

Vol. 33, No. 1 | spring 2015

# BUILDINGENERGY

THE MAGAZINE OF THE NORTHEAST SUSTAINABLE ENERGY ASSOCIATION



Rethinking the Grid:  
Encouraging Distributed  
Generation

BuildingEnergy Conference Preview Issue

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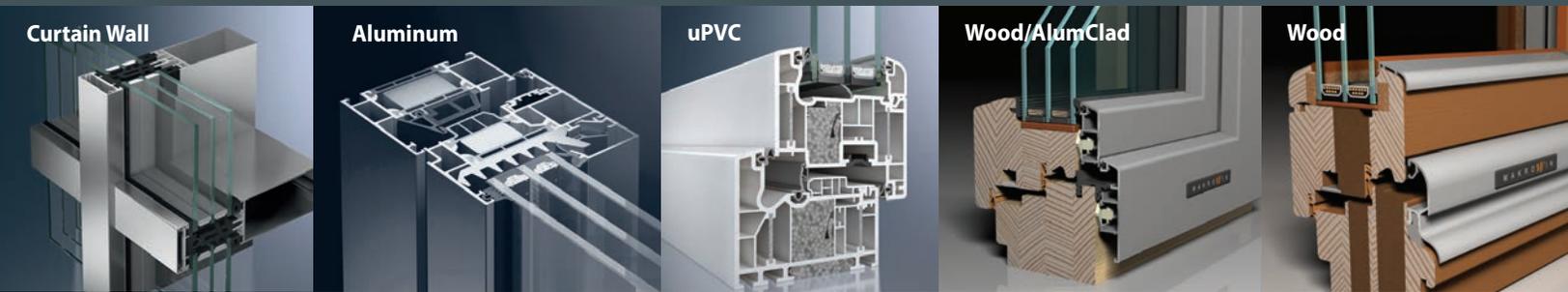
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# BUILDINGENERGY



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### On the cover

The time has come to complete the transformation of the electric utility sector. A deliberate and sustained effort to establish robust markets for distributed energy serves as the major remaining step in that process. Karl Rábago's article *Rethinking the Grid, Encouraging Distributed Generation*, starts on page 11.

### About NESEA and *BuildingEnergy Magazine*

The Northeast Sustainable Energy Association (NESEA) is the region's leading organization of professionals working in sustainable energy, whole systems thinking, and clean technology. We advance the adoption of sustainable energy practices in the built environment through this magazine (distributed to NESEA members), our annual BuildingEnergy conference and trade show, professional workshops, BuildingEnergy Bottom Lines, and more. A *BuildingEnergy* subscription is \$55/year, which includes NESEA membership. Copyright 2015 by the Northeast Sustainable Energy Association. No part of this publication may be reproduced without permission.

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## Emerging Professionals, Emerging Knowledge

When I joined NESEA as interim executive director in 2009, many were concerned that our members were starting to "age out" and that we weren't doing enough to welcome the next generation into the fold. The perception was that some of our pioneers were becoming curmudgeons who had lost their "edge" and that there was not enough new blood in our midst to ensure NESEA's vitality. Many were asking how NESEA would remain relevant across generations. We set

to work on this issue, and one of the feature stories in the spring 2010 issue of *The Northeast Sun*, this magazine's precursor, was an interview with 13 emerging professionals about what they valued in NESEA and how they wanted to see it evolve.

Five years later, as NESEA turns 40, this concern is becoming a distant memory. We have been deliberate in our attempts to engage the next generation, and many of the 13 we interviewed—Luke Falk, Brian Hayden, Caroline Petrovick, Jesse Selman, Jason Forney, Jess Lerner, and others—are still engaged, some in leadership roles, within our community.

We've welcomed many others into the fold as well, including BuildingEnergy Boston Chair Matt Root and Vice Chair Rachel White, and BuildingEnergy NYC Chair Heather Nolen. Some have pledged their enduring commitment to NESEA, investing in lifetime membership.

Through their involvement, these young leaders have learned that NESEA is not an organization in which you have to "pay your dues" before anyone will listen to you. (You do have to pay for a membership, of course!)

Design, engineering, and construction tend to be conservative professions where the old guard and the old ways prevail. NESEA is great at countering that—it's one of our key competitive advantages. We understand that we absolutely have to bring emerging professionals of all ages into the fold if we're going to stand any chance at all of fulfilling our mission of transforming the built environment. We welcome them with open arms so they can help create the solutions in which they themselves have an enormous stake. We need their voices, their energy, their spirit, and their willingness to work with the seasoned veterans to get things done. They're an essential and honored part of our team.

With that in mind, in the coming months we'll be doing more than ever to welcome emerging professionals into our community. One event I'm particularly excited about is a career workshop for emerging professionals which will be offered at BuildingEnergy this year on Wednesday, March 4. The purpose of this event is to reach out to emerging professionals, continue the culture of mentorship at NESEA, cultivate new members, and, of course, promote BuildingEnergy in Boston. I hope this will be the first of many such events throughout our 10-state footprint. If you are interested in hosting a similar event in your area, we'd love to hear from you. Please contact our membership manager, Katie Schendel, at [kschendel@nesea.org](mailto:kschendel@nesea.org), and she'll help make it happen.

