

5. Developing Effective Codes and Standards for Net-Zero Energy Buildings

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In the past couple of years, policymakers have come around to viewing energy codes as an opportunity to effect wide-ranging changes in energy use. The past two cycles of ANSI/ASHRAE/IES Standard 90.1 and the past and current cycles of the International Energy Conservation Code (IECC) already have resulted in improvements on the order of 30% in energy efficiency, in contrast to the single-digit improvements in prior versions. So-called “stretch codes and standards” designed to reach even further, notably ANSI/ASHRAE/USGBC/IES Standard 189.1 and the International Green Construction Code (IgCC), are also coming to the fore.

Leading organizations within the building community, including the AIA,¹ ASHRAE, the U.S. Green Building Council, and the Illuminating Engineering Society, as well as top design and construction firms and government agencies such as the U.S. Department of Energy and the General Services Administration, have identified net-zero energy buildings as the ultimate goal for cutting energy use in buildings and reducing their greenhouse gas emissions. Achieving widespread net-zero energy buildings through the adoption and enforcement of codes and standards is likely a long way off, but if we are to move an industry that often is slow to change, the discussion must start now.

Understanding how current building energy codes function, their shortcomings, and the possibilities for improvement are essential if we are to achieve cost-effective, technically sound net-zero energy buildings. Currently, there seems to be little attention focused on how energy codes function, whether they are getting us to our energy goals, and what future codes might look like.

Even though “energy” is in their names, current energy codes do not actually regulate energy use. They regulate the thermal envelope and the systems for HVAC and lighting that influence the use of energy but not the building’s actual energy use. The codes also are based on utilization in an ideal world where equipment, insulation, ducting, windows, doors, air barriers, lighting systems, equipment, and controls are all installed perfectly, where O&M requirements are followed to the letter, and where building occupants don’t override the

systems and make educated decisions about their energy use. In practice, the actual performance of buildings is never perfect, no matter how diligent the Building Team, operations staff, building occupants, and owner may be.

Moreover, current codes do not cover all the energy-consuming functions in a building, even though these functions contribute to the overall energy use and influence the energy use of equipment covered under the code. Plug and process loads and elevators and escalators generally are not included. In California, for instance, plug loads account for about 40% of overall energy use in buildings—closer to 65% in hospitals and restaurants.²

Finally, annual spending for code development, implementation, training, and enforcement is estimated at around only \$200 million dollars, well short of the \$810 million needed to ensure a 90% compliance rate.³ Current compliance rates also are unknown, although some reports indicate levels as low as 40%.⁴ This is far from the 90% compliance by 2017 mandated in the American Recovery and Reinvestment Act (Public Law 111-5).

Net-zero energy buildings are just beginning to enter the marketplace. However, to achieve energy independence and reduce greenhouse gas emissions, they and other buildings that are verifiably green throughout their life cycles must gain much wider adoption. The current approach to determining and regulating energy use will not get us there. If we are to get to truly net-zero energy buildings, we’ll need codes and standards that measure real (not just modeled) energy performance, account for all energy uses in buildings, and provide for post-occupancy regulatory scrutiny.

THE MANY FLAVORS OF CODES AND STANDARDS

Codes and code-intended standards are specifically written for adoption by jurisdictions to facilitate the achievement of community goals. Minimum codes and standards (such as the IECC and Standard 90.1) provide baseline levels that all buildings should meet. Stretch codes or standards (such as Standard 189.1 and the IgCC) require higher levels of achievement and can be used in a variety of ways by jurisdictions or individual building owners—for example, to apply to all buildings

1 *Architecture 2030, The 2030 Challenge*. At: http://architecture2030.org/2030_challenge/the_2030_challenge, accessed 23 September 2010.

2 *Architectural Energy Corporation, “Rethinking Percent Savings: The Problem with Percent Savings and the New Scale for a Zero Net-Energy Future,” 2009*. At: <http://www.archenergy.com/news/rethinking-percent-savings-the-problem-with-percent-savings-and-the-new-scale-for-a-zero-net-energy-future>.

in a jurisdiction, or to apply only to specific types of buildings as the basis for earning incentives. Stretch codes define a higher level of energy efficiency that may be used as the basis of voluntary programs (such as utility efficiency efforts) or government construction projects, or may be adopted by local jurisdictions to go beyond state-required minimums. Stretch codes are likely to be the first places NZEBs will enter the code world (see Figure 6-1).

