and be left with a significantly under-performing house.
- The amount of energy being used by the home is not reduced by on-site renewable generation. The home continues to receive its electricity from the local utility, and while it may deliver "green" energy back to the local utility, it does not actually offset the energy use of the home where the system is affixed.
- The next homeowner in the door after a solar-topped home is sold may not retain the solar lease or equipment, and will then be saddled with high utility bills.

Case Study: Florida

The Florida Building Commission released a memo in April, *Renewable Energy Trade-Offs in the Building Energy Code* that reviews what would happen if on-site generation is allowed for compliance in the Florida Building Code.

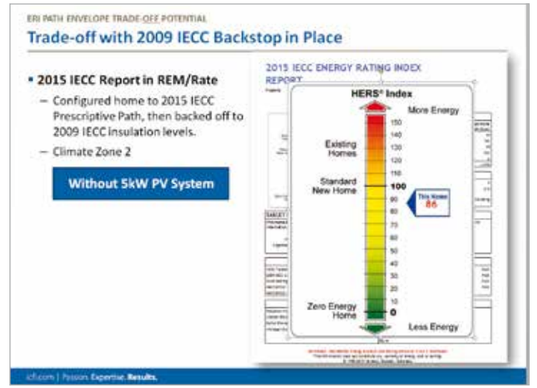

Figure 1

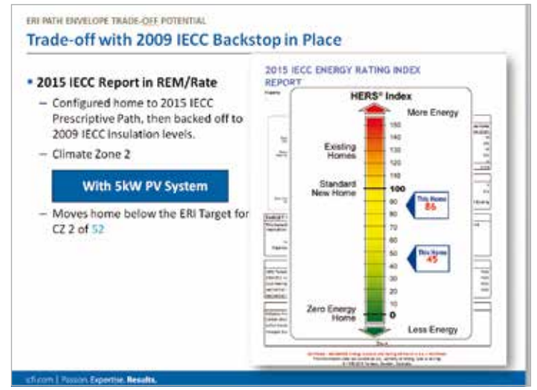

Figure 2

Check out this video that details the issues surrounding Florida's solar-versus-high-performance stance. http://bit.ly/2cUx6AB

FLORIDA ENCOMPASSES TWO CLIMATE ZONES for purposes of building energy code compliance—Climate Zones 1 and 2. For those climate zones, the IECC establishes an ERI compliance target of 52. This target was modified however, by Florida HB 535 to an index of 58 in both climate zones.

If on-site generation is allowed for compliance in the Florida Building Code, there is a very real possibility that homes will be constructed that meet only minimum efficiency standards and still meet the ERI target.

As Figure 1 illustrates, a home built in Tallahassee to minimum 2015 prescriptive standards and the 2009 thermal envelope standards receives a failing score of 86. That same home with 5 kW of solar panels (Figure 2) achieves a passing score of 45.

Allowing on-site generation to substitute for building energy conservation has a number of negative impacts:

- Building envelope energy efficiency measures like insulation, sealing and windows deliver efficiency for the life of the building. In the case of sealing and wall insulation, these measures are typically maximized at time of construction or the opportunity is lost for the life of the building.
- Failing to optimize the efficiency of the building envelope means a lost opportunity to reduce the size of heating and cooling requirement and to reduce the solar PV system needed to meet the home's electricity requirements.
- A less energy efficient home translates into higher utility bills to that homes occupants, even with renewable generation.

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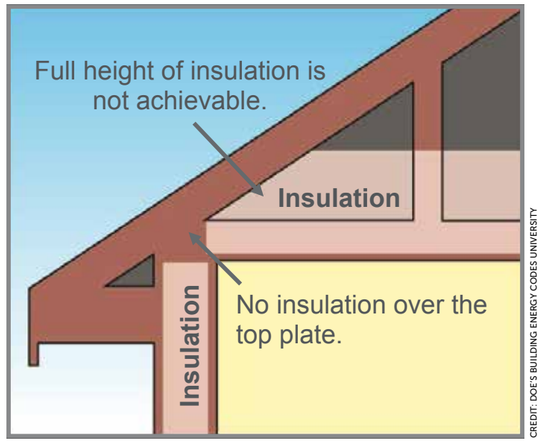
Ceiling Insulation: "Prescriptive" Options

Here's a quick primer on how to get the right R-value in ceilings when following the Prescriptive Path of the 2009, 2012 and 2015 IECC.

BY STEPHEN CARR

After conducting many code trainings with local building officials, builders and insulation companies throughout the nation, I realized there was a common question when it came to ceiling insulation: **"What R-value is the right R-value when following the Prescriptive Path?"** So, I broke this section of the code down and extended the answer to the other alternatives in the code where the project may comply. **There are two types of ceilings in the Energy Code: ceilings with attic spaces and ceilings without attic spaces.** Other than exceptions listed in the code, there are no trade-offs that will lower these R-values more.