Warmly,

Jennifer Marrapese  
[jmarrapese@nesea.org](mailto:jmarrapese@nesea.org)

**Chris Benedict**, is a licensed Architect in New York, New Jersey, North Carolina and Washington, D.C. She is a graduate of the Irwin S. Chanin School of Architecture at The Cooper Union in New York City. Before starting her own architectural firm in 1995 she managed retail, commercial, and residential projects for four architectural firms in New York City. Chris is a sought after public speaker and has presented her projects nationally. She teaches about energy efficiency and sustainable practices to Architects, Engineers, students and Contractors.

**Ann Edminster** is a leading international expert on green homes. She chairs the Green Building Task Force for the U.S., Canada, and Mexico's Commission for Environmental Cooperation, and was a principal developer of LEED for Homes. She serves on the Board of the Net Zero Energy Coalition, chaired the Coalition's inaugural Net Zero Leadership Summit, and is the director of the 2015 Summit.

**Paul Eldrenkamp** founded Byggmeister (Scandinavian for "master builder") in 1983. Paul is a widely-recognized expert in high-performance homes and frequently speaks to industry groups and the public about energy efficient construction. He is also a founding partner of The DEAP Energy Group, a consulting partnership focusing on Passive House, zero-net energy, other high-efficiency building standards.

**Thomas R.C. Hartman**, AIA, is a partner at Coldham & Hartman Architects in Amherst, Massachusetts. The firm provides professional design services for residential, commercial, and institutional clients committed to creating green buildings and communities throughout the Northeast. He served on the Board of Directors of the Northeast Sustainable Energy Association for two terms as Treasurer.

**Robert Leaver** is the founder of New Commons. He has over 38 years of experience organizing over 500 projects for clients across the country. As a convener and facilitator, he has led thousands of groups on the journey from confusion to

clarity, managing each group's unique dynamic to help them generate their best thinking, identify the connections to required capabilities, and implement a clear plan of action.

**Andrea Love** is the Director of Building Science at Payette, a Boston based architecture firm. She leads the firm's sustainability and research efforts, working across all projects to improve building performance. She was the recipient of the 2012 AIA Upjohn Research Grant investigating the thermal performance of façades.

**Sean Maxwell** works in the multifamily division of Steven Winter Associates, Inc. He has extensive experience testing small and large residential buildings as a HERS rater and Certified Energy Manager. His recent work has focused on cost-effective retrofits for multifamily buildings.

**Heather Nolen**, BPI MFBA, has specific expertise with energy efficiency in multifamily buildings. Her work at Steven Winter Associates focuses on energy benchmarking and auditing, health and safety in buildings, training building operators and maintenance staff in sustainable operations and energy efficiency, and implementation of efficiency measures. Ms. Nolen is currently working with multifamily buildings across NYC to increase building performance.

**Rebecca Owens**, LEED AP, is sustainability program manager for Xanterra Parks and Resorts at Yellowstone National Park, and recently completed an MBA in Sustainability at Antioch University New England.

**Karl R. Rábago** is the executive director of the Pace Energy and Climate Center, at the Pace Law School in White Plains, New York. The PECC mission is to protect the earth's environment through solutions that transform the ways that society supplies and consumes energy. Karl has some 25 years experience in energy and climate policy markets.

**Matt Root** is a senior project manager at Conservation Services Group and is serving as chair of NESEA's BuildingEnergy 15

Conference and Trade Show. Currently Matt is working to develop CSG's Consulting and Construction Services group's exterior enclosure commissioning services. A primary focus of this work is visual in-field verification and diagnostic testing for commercial and large scale multi-family housing projects.

**Andy Shapiro**, through his company Energy Balance, Inc., has been providing energy consulting and design services to a wide variety of clients since 1988. He works with homeowners, architects, engineers, and builders, as well as towns, landlords, non-profit housing organizations, and electric utilities. Services range from house-doctoring to sustainable building design and include research projects as well as utility program design and impact evaluation.

**Peter Troast** is founder and CEO of Energy Circle, where he leads a team of strategists and web developers that make sustainable building companies and organizations more effective in the digital world. This year, he serves as chair of the BuildingEnergy 15 Marketing Committee.

**Fred Unger** has been involved with NESEA since 1979. He served on the board for six years and chaired the BuildingEnergy conference in 2003. He has worked as a builder and real estate developer. For the last five years he has managed operations for a solar project development company with 62 interconnected systems operating and many more in development. His company website is [www.heartwoodsolutions.com](http://www.heartwoodsolutions.com).

**Alex Wilson** is the founder of BuildingGreen, Inc. in Brattleboro, Vermont, and for many years he served as editor of Environmental Building News. Prior to starting his own company he served as executive director of NESEA from 1980-1985, and he served on the NESEA Board for six years after that. He was the recipient of the first annual NESEA Distinguished Service Award in 1993. In 2012, Alex launched the Resilient Design Institute.

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## A Conversation with Caitriona Cooke

**You are just stepping down from a two year stint as board chair. How have you enjoyed serving in that role?** I have enjoyed it immensely. I feel like it has been a great experience for me. The board members are impressive in terms of what they bring to the table, but they are also really good people who I have enjoyed spending time with.

**What have you learned as board chair?** I have learned a lot about what it takes to have a strong board supporting a great organization. We have such a strong, committed, and honorable board. I certainly don't take that for granted. It is really important to recruit board members who show up, who believe in the cause, and who are willing to work with each other to get the job done.