Today's energy codes come in two basic formats, *prescriptive* and *performance*, each with its pros and cons. A possible third format, *outcome-based*, has begun to pique the interest of the building community.

PRESCRIPTIVE CODES: EASY TO USE, EASY TO ENFORCE, BUT REACHING THEIR LIMITS

Prescriptive codes provide minimum characteristics for many building components (e.g., R-values for wall and ceiling insulation, U-values for windows, and SEER or EER for unitary air conditioners). Prescriptive codes represent a checklist of requirements and minimally acceptable specifications, making them relatively easy for Building Teams to comply with and code officials to enforce.

However, prescriptive codes have several shortcom-

ings. Since they are based on strict requirements and updated on a fixed cycle (currently three years), they can be slow to incorporate new technologies. Nor do they reward more efficient design decisions that look at the building as a total system. Lastly, prescriptive codes favor projects seeking minimum levels rather than those seeking high performance.⁵

Moreover, criteria in prescriptive codes are based on the ideal, not actual practice. The building's actual total energy use cannot accurately be determined through the codes because the codes do not cover all energy uses (although building energy modeling does allow for determinations based on assumptions associated with unregulated energy uses).

Even though policymakers may believe that prescriptive energy codes will reduce energy used in new construction and renovations, prescriptive codes do not contain a requirement to measure energy use, to see if the desired results are being met. Moreover, the very nature of prescriptive codes and the many aspects of building design that they do not touch (such as window area and building massing, shape, and design) make it difficult to compare actual energy use between buildings even if it was required to be measured.

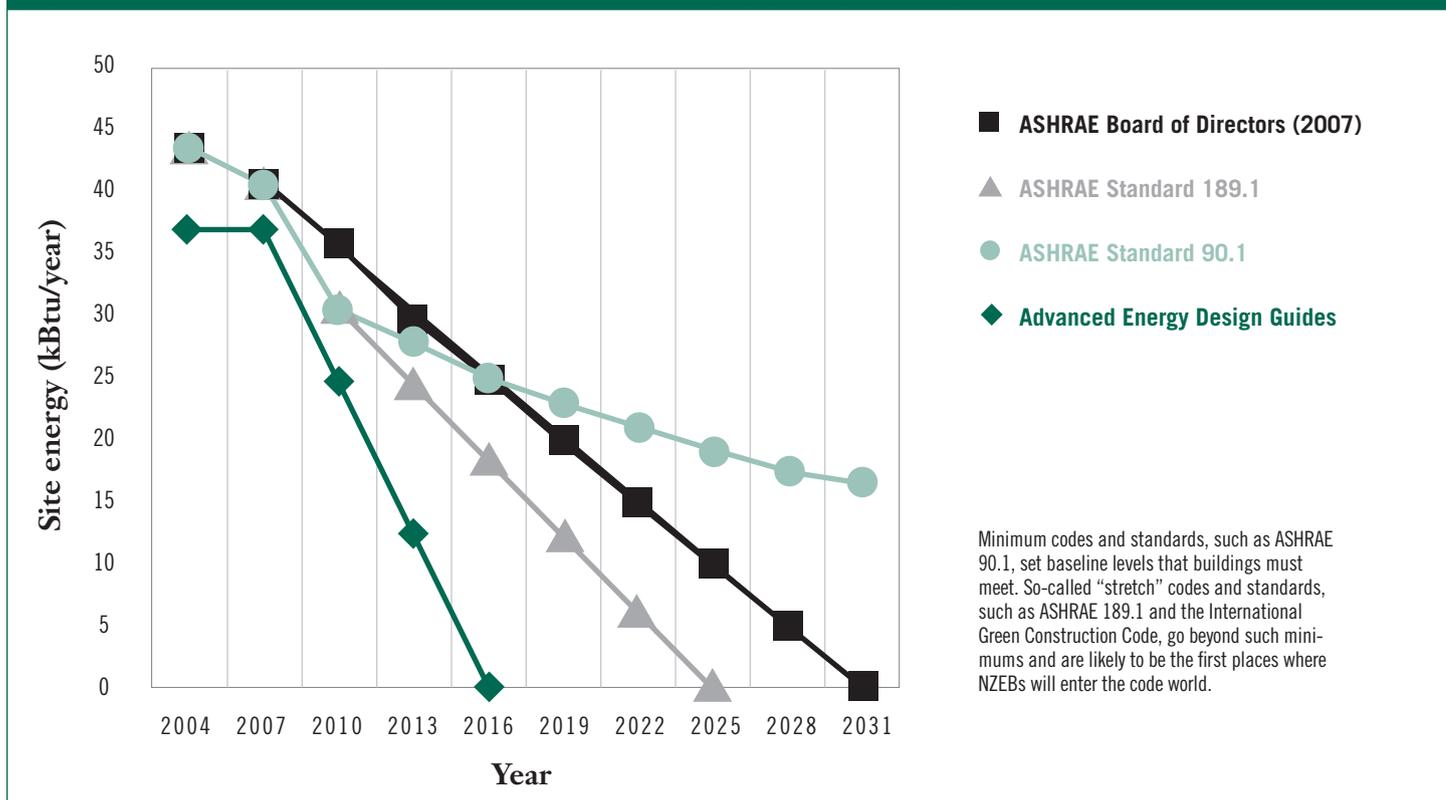
Given the nature of prescriptive codes and their