CREDIT: DOE'S BUILDING ENERGY CODES UNIVERSITY

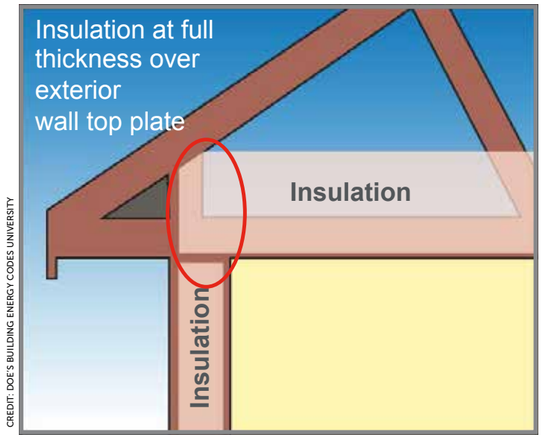
Figure 1

CEILINGS WITH ATTIC SPACES

FOR CEILINGS WITH attic spaces in climate zones requiring a Prescriptive R-38 or higher, the insulation in the ceiling assembly must follow the Prescriptive Method of the Code Table R402.1.1 (2009 and 2012 IECC) or R402.1.2 (2015 IECC). The insulation either does not cover the top plate or it is compressed to a level less than R-30.

If your Energy Code calls for a Prescriptive R-38 in the ceiling, then, as shown in Figure 1, that is the level to which the main part of the attic will be insulated. The code is assuming that near the eaves there will be less than R-38 and does not call out any requirements for that area. This also applies for R-49 required jurisdictions as well.

Look at Figure 2. In this scenario, a raised heel truss (or energy truss) allows for the full uncompressed R-value to be over 100 percent



CREDIT: DOE'S BUILDING ENERGY CODES UNIVERSITY

Figure 2

of the ceiling area while extending over the wall top plates, therefore qualifying the ceiling to reduce the R-value as follows:

- R-30 complies where R-38 is required.
- R-38 complies where R-49 is required.

It is the top plate that is the defining factor; if you insulate over the top plates you can reduce the R-value over the entire ceiling assembly.

CEILINGS WITHOUT ATTIC SPACES

WHEN YOU ARE building homes where there is no attic above the ceiling (slopes, roof assembly insulated, etc.), there are a few things to consider.

Where the insulation levels are required to be greater than R-30 (e.g., R-38, R-49, etc.), there won't be sufficient space to meet the higher levels. R-30 is allowed for 500 ft^2 or 20 percent of the total insulated ceiling area, whichever is less.

If the ceiling in question does not meet these requirements then either the U-Factor or UA Alternative will need to be calculated to determine compliance.

If all of the above methods don't work, the Performance Method must be used to determine compliance. This is where more trade-offs are allowed and help get the building in compliance with the energy code. For those states and municipalities who have adopted 2015 IECC, there is one more alternative which is the Energy Rating Index (ERI). GB

Stephen Carr is regional building science manager for TopBuild Home Services. Have a question? Email him at Stephen.carr@topbuild.com

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FROM THE TAILGATE

New Offerings for the Sustainable Minded

By Ron Jones

Real Builders Respect Building Codes

When people rail against building codes and regulation, it's often a smoke screen for acceptance of the lowest common denominator.

IF ONE WERE TO LISTEN only to the endless railings of the building industry voices against every form of regulation—but most especially any proposed increases in energy performance requirements and the attendant adoption of codes and standards that are developed to implement and enforce those enhancements—it might be easy to assume that the loud and stubborn opposition on the part of industry practitioners is universal. My experience tells me that nothing could be further from the truth.

Advocacy groups and special interest trade associations have much more at stake than just the concerns of their constituents. In the end, the most effective way for them to justify their own existence, and to validate the continuation of their lucrative operations, is to convince their target audiences that they need their protection, to perpetuate the notion of persecution, to promote the fear of change and to decry what they describe as the needless interference in their businesses by those regulators and enforcement officials who they portray as meddling adversaries.

In many cases, this is not a difficult sell. I have had more than one irate builder declare to me that they "just don't like being told what to do!" My consistent response is that he or she needs to get over it. We all are required to follow rules and regulations that have been deemed to serve not only our own safety and well-being, but also the common good. One can't help but wonder if such a position is little more than a smoke screen to excuse the acceptance of the lowest common denominator.

More often, however, builders have confided in me that while they do sometimes find regulations, codes and standards burdensome and annoying, they nevertheless appreciate the consistency, predictability and technical guidance they provide. They also point to codes and regs as the baseline that provides the perfect metric against which they can contrast their commitment to superior results and performance in their projects versus those who are satisfied to deliver only the bare minimum. I have never talked with a builder who claimed to know everything there is to know about building. Rather, they are glad to have the backstop of the body of knowledge and experience on which the rules are predicated.

Those who oppose requirements aimed at helping the building industry to improve the results of our collective labors would have listeners believe that they speak for all of us, that they have the best interests of those who live work and play in the built environment as their top priority, and that "affordability" can be legitimately substituted for "profitability" in their arguments against improved results. The shrill voices of opposition may be impossible to ignore, but they do not represent the whole of the industry, despite their efforts to convince us otherwise. **GB**

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