**What are you most proud of with respect to your involvement in NESEA?** As I became more involved with NESEA, I wanted more of my colleagues from Conservation Services Group (CSG) to be able to participate in BuildingEnergy. I have made great use of the BuildingEnergy Conference in Boston as a learning opportunity for a broad group of my coworkers. Attending the conference, participating in the planning process, and speaking at the conference have submersed our employees in a wonderful industry organization where they can network, meet like-minded people in the region, and learn from top practitioners.

The younger staff members were particularly excited and inspired. It has been well worth it to me to put more money into the budget each year for training through BuildingEnergy. We receive fantastic value, the conference is on our doorstep, and it inspires and energizes people.

Once I had earmarked funds for most of my team to attend, I encouraged other managers to consider sending their staff to the conference. Attendance seems to give many of our employees a bigger sense of purpose. It takes them out of their daily grind for a short while and makes them aware that they are part of an industry that is interesting and evolving.

It's also really good for the industry as a whole to have what NESEA provides —sessions that excite you, people that are jazzed about their work, and the opportunity to socialize with like-minded people. NESEA provides the glue to help us recognize that we're all working toward a bigger goal.

It was an easy pitch to have CSG sponsor NESEA, because when I look at our mission statements there is a lot of alignment, not just in the words of the mission but also in our approaches and our the underlying purpose.

**How has NESEA helped you develop leaders on your team at CSG?** It has been fantastic having Matt Root as the chair of BuildingEnergy 15. The role has provided him with a great experience beyond his daily commitments—not just in terms of what to do and how to do it, but also in terms of navigating and strengthening his professional relationships. Matt is a born leader, and chairing BuildingEnergy has provided a great growth experience. It has been almost like his own, personal, sustainable MBA.

**Now that you are stepping down as board chair, what's next for you and your involvement with NESEA?** As of January, I will be starting a three-year term as membership service liaison to the board of directors. This is a new role that the board has

created as we move away from a formal chapter structure and toward more direct local member support.

As membership service liaison, I will work with Katie Schendel, NESEA's membership manager, to gather feedback through surveys, focus groups, and one-on-one interaction to learn more about how we can serve our members better. Through the process, I am hoping we can engage more members in activities like the BuildingEnergy conference planning process. I hope members will see that as their opportunity to be heard and to influence the content.

I am often struck by how vibrant NESEA's membership is. There's rarely agreement or consensus on anything, but that is not a bad thing—it is stimulating to have to argue your case. Organizations in which everyone agrees tend not to have a lot of life to them. By contrast, I have seen NESEA members in heated

arguments one minute and sharing a pint the next. We are a very lively crowd!

**What do you hope to accomplish in that role?** I would like to help grow our membership so that we continue to see many new members joining and being welcomed by long-term members. Not just emerging professionals, but more practitioners from across the board—established architects, builders, developers, and others. We have a lot of specialists in our midst, but I would like to see the conversation expand to include a broader knowledge base.

I'd also like to see more people with the passion of long-timers like Marc Rosenbaum, Fred Unger, John Abrams, Katrin Klingenberg, and Jean Carroon. I look forward to meeting the next Marc, John, Katrin, or Jean and seeing them grow within our community and bring value.

**Any final thoughts?** Belonging to a quality professional organization is very important. CSG's emerging professionals group invited me to speak on a panel on the topic of networking. My pitch to them focused on this question: do you want a job or a career? Work will always be hard, but if you see yourself as a professional, and your career as something that is developing or evolving, it takes on a different meaning. Belonging to a professional organization such as NESEA is how you make a career. It is a place where you can get excited about what you do, develop a common body of knowledge, see the options for expanding that knowledge, and stretch yourself both personally and professionally. Belonging to an organization that's as vibrant as NESEA is inspiring. It gives you the opportunity to create a career for yourself far beyond your nine-to-five daily grind. 🌐

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# BuildingEnergy Online

By Peter Troast

We at Energy Circle have always felt that NESEA brings together the greatest sustainable building community anywhere. And being from Maine only makes us a little biased. We have relied on NESEA ourselves to connect with our community of customers and collaborators since the firm's inception. The experience of attending a BuildingEnergy conference has always been transformative both for our business and for me personally. Every year we leave inspired from the days immersed in this amazing community.

The glow of that conference experience, combined with NESEA's charge of "connecting sustainability professionals to ideas and each other," were the driving forces behind a recent project to rebuild the organization's online presence. Many came to refer to the website overhaul as BuildingEnergy 365. We asked, "how do we retain the inspiration and sense of community of the conferences throughout the rest of the year?"

Energy Circle was thrilled to have been chosen by NESEA to build an online infrastructure to put those ideas into action. Through the addition of new platforms and services, we were able to tap even further into the extraordinarily giving community of NESEA members. Their willingness to share their expertise with the community allowed us to make that knowledge more accessible.

With those principles of connection, sharing, and transformation in mind, some of the key new features of the NESEA BuildingEnergy site are:

## BUILDINGENERGY Masters Blog

A place for leaders in the industry to share their insights on new policies, trends, and opinions. These data-rich pieces will help shape the next chapter of our businesses.

## Local Event Q&A

NESEA brings together the community online and offline with local events and tours. With the new post-event Q&A section, attendees of local events will have the opportunity to interact with the project sponsors and ask the questions they didn't get to in person.