³ Institute for Market Transformation, "\$810 Million Funding Needed to Achieve 90% Compliance with Building Energy Codes," Washington, D.C., 2010. At: <http://imt.org/codecompliance.html>.

⁴ Building Codes Assistance Project, "Roundtable Discussion on Energy Code Compliance and Evaluation," Washington, D.C., 2009.

⁵ Dave Hewitt, Mark Frankel, and David Coban, "The Future of Energy Codes" in *Proceedings: 2010 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Washington, D.C.* At: zeroenergycbc.org/.../ACEEE%20Panel%208%20-%20Future%20of%20Energy%20Codes%20v2%20DRAFT.pdf.

FIGURE 6-1. ENERGY REDUCTION PROJECTIONS FOR ASHRAE STANDARDS & ADVANCED ENERGY DESIGN GUIDES



development, gains in energy efficiency are predicated on incremental improvements in the efficiencies of individual building components or systems. As these components and systems become more efficient, they will represent a smaller proportion of the building's total energy use, thus making it harder to impact total energy use through prescriptive codes. At some point, the laws of thermodynamics, potential technology improvements, and cost will make increasing the efficiency of existing components and systems prohibitive.

PERFORMANCE CODES: FLEXIBLE, TECHNOLOGY NEUTRAL, BUT STILL NO REQUIRED RESULTS

Performance-based codes set a desired level of energy performance, often based on the anticipated results of parallel prescriptive codes. This gives Building Teams flexibility in selecting how to meet the intent of the prescriptive code without necessarily complying with every prescription. Such an approach is particularly desirable for larger buildings, as it provides opportunities for trade-offs across energy-influencing systems to come up with the most cost-effective means for achieving compliance. Further, performance-based codes are technology neutral, thus enabling quicker incorporation of energy-saving technologies and practices into the marketplace.

However, performance codes still are based on proxies for energy use that are essentially derived from prescriptive code provisions. Designers typically demonstrate compliance through energy modeling of the building, incorporating their selected building specifications, and then doing the same modeling but substituting the minimum prescriptive requirements from the code. Models that fulfill requirements under the code may not include all potential energy-saving opportunities in the calculations, including the orientation, massing, and shape of the building. Energy models also are based on numerous assumptions about how the building will be used—its operating hours, occupant density, plug load, and so on.

While building energy modeling has improved significantly in recent years, energy models often do not correlate to actual building energy use,⁶ not least because buildings are complex systems with numerous variables, including the behavior of building occupants themselves. (COMNET, the Commercial Energy Services Network [<http://www.comnet.org>], is seeking to provide consistency across models through the establishment of modeling rules.) Today, energy models are largely intended to determine relative energy performance based on component and systems choices rather than as predictors of actual energy use.⁷

As with prescriptive codes, performance codes do not necessarily provide any assurance that the completed building actually will perform at the level anticipated

by the code. Typically no follow-up of actual results is required, just inspection during construction. However, some jurisdictions, including Baltimore and Seattle, now require post-occupancy evaluations.

While performance codes may be desirable for large buildings, small building owners typically do not have the resources to invest in energy models, nor do most code officials have the expertise to evaluate and verify the accuracy of these models. Certification of the model outputs by the architect or engineer of record, if required at all, typically is deemed sufficient.

OUTCOME-BASED CODES: MEASURE, MONITOR

Recognizing the difficulties in applying current prescriptive and performance equivalence energy codes to achieve defined and measurable levels of energy use, thought leaders in the building community are calling for a transition to outcome-based codes. The IgCC may even include an outcome-based approach to energy use once it is finalized later this year.

Outcome-based codes establish a target energy use level and provide for regular measurement and reporting of energy use to assure that the completed building performs at the established level. Such a code can have significant flexibility to reflect variations across building types and can even cover existing and historic buildings. Most importantly, it can address all energy used in a building and provide a metric to determine the overall energy efficiency of the building's design, construction, and operations.

Despite the potential benefits of outcome-based energy codes, *three major areas of concern* must be addressed before widespread adoption of outcome-based codes is possible:

1. How energy-use targets are to be set
2. Who would be responsible for performance
3. How the code would actually be enforced

Setting energy-use targets. Ideally, in setting energy-use targets, it would make sense to work backwards from the stated goal of net-zero energy. However, what pace is realistic for ultimately achieving net-zero energy? To set a realistic starting point and a schedule for improvement, code developers must understand the current levels of building energy use not only from existing buildings but also from new buildings that are designed to meet current prescriptive energy codes.

One source of data is the Energy Information Administration's Commercial Building Energy Consumption Survey (<http://www.eia.doe.gov/emeu/cbecs/>). CBECs provides data based on a survey of some 5,000 buildings of different types from across the country. As of February 2011, however, only data from the 2003 survey was available, and some building types do not

6 RK Stewart, "Attention: Performance Marker Ahead," *DesignIntelligence*, at: http://www.di.net/articles/archive/attention_performance_marker_ahead, accessed 16 September 2010.

7 Sean Denniston, Liz Dunn, Jayson Antonoff, and Ralph DiNola, "Toward a Future Model Energy Code for Existing and Historic Buildings," in *Proceedings: 2010 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Washington, D.C. At: eec.ucdavis.edu/ACEEE/2010/data/papers/2188.pdf*.

have statistically significant data for certain climate zones. Improvements to CBECS or other sector-wide datasets will be necessary to have a meaningful baseline and to monitor progress toward net-zero energy goals. Reported energy use based on implementation of outcome-based codes or the emerging disclosure requirements can start the development of a meaningful database.

For small, non-complex buildings with tight budgets, however, prescriptive requirements may still be desirable, and could be developed utilizing the outcome-based targets. It is possible to envision multiple parties establishing prescriptive pathways to reach specified energy targets. For example, an HVAC manufacturer or association might develop prescriptive pathways that feature very high-efficiency mechanical equipment, while other interests might develop pathways for daylighting/lighting controls or high-efficiency envelope performance.

Assigning responsibility for achieving performance goals and post-occupancy enforcement for outcome-based codes is a matter that will need to be addressed even at the pilot stage. Initial steps include providing submetering within buildings to better determine how energy is being used, requiring owners to pay for recommissioning major building systems if anticipated performance levels are not achieved, or imposing a surcharge on energy bills or taxes. The starting point for outcome-based codes may simply be setting performance targets that need to be achieved, followed by required monitoring of energy performance. This would at least create awareness of building performance, along with a useful database on actual building energy use. In this way, outcome-based codes would be closely tied to the benchmarking efforts that various cities and states are beginning to require.

Outcome-based codes will likely require a two-stage process for verifying compliance. The first stage would focus on the design and construction of the building, including plan review and on-site inspections. Code officials could continue to use existing methods for verifying building compliance prior to occupancy. Although greater flexibility of code interpretation and enforcement might be granted in this first stage, resources and training for code officials and the building design and construction community will still be required.

The second stage would be based on the measurement



The 2,600-sf Aquarium of the Pacific Watershed Classroom, from the Building Team of EHDD Architecture (designer), structural engineer Rutherford & Chekene, and mechanical/plumbing engineer Rumsey Engineers, employs a living roof, thermal mass, passive heating and cooling, and a 2.8 kW photovoltaic system.

and reporting of ongoing building performance. Since the regulation of outcomes is largely outside the current practice of building code enforcement, new mechanisms for ongoing enforcement and addressing noncompliance, both incentive- and penalty-based, would have to be examined. Measurement and reporting tools will be essential for verifying ongoing compliance. ASHRAE's Building Energy Quotient (<http://www.buildingEQ.com>) and RESNET's HERS rating system (<http://www.resnet.us/home-energy-ratings>) may provide helpful models.

'Non-Codes': LEED and Energy Star. Some jurisdictions have implemented code-type requirements based on voluntary programs, primarily LEED and the U.S. Environmental Protection Agency's Energy Star program. Due to the voluntary nature of these programs, they do not fit well into the role of a mandatory code. For instance, if a jurisdiction were to require a specific level of LEED certification for certain projects, such levels can be achieved through many different combinations of points that may or may not reflect the community's priorities.⁸ Finally, such requirements essentially abdicate code enforcement to a third party that is not beholden to the jurisdiction. In fact, the USGBC recognizes that LEED is not appropriate for wholesale adoption as a code for all buildings within a jurisdiction and cites this as a reason for being a partner in the development of Standard 189.1.⁹

IS 'DESIGNED FOR NET-ZERO' ENOUGH?

Setting a concrete goal like net-zero energy use demands actual results, while current claims of a percentage above code are based on numerous assumptions and

⁸ Four hundred forty-two localities (384 cities/towns, 58 counties), 34 states, and the Commonwealth of Puerto Rico have adopted LEED initiatives—legislation, executive orders, resolutions, ordinances, policies, and incentives—some of which cover private-sector projects. See <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1852>. For a list of state and local government incentive strategies for green building, see <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2078>.

⁹ U.S. Green Building Council, *Greening the Codes*, Washington, D.C. At: www.usgbc.org/ShowFile.aspx?DocumentID=7403.

variables that may not necessarily produce meaningful results. Eventually, net-zero energy buildings will be codified, and Building Teams, owners, and operations teams will have to be ready to produce net-zero energy use over the life of the building. As targets approach net-zero energy use and ongoing measurement and reporting requirements are implemented, component-by-component and discipline-by-discipline approaches will no longer produce the desired results. Building information modeling (BIM) and integrated project delivery (IPD) will assist Building Teams in understanding the results of decisions made throughout the design process and the synergies across building systems.

Under current contracting processes, Building Teams are not necessarily compelled to address long-term energy use and other performance factors for which they might share risk. (Note: AIA IPD documents do address shared risk and liability.) Barring the discovery of negligence or fraud, building owners and jurisdictions have no assurance that completed buildings will actually perform at the levels anticipated by the energy codes. Furthermore, it is not common practice for Building Teams to follow up to learn whether completed projects are achieving the target energy use. (A notable exception: the 138 architecture firms that have signed the AIA 2030 Commitment, under which they agree to provide detailed energy-use data. See <http://www.aia.org/about/initiatives/AIAB079458>.)

There are few examples of code language that mandate and enforce activities that can assist in the long-

term realization of NZEBs, such as commissioning and operations and maintenance (O&M); however, changes being considered in U.S. model codes and standards could include requirements for pre-occupancy commissioning and the development of O&M plans. Another concern is whether design teams have sufficient interaction with O&M personnel and building occupants to explain the design intent, get feedback on the practicality of proposed solutions, and provide training on the selected systems. (The exception here would be owner-occupied structures, especially for education, healthcare, and corporate real estate clients, where owners and end users often have a significant role in the design.)

Another concern is that buildings are intended to last anywhere from 30 to 100 or more years, yet most of the design and specification of systems is based on returns on investment as short as two to three years. Property owners who focus on such short-term returns have little incentive to invest in long-term energy savings. This also holds true when energy costs are paid by building tenants but the key energy-consuming systems are controlled by the building owner.¹⁰

Outside the U.S., the European Union's Energy Performance of Buildings Directive requires member countries to establish an energy performance certification for buildings.¹¹ In the U.S., a few jurisdictions (notably the states of California and Washington, the District of Columbia, and Austin, Texas) have adopted requirements to periodically monitor and report actual building energy use.¹² While attempts are under way to measure actual energy performance in the U.S., there are no requirements to compare actual performance to the anticipated energy use modeled in the design phase.

Programs like LEED and ASHRAE's *Advanced Energy Design Guides* (accessible at: <http://www.ashrae.org/publications/page/1604>) provide resources and recommendations for the design and construction of 30% more energy-efficient buildings, but continue to rely on proxies for energy use to determine energy efficiency. The relatively new LEED for Existing Buildings Operations & Maintenance (LEED-EBOM) and USGBC's Building Performance Partnership (BPP) are beginning to address post-occupancy energy use and the disconnect between design and operations.

California has set a target of 100% of new commercial buildings and 50% of existing buildings to be net zero by 2030.¹³ NZEBs as currently defined in California and other jurisdictions may not be feasible for high-use buildings like hospitals and quick service restaurants or in taller buildings in dense urban environments. Exploring a community-wide approach to NZEBs may produce the desired results but in the most cost-effective manner. Most NZEBs built to date

10 *The Model Green Lease Task Force*, chaired by B. Alan Whitson, RPA, is attempting to address the first cost vs. long-term rewards issue through the development of the so-called "green lease." See http://www.squarefootage.net/TMGL_task_force.html.

11 *European Parliament Directive 2002/91/EC*. See http://ec.europa.eu/energy/efficiency/buildings/buildings_en.htm.



RENDERING: EHDD ARCHITECTURE

Interior courtyard of the net-zero energy David & Lucile Packard Foundation building, currently under construction in Los Altos, Calif., by DPR Construction, with occupancy expected in 2013. After reducing energy use as far as possible through such strategies as daylighting, chilled beams, and a high-performance building envelope, a 285 kW PV system will provide the energy needed to enable the project to achieve net-zero status.



PHOTO: MICHAEL DAVID ROSE; COURTESY EHD

The 21,227-sf Chartwell School, in Seaside, Calif., employs a 30 kW photovoltaic array to achieve net-zero electricity use. Experts in the field believe that future building and energy codes and standards are going to have to develop ways to ensure that actual energy use is measured, if net-zero energy buildings are to gain a firm foothold in the U.S.

have been small, owner-occupied buildings, and the definition of renewable energy generated on site will almost certainly need to be modified to apply across a variety of building types and sizes and avoid unintended consequences, such as supporting low-density development.¹⁴ Washington State avoided this quandary in recent legislation by simply requiring energy codes to be 70% more efficient by 2031.¹⁵ This is an efficiency level that would enable many buildings to achieve net-zero energy use on site if they were to use on-site renewables.

Several voluntary programs have also been initiated to begin the drive to NZEBs. California utilities and the Energy Trust of Oregon are implementing commercial new construction programs that provide additional incentives and design assistance for owners and design teams whose buildings approach NZEB efficiency levels (i.e., 40-50% more efficient than current code). The California Public Utilities Commission has developed an Action Plan to support the development of NZEBs in the Golden State. And the Living Building Challenge (<http://ilbi.org/lbc>), developed by the Cascadia Green Building Council, has certified three NZE buildings, with another 60 or so in the pipeline. Add to these efforts that of the Zero Energy Commercial Buildings Consortium (the authors' organizations—AIA, NBI, and NIBS—are members of the ZECBC Steering Committee; see Chapter 8 for other NZEB initiatives).

such as enhanced security or historic preservation may have priority over saving energy.

As the largest energy-using sector, buildings represent arguably the best opportunity to reduce energy consumption.¹⁶ However, today's codes and standards are based on proxies for energy with no requirement to actually measure the end result and leave many building energy uses unaddressed. To reach the goal of net-zero energy buildings, these methods must change. Modeling capabilities must improve, and actual outcomes must be measured.

A recent report on BIM use found that a majority of the companies surveyed attach high importance to verifying that building performance corresponds to the targets identified in design.¹⁷ The World Business Council for Sustainable Development (WBCSD) has developed a roadmap for reducing energy consumption in new and existing buildings that calls for design fees and incentives based on actual energy performance.¹⁸

Codes and standards can play a significant role in the future of net-zero energy buildings. But the U.S. building community and policymakers must lay a solid foundation through research and changes in practice that will lead to the adoption of energy codes and standards that effectively incorporate advanced building technologies, consider all energy uses in buildings, and account for energy performance after the building is occupied. **BD+C**

There is no doubt that the finance and insurance sectors must also play a key role. Many actors within the energy-efficiency community have raised concerns that the finance, insurance, and appraisal sectors are not including energy-efficient measures as they evaluate risk and determine value. Requirements to demonstrate actual performance may overcome some of these deficiencies.

SETTING A FOUNDATION FOR NET-ZERO ENERGY CODES AND STANDARDS

No matter what code or standard is used to get the building stock to net-zero energy use, important building requirements contained in other codes, including indoor environmental quality, must be maintained. For certain types of buildings, high-performance attributes

12 Dunsky Energy Consulting, *Valuing Building Energy Efficiency Through Disclosure and Upgrade Policies: A Roadmap for the Northeast U.S., Northeast Energy Efficiency Partnerships*, 2009.

13 California Energy Efficiency Strategic Plan, *Zero Net Energy Action Plan: Commercial Building Sector 2010-2012*, <http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eeps/>.

14 David B. Goldstein, Lane Burt, Justin Horner, and Nick Zigelbaum, "Zeroing in on Net-Zero Buildings: Can We Get There? How Will We Know When We Have Arrived?" in *Proceedings: 2010 Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy*, Washington, D.C. At: www.uceee.edu/ACEEE/2010/data/papers/2270.pdf.

15 SB 5854 and HB 1747, 2009-2010 Session, Washington State Legislature. At: apps.leg.wa.gov/billinfo/summary.aspx?bill=5854&year=2009.

16 U.S. Department of Energy, *Buildings Energy Data Book 2009, Table 1.1.3: Buildings' Share of U.S. Primary Energy Consumption*, <http://buildings-databook.eren.doe.gov/TableView.aspx?table=1.1.3>.

17 Harvey M. Bernstein, editor, *Green BIM SmartMarket Report*, McGraw-Hill Construction, Bedford, Mass., 2010. At: [images.autodesk.com/.../mbc_green_bim_smartmarket_report_\(2010\).pdf](http://images.autodesk.com/.../mbc_green_bim_smartmarket_report_(2010).pdf).

18 World Business Council for Sustainable Development, *Roadmap for a Transformation of Energy Use in Buildings*, Geneva, 2009. At: www.wbcsd.org/includes/getTarget.asp?type=d&id=MzQyMTY.

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The idea of a net zero energy building has quickly moved from concept to reality. In fact, it is now a compelling and integral part of the “green construction movement.” Tomorrow’s net zero energy buildings will improve this country’s energy balance and help put the U.S. back on a path toward greater energy security and sustainability.

Energy efficiency is the key to its success. The availability of existing, yet energy and environmentally efficient technologies, such as high-performance insulation systems, is one of the reasons the net zero building concept has advanced so quickly. At the forefront of these discussions is the North American Insulation Manufacturers Association (NAIMA).

The North American Insulation Manufacturers Association is a trade association of North America’s leading fiber glass, rock wool and slag wool insulation manufacturers. NAIMA has a 75-plus year history in the energy efficiency arena, and its fundamental objective is to promote energy efficiency, sustainable development, and environmental preservation through the safe use of high-performance fiber glass, rock wool and slag wool insulation.

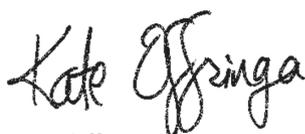
Insulating the Building Envelope: Maximizing Energy Efficiency on the Road to Net Zero Energy Buildings

NAIMA firmly believes that the first step toward net zero energy buildings must be maximizing energy efficiency in the building envelope. Today’s thermal envelope systems are designed specifically to reduce energy consumption and improve occupant comfort. The good news is these insulation technologies are one of the few that can be implemented immediately and installed to meet the energy code requirements of today and energy demands of the future. Unlike many of the other technologies targeted for net zero energy buildings, insulation requires no additional energy such as electricity to function. And, most importantly, these insulation systems will enhance the performance of additional energy efficiency technologies as they are designed into or added to the buildings.

Architects, specifiers, builders, homeowners, and policymakers are all part of the process to building a sustainable future. To help these important audiences in their building and construction decisions, NAIMA maintains a large literature library filled with free (and many downloadable) specification tools, scientific research, installation recommendations, and codes and standards information. In addition, our website (www.naima.org) maintains current information on the status of building energy codes, federal and local tax incentives as well as links to our members, who offer advanced insulation thermal envelope systems.

NAIMA is active in the Commercial Buildings Consortium and other formal and informal dialogues on the topic of net zero energy buildings. As an industry leader in the energy efficiency discussion, NAIMA has always taken an active role in the many leading U.S. and global organizations that are helping to develop policies and implement educational programs that will make their way into the net zero energy building arena.

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