Oregon State Bar
Sustainable Future Section

Photo: J. Michael Mattingly

Introducing Net Zero Building—Shifting From Green Building to Green Performance

By Clark Brockman

For the past decade or more, the world of green building has been dominated by the evolution of third-party certification systems for green buildings. The Leadership in Energy and Environmental Design ("LEED") rating system of the U.S. Green Building Council ("USGBC") has led the way in this regard, transforming the commercial building marketplace in the United States. Ten years ago, all facets of the building industry (i.e. owners, developers, designers, engineers and contractors) found the requirements of green building very challenging, and often costly. This was primarily because the services, expertise, processes and products needed for green buildings were poorly understood or nonexistent in many markets, thus driving the need for transformation. Now that LEED certification of commercial buildings is becoming more and more common, *and* is required for a majority of public buildings, *and* is now part of the building code for a small but growing number of cities, let's look at a key "what's next" trend for the green building movement.

What's next is a growing focus on the actual performance of buildings, delineated by the growing interest around "Net Zero Energy Buildings" (NZEBs), and "outcome based codes". *(Note: for the purposes of this article, an NZEB is a building that makes as much (or more) renewable energy on site in one year as it uses in that same year. For more on the sub-definitions of NZEB, please see the National Renewable Energy Laboratory white paper on the subject at: http://www.nrel.gov/sustainable_nrel/pdfs/44586.pdf.)*

This focus on how buildings actually perform is easy to describe, yet profound in its implications. To understand this, one must first understand the metrics by which we currently measure buildings: building codes and certification systems. Both of these metrics are inherently prescriptive and predictive in nature. Said another way, both of these systems ask the development/design/construction team to declare or "promise" a certain level of performance across a wide range of systems and flows within the building based on modeling–from structural integrity to energy and water usage, a series of models are employed to predict how the building will perform under "design conditions" (e.g., earthquakes, very hot or cold days, very dry or wet years).

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Regarding models, we need to remember George E.P. Box's often-quoted phrase: "Essentially, all models are wrong, but some are useful." The green building community has been living this axiom for the last few years, focusing intently on a variety of complex (and useful) models to help us understand, to some degree, how our high-performance buildings are going to work. After a decade of this work, enough LEED buildings have been built and certified to provide some meaningful statistics on how they have actually performed as compared to how their models predicted. This analysis is well illustrated in a report entitled "Energy Performance of LEED® for New Construction Buildings," published in 2008 by The New Buildings Institute. The report can be found at:

http://www.newbuildings.org/sites/default/files/Energy_Performance_of_LEED-NC_Buildings-Final_3-4-08b.pdf.

The study found: "that projects certified by the USGBC LEED program average substantial energy performance improvement over non-LEED building stock." Another interesting result from the study, which looked at the actual performance of 121 LEED-certified buildings as compared to their predictive energy models, was that there were as many buildings outperforming their energy models as there were those performing worse than their models, and that very few buildings performed actually as modeled. These findings support Box's axiom.

Interestingly, this study was widely cited as evidence that LEED buildings don't live up to the promises made by LEED's certification process. Yet such criticism is only evidence of the lack of understanding by those making these critiques of what is and isn't

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promised by LEED and, in this specific case, by the energy models developed for the building analyzed. What this study did illustrate is the dramatic impact that the plug loads, or "people loads" within a building have on the building's actual energy usage, and the inability of our current modeling techniques to isolate those plug loads, which are largely dependent on the building's occupants and owners.

At this time, there is no codified way for energy modelers to accurately predict how people in a building will actually use energy, both in terms of the intensity of their use and the schedule of their use, but methods and protocols are beginning to be developed. The advent of real performance requirements on projects is driving the development of such protocols. Three examples of such performance requirements are:

- NEZB
- The Living Building Challenge, a recent addition to the world of green building standards which requires achievement of 20 "imperatives," including net zero energy, net zero water and net zero wastewater performance. A copy of this standard can be found at: https://ilbi.org/lbc/Standard-Documents/LBC2-0.pdf.
- Energy Star, the U.S. E.P.A.'s program, which has created national branding around the measured energy performance of many things, from TVs to washing machines to buildings. The program website is found at: http://www.energystar.gov/.

As it turns out, it is a game-changer to have a specific performance goal being clearly understood at the beginning of a project by all three key contractual parties: the building owner/developer, the design team, and the contractor. This goal, which by definition requires proof of actual target energy performance over a period of at least one entire year, requires an entirely different contract between the parties than the contracts currently entered into by the design and construction industry. Not only does the contract performance period actively extend to some period beyond 12 months after occupancy (much longer than standard current design/construction contracts), but all three parties, including the owner/developer, retain key obligations during the performance period for successful achievement of the project's energy performance goal. This point is key because it requires all three parties to acknowledge their roles in the achievement of actual energy performance and to work as team members throughout the post-occupancy performance period to achieve success. For a project with aggressive performance goals, the design team, contractor, and owner need to collaborate from early in the design process on everything from accurate occupancy and schedule predictions (led by the owner) to understanding the building's response to its climate (led by the design team) to the best way(s) to construct the building and its interrelated systems to best perform within the established constraints (led by the contractor and its key subcontractors).

In addition to changing the way the design/construction/owner teams work together, the growing focus on actual performance of buildings is also being seen in the development of a new type of building code: outcome-based codes. These codes will govern how buildings actually perform in terms of their energy use. Initially, this is being explored in the context of existing buildings, since the United States' existing building stock is responsible for almost 40 percent of the country's CO_2 emissions (according to the U.S. Energy Information Agency). A report on this subject was recently released by the National Trust for Historic Preservation and the New Buildings Institute and can be found here:

http://www.newbuildings.org/sites/default/files/SeattleOutcomeBasedEnergyCodesReport.pdf.

As a firm working on multiple projects with aggressive performance targets (in addition to the industry norm prescriptive, predictive metrics), SERA Architects has found this evolving process to be inspiring, and unnerving at times, as we work with our clients and their general contractors to move toward a new way of making buildings in which the primary parties to the contract(s) need to work as partners in order to achieve success. We find it to be a richer and more interesting prospect than the status quo alternative, and we are finding that it is helping us to make better buildings as we all get better and better at collaborating in the process.

Clark Brockman is the Director of Sustainability Resources Group and Associate Principal at SERA Architects. He is the recipient of BetterBricks Awards in both the Designer and Advocate categories (2007 and 2011, respectively).