## Masters Q&A

Ask NESEA masters the specific questions you have to help you expand your knowledge in any area. Some upcoming featured Masters include: Marc Rosenbaum about net-zero energy; Andy Shapiro about energy metrics, Paul Eldrenkamp about building durability, and many others.

## BUILDINGENERGY Community Blog

The hub where the entire community, including YOU, can contribute with straight-forward, substantive information on what's going on in your region and business.

## BUILDINGENERGY Conversations

Unlike other overcrowded, confusing forums on the web, we built a platform for carefully curated topics, a steady hand of moderation, and engagement by experts, so you can find the information you need without all the noise.

## Connecting the Community

In order for attendees to get the most out of the live events, we wanted to connect community members before and after the conference. We've made it easy to see who's attending, what they're interested in, and how to connect throughout the year. 

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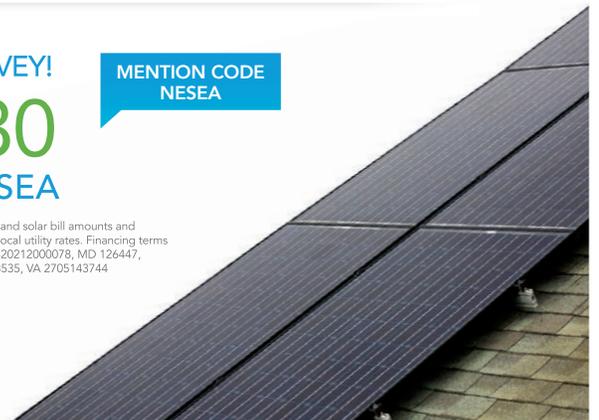
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# Rethinking the Grid

## Encouraging Distributed Generation

By Karl Rábago

Peer reviewed by Fred Unger

For more than 100 years, taxpayers, ratepayers, investors, and policymakers have supported the growth and operations of the electric utility industry. The ratemaking formula, under which capital investment is recovered and healthy profits are guaranteed, has helped make electric service in the United States nearly universal and relatively cheap. For much of the last century, the model leveraged increasing economies of scale to enable the provision of electricity as well as profits and dividends.

Along with those benefits come significant costs. The electric utility industry is a major consumer of fossil fuels and a large emitter of greenhouse gases, mercury, and other pollutants. The implicit preference for large plants creates a business culture that is stodgy and resistant to change.

Where the vertically integrated monopoly remains, so do the problems. In states where "deregulation," more accurately termed restructuring, was undertaken, the problems are almost as bad. While restructuring has produced some benefits by encouraging competition among generators and open access to the wholesale grid, retail service competition has not delivered on the promises with which the concept was originally pitched.

In particular, robust markets for energy efficiency and other clean and distributed energy resource technologies and services have not emerged. These services are still overwhelmingly implemented through public purpose funds and programs, as mandates imposed on distribution utilities. Bringing innovation in distributed energy services to customers,



One of two 1.6 MW wind turbines installed at Mount Wachusett Community College in Gardner, Massachusetts. These supply all of the college's annual electricity requirements along with excess, which is sold back to the grid.

especially residential and small commercial customers, is overdue and will require another round of structural change.

### A Revolution in Scale

Utilities are more insulated from market forces than many other businesses, but they are not immune. Low gas prices, for example, have increasingly rendered coal-fired and nuclear generation economically unviable, while public concern over environmental and human health consequences has made these plants hard to site and difficult to permit. High gas prices induce conservation and shifting toward alternative sources of fuel. Nuclear power plants,

with their chronic cost overruns and delays, strain the patience of investors and require ever-stronger incentives as well as questionable cost-effectiveness evaluations and contorted resource planning processes. Meanwhile, customers and the buildings they occupy are becoming increasingly energy efficient. All this weakens growth in revenues at the utility level. Remarkably, the electricity industry is driven overwhelmingly by three key factors, all of which are completely beyond the control of either regulators or utility executives: weather, commodity fuel prices, and general economic conditions.

A new and growing component of market pressure on utilities over the past few decades has been the shift

## BuildingEnergy 15 Preview

*Rethinking the Grid* (Opening Plenary) with Karl Rábago, Mary Powell, and Ron Binz.

[nesea.org/be15](http://nesea.org/be15)

toward smaller, more distributed energy resources and services. As chronicled in *Small Is Profitable*, published by the Rocky Mountain Institute, right-sized resources offer numerous economic, financial, operational, and engineering benefits for meeting the demand for energy services. These distributed energy approaches offer modularity, risk-reduction, resiliency, and other benefits now increasingly recognized and monetized by customers and entrepreneurial service providers alike. Growth in clean, distributed energy has not come easy, but many concede that the forces of change in the utility industry are now inevitable.

## Challenges to Growth

Regulators, policymakers, and industry leaders now speak of the need for another restructuring of the energy industry, with the aim of transforming the sector toward "Utility 2.0," or the "Utility of the Future." But several obstacles stand in the way of realizing the full potential of distributed energy services.

**Pressure on Public Benefit Funds** Public benefit fund programs always face funding pressure. Electric service providers and suppliers make money from sales or have revenues indexed to throughput, so they are often less than enthusiastic about supporting distributed energy. Policy makers and regulators, especially in restructured states, have few other mechanisms for reducing charges to customers, and face continued pressure to reduce or restrain growth of public benefit funds.

### **Increasing Fixed Customer Charges**

A number of distribution utilities are seeking to change the ratio of fixed and variable charges for their services.

Traditionally, customers are charged relatively small "customer charges" designed to recover metering and administrative costs. Other costs are recovered through volumetric charges based on kilowatt-hour usage. Now a number of utilities are seeking to increase fixed charges and thus their revenues. Because fixed costs cannot be avoided by lowering consumption, increases in these costs also increase payback terms for distributed resources, making installation less attractive.

**Generation Capacity Costs** Electric generating capacity reserve margins are extremely high in New York and New England, due largely to a massive growth in natural gas capacity over the past decade or so. This new gas generation creates opportunity for demand-side resources, such as demand-response programs in the winter, when gas supply constraints pose potential problems. But overall, excess capacity and relatively low natural gas prices create strong economic challenges for distributed energy market growth.

**Transmission and Distribution Infrastructure Investments** Investments in the transmission and distribution grid comprise a two-edged sword for distributed energy resources. On the one hand, investment at the "Smart Grid 1.0" level, involving advanced metering infrastructure, distribution automation, and other system improvements, is critical to enable value optimization for many distributed energy options, especially demand response and load management. However, major transmission and distribution investments, especially hardening and some resiliency improvements, compete for scarce capital and create large, unamortized, rate base balances. Some utilities see increased deployment and operation of distributed energy as a threat to timely recovery of these investments.

**Attacks on Net Metering** Most notorious in utility regulatory policy arenas over the past few years are utility industry efforts to abolish or severely undercut net metering for dis-

tributed generation, particularly rooftop photovoltaic systems. Championed by the Edison Electric Institute, American Legislative Exchange Council, Americans for Prosperity, and other advocacy groups, the effort to end net metering is taking place in both legislative and regulatory forums. The standard argument is that net metering, which allows self-generation to offset consumption charges at the retail consumption rate, constitutes a subsidy, because the credit is greater than the cost of wholesale power. The argument continues that because the bill of a net metering customer is lower, the difference constitutes a shortfall in projected revenues for the utility that must be made up on the backs of non-solar customers. These non-solar customers, it is argued, are poor people who the utility can never imagine enjoying solar energy systems.

Cynicism aside, the argument suffers most from the faulty premise that one can assume electricity produced at the point of consumption can never have more value than the wholesale price of electricity. And though a bedrock principle of utility ratemaking is that rates must be founded on cost-of-service studies and objective cost allocation exercises, not one cost-of-service study has yet supported the subsidy argument. Dozens of valuation studies have been conducted in recent years, most of which support the argument that distributed solar generation is worth more than the retail prices of electricity, and that solar customers who only receive retail rate credit are, in fact, subsidizing other utility customers.

The real issue with distributed resources is that they reduce revenues for utilities and conventional generators in the commodity electricity business model. Distributed generation reduces the need for generation and transmission infrastructure, both today and in the long run. With rapid growth in distributed energy resources due to falling prices and increasing popularity, this



A solar installation on sixteen buildings at Mishaawum Park Apartments in Charlestown, Massachusetts, serves 337 units of affordable housing.

emerging trend has been characterized as an existential threat to utilities.

## One for One for One: One for All

The gap between where we are and where we must go is daunting. As difficult and expensive as it has been to install open-access wholesale markets, the realization of healthy markets for distributed energy will be exponentially more difficult. In an environment where the scale of solutions required is huge and the political risk associated with even proposing them is formidable, proposals for regulatory reform often lead to only incremental changes.

Pilot programs have demonstrated all that they can. It is time to complete the process of bringing sustainability to the electric utility sector. Three major agenda items pave the way for the transition.

**Valuation Analysis** The process of transformation should be primed with value-based pricing of distributed energy solutions. Assumptions about subsidies and cross-subsidies in net metering, energy efficiency, and other distributed

systems should be flatly rejected in favor of actual analysis of full, long-term benefit and cost analysis. The analysis of the value of solar that began with *Small Is Profitable* should expand to all the major distributed energy resource categories—solar, savings (efficiency and demand response), storage, security, and smarts. Rates, charges, and incentives associated with these resources should be based on actual analysis of value to service providers, customers, and society. Once the value of distributed energy resources is understood, regulators can move to create competitive market opportunities for third-party providers of these services from within the current model through local integrated resource planning.

**Third-Party Participation** The utility sector must be aggressively opened to third-party service and technology provider participation, especially in distributed energy service markets. With advances in intelligence and information systems, there is no reason for electric service to remain so dumb and data-poor. The culture of utility management needs an injection of innovative thinking that third-party entrepreneurs can bring. Elements of retail electric service amenable to competitive service should be

unbundled and offered up to competitive providers on open-access terms, just as has been done in competitive wholesale markets. This will lead to loss of market share among current big suppliers, but can provide far more value for ratepayers and society. With proper oversight, providing utilities an opportunity to compete fairly for some of that market share can mitigate such adverse impacts.

**Performance-Based Regulation** The utility sector elements that serve customers must move from cost-plus regulation to performance-based regulation. The old system was perfectly designed to encourage over-building of infrastructure and over-consumption of electricity. While the benefits of widespread electrification and economies of both generation and grid infrastructure justified that model for more than half of the last century, it has outlived its usefulness. The commodity model must be replaced with a service model. Instead of compensating utility service providers based on commodity production and delivery in a model focused on rates, a shift to performance regulation would reward service providers for maintaining grid reliability while helping customers manage their bills. It would also derive maximum energy

service value from the most cost-effective blend of supply- and demand-side resources. This shift could align utility and customer interests while securing improved environmental, economic, and equitable performance in the near and long term.

The entire transition process should be structured around a defined system of metrics. The utility sector today is not competitive, and markets are significantly distorted by the lack of meaningful competition among retail electricity service providers. In vertically integrated monopoly systems, fuel prices are still passed directly through to customers. In the restructured markets, the pervasive model is rate competition only, with little focus on service. An intentional path of market structure conversion is essential.

Policy makers should adopt a "one for one" transition model: For every new megawatt worth of conventional generation or transmission capacity added to the system, regulators should secure the



This 986 kW solar farm in Gardner, Massachusetts, serves an affordable housing community, a sheltered workshop, an elderly housing complex, and a local business.

permanent retirement of one megawatt of existing conventional generation, and the permanent addition of one megawatt of distributed energy resources.

The deal is easy to understand and offers a clear path toward the desired

end state of robust distributed energy markets. Regulatory mandates can be relaxed as the market grows. Distributed energy acts as a hedge and price-check on additional investments in conventional resources. The retirement of existing

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One of two cogeneration units at LB Johnson Apartments in Cambridge, Massachusetts. These units provide heat and domestic hot water while also providing 56% of the electricity used in this high rise elderly housing apartment building.

conventional generation prevents significant excess capacity from frustrating transition efforts. The goal is the emergence of a new utility model remarkably reminiscent of the original light company model, but with the benefit of modern technology and competition—the load management utility.

## The Load Management Utility

Yogi Berra tells us, "If you don't know where you are going, you'll end up someplace else."

Even with the uncertainty that accompanies a major undertaking like utility restructuring, some effort to visualize a desired end state is an essential first step in the journey. The utility of the future must embrace, not oppose, distributed energy resources. It must thrive on and encourage innovation, internalize environmental responsibility and customer empowerment, and provide a platform for innovation in product and service development. In short, the utility of the future must be the current system turned upside down.

Today's utility model can be summarized quite briefly: forecast and assume demand, build or acquire supply to fit, and implement demand-side options only to the extent forced to do so. The inverse of this model, or "the utility of the future," is the load management utility (called the "distribution system platform provider" by the New York *Reforming the Energy Vision* publication).

The load management utility is an entity operating under performance-based regulation and compensated not on throughput, but on service. Its mission is to manage electricity loads using every distributed resource and technology at its disposal, through third-party partners, using wholesale resources only when all distributed resource options are exhausted.

The load management utility shifts market surplus downstream to customers, as happens with all mature markets. It utilizes a robust, locally integrated resource planning process, and provides transparent price information determining short, medium, and long term planning cost values for marginal distribution capacity and energy.

The performance standards reward optimization of several factors, including

short and long-term prices, environmental responsibility, customer satisfaction, grid reliability and service quality standards (especially for service to low-income customers), and minimization of revenue requirement.

The load management utility uses its platform provider role to encourage third-party participation in provision of services rather than to exercise market power, operating essentially as an "independent distribution system operator." The load management utility operates at the retail level, fully under the oversight of markets and state regulators. Its functions are therefore not wholesale transactions until it buys or sells energy or other services to the wholesale system operator, thus reducing problems associated with bifurcated jurisdictional authority over electricity rates and services.

The load management utility is a vision of what today's utility distribution service providers can become, for the benefit of the utilities, customers, and society alike. Its incentives align with the best interests of all three, eschewing the sub-optimization inherent in traditional approaches that seek to "balance" economic and environmental concerns, or economic and equity concerns.

## Conclusion

The time has come to complete the transformation of the electric utility sector. A deliberate and sustained effort to establish robust markets for distributed energy services is the major remaining step in that process. Policy makers, regulators, and utility leaders must focus first on understanding the value of distributed energy resources of all kinds, creating meaningful opportunities for third-party technology and service providers to participate in competition for marginal energy service dollars, and shifting utility regulation to a performance based model of regulation. In the end, the process can lead to the emergence of the new central feature of electric service—the retail level load management utility. 



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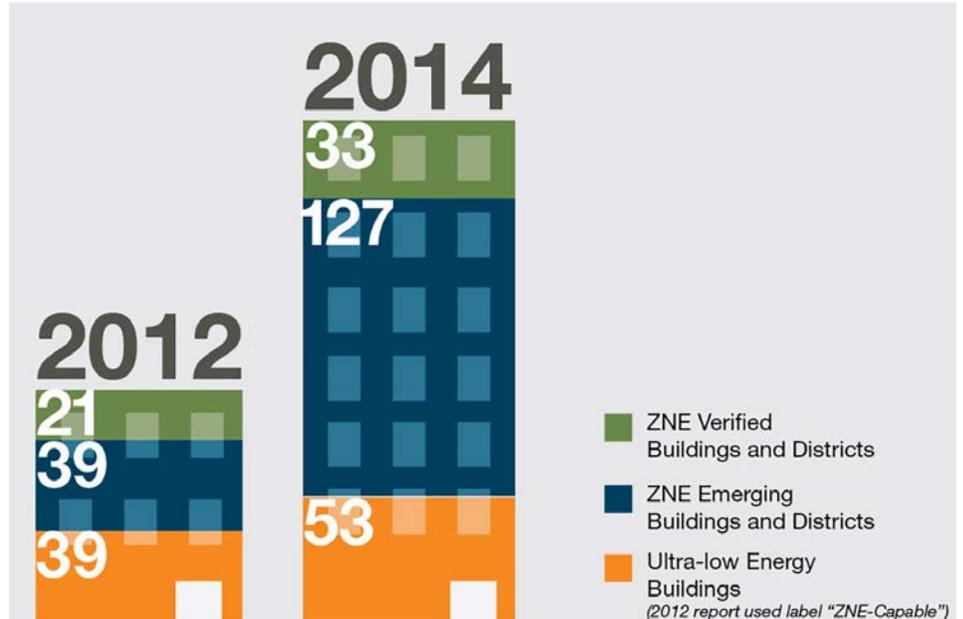


# The Energy Holy Grail

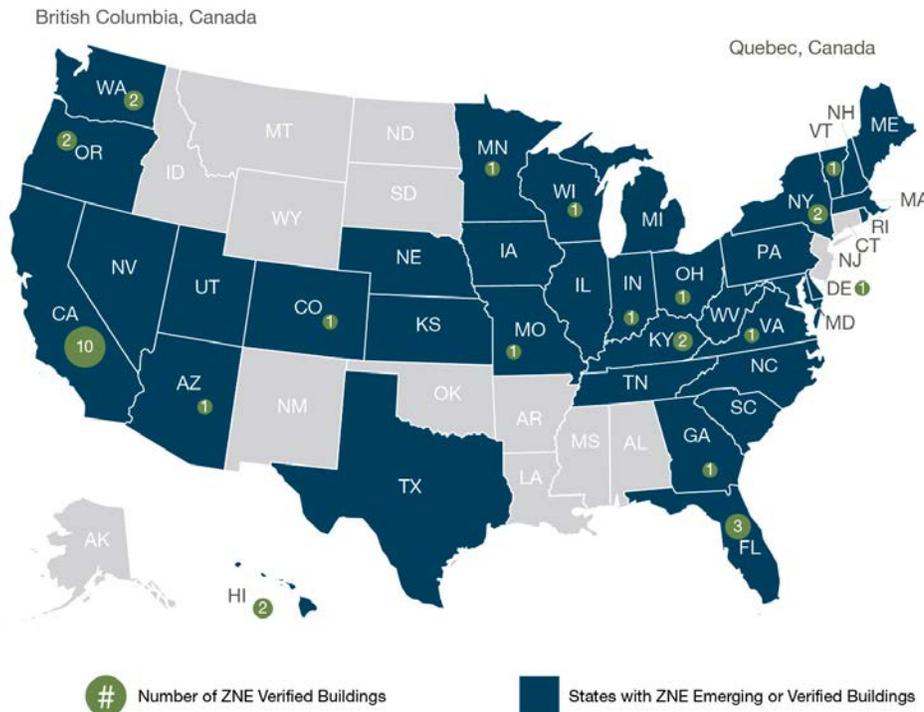
## What's Really Getting in the Way of Achieving Net-Zero Energy?

By Ann Edminster

Many individuals and organizations—for the most part acting independently—have been pursuing the goal of net-zero energy buildings (NZE or zero-net energy, ZNE) for a decade or more. Recently these initiatives have hit a sharp inflection point—media attention and focus within the building industry have dramatically increased in the last few years. At the same time, the scope of NZE practitioners' and advocates' ambitions have similarly expanded. NZE or carbon-neutral neighborhoods, towns, and entire metropolises are now firmly in the sights of those leading the charge, as are aims even beyond "net zero"—including net-positive, regenerative, restorative, and even "living" buildings and communities. We are witnessing a sea change.



Number of ZNE Projects from 2012 to 2014



Locations of ZNE Buildings and Districts

Among the more progressive governmental entities aiming towards net-zero energy performance are the U.S. Department of Energy with its Zero Energy Ready Homes program; the states of California and Massachusetts; and a smattering of cities in the Northeast and the West, as well as outside the U.S. (including Denmark's capital, Copenhagen). Yet it is not as though NZE communities are appearing overnight; there are numerous impediments to achieving these lofty goals. Notably, there is a strong consensus among seasoned NZE practitioners that the principal obstacles to NZE (and beyond) are not technical, but mostly institutional and cultural.

In October 2013, inspired by the vision of how much more might be accomplished—and how much more quickly—through collective action, the Net Zero Energy Coalition (NZEC) convened the

inaugural Net Zero North American Leadership Summit, bringing together leaders from across North America to begin to work collaboratively to identify and address these institutional and cultural barriers. Acclaimed by numerous participants as a pivotal event for the NZE movement, the Summit concluded with an all-hands workshop designed to start framing needs and opportunities for collective action aimed at vanquishing the barriers to NZE.

Recently launched by the Net Zero Energy Coalition as a direct outgrowth of that Summit workshop, six NZEC Activation Teams are now pursuing directed agendas. Each Activation Team addresses a particular set of institutional and cultural barriers that impede faster, wider realization of NZE goals. Those teams are focused, respectively, on:

- Policy and Programs
- Finance and Real Estate

- Education and Tools
- Products and Design Innovation
- Market Awareness
- The Grid and Utilities

A brief description of how each Activation Team is tackling each particular challenge follows.

## Policy and Programs

The Policy and Programs Activation Team (PPAT), chaired by Dave Hewitt, who recently retired from the New Buildings Institute (NBI), includes representatives from the City of Boston, Natural Resources Canada, Massachusetts Department of Energy Resources, the City of Cambridge, U.S. Department of Energy, National Grid, Southern California Edison, and a number of private firms. The PPAT has set out to identify and expand on the top ten policy priorities to ad-

vance NZE, an idea first proposed at the 2013 Summit. The group is also considering focusing on one key "game changing" policy that the Coalition could organize around.

Subsequent to the 2013 Summit, NBI adopted the "top ten" idea and developed a list of priority policies aimed at commercial NZE buildings (more details are available at [newbuildings.org](http://newbuildings.org)). The NBI list, which is being used as a starting point, includes the following steps:

- Develop a building energy codes roadmap.
- Establish annual benchmarking and disclosure policies and aggregate energy-use data to set local energy reduction targets.
- Establish rate policies that fairly credit renewable energy production while acknowledging the changing role of the electric grid.

Focus Area	Path to Zero Priorities
<b>Policy &amp; the Grid</b>	Develop white paper on top 10 issues (business models, technical issues, model NZE codes, align with carbon issue, storage issue, cost) Form an advisory committee and group to influence policy & grid stakeholders. Enlist policy advocacy advocates (environmental groups), enlist a broader audience, leverage existing efforts (i.e. RMI eLab, ACEEE) and enlist leveraging agents
<b>Driving Market Demand</b>	Hire firm to develop a deeper understand of what the industry needs to deliver and communicate to the market (anthropological analysis & ethnographic profiling) Launch an industry awareness campaign, borrowing from other successful campaigns Conduct market awareness campaign Enlist environmental movement as allies for broader influence
<b>Finance &amp; Real Estate</b>	Train real estate appraisers on green and energy-efficient code Work with State boards to change appraisal standards Create a simple costing budget for NZE Develop tools such as calculators to value NZE Form an industry influencer group to educate and drive key financing and real estate stakeholder groups
<b>Education &amp; Tools</b>	Identify competency gaps in the workforce: who we're going to teach, what to teach, how; segment and prioritize target groups for dissemination of information Create a database of education resources Develop a standardized format for case studies (task group formed to do this); look at Challenge Home case studies Incorporate energy modeling tools a part of process for building, measurement, and certification programs
<b>Products &amp; Technologies</b>	Address barriers to entry for product certification issues Form an industry influencer group to drive quality, specs, and costs of product manufacturers. Early wish list includes cheap triple glazed windows, early quantification of value, smaller DHPs, small scale HRVs, and energy dashboards Oversee superefficient dryer initiative – model already gaining great traction

- Provide supportive programs by utilities or program administrators.
- Create incentives for NZE at the state or local government level.
- Set NZE goals for government and other public buildings.
- Identify and support target sector efforts.
- Encourage district or community-scale renewable energy systems.
- Adopt improved appliance standards to reduce energy use that falls outside the scope of building energy codes.
- In coming months, the PPAT will examine this list more closely and work to refine it to represent a consensus among the team members. Their findings will be presented and discussed by NZEC members at the 2015 Summit in Boston on March 3.

## Finance and Real Estate

The worlds of finance and real estate have been moving slowly into the realm of sustainability and efficiency. Appraisal standards, valuation, and sales training programs aimed at high-performance and NZE buildings are available, but not yet prevalent. The Finance and Real Estate Activation Team is working toward better education as well as implementation of programs that will accurately recognize property and cash flow benefits from energy efficiency and distributed generation measures.

This group includes leaders from Wisconsin Energy Conservation Corporation (WECC), Sage Real Estate, Barnraisers Group, Build It Green, and Solid Green Systems. In the coming months, the team will work to craft an agenda that will engage the other real estate and finance industry stakeholders who will attend the Summit.

## Education and Tools

Shawna Henderson and Hal Richman of Blue House Energy and Barbara Hernes-

man of CalCERTS began collaborating on projects before the founding of the Education and Tools Activation Team (ETAT). The group has since expanded to include representatives from U.S. Department of Energy, Earth Advantage Institute, Energy and Environmental Building Association, Sustainable Performance Institute, and Build It Green, among others.

The ETAT has established several working goals:

- Catalog existing education offerings available to equip various workforce sectors to achieve NZE, and identify gaps in those offerings that need to be filled.
- Establish an education and training clearinghouse on the Coalition's website—a database listing education projects, programs, and resources and describing the audiences, format, learning objectives, and so forth for each one.
- Develop a plan for how to engage builders and other stakeholder groups to ensure that those being hired to work on NZE projects have the appropriate education to accomplish the work effectively.

In preparation for the Summit, the ETAT plans to conduct a survey of stakeholders to develop a better understanding of NZE education needs and opportunities. The findings will be presented at the Summit. Also at the Summit, the ETAT will offer a presentation about how to develop competency models, which form the basis for curriculum development. The goal is to ensure that all those working on NZE education initiatives have a common base of understanding from which to work.

## Products and Design Innovation

The Products and Design Innovation Activation Team is somewhat unique in that it covers two distinct constituencies: design practitioners and supply chain entities (manufacturers, retailers, distributors, and installers). The intersection between

these two groups is their mutual interest in increased knowledge about each other. Suppliers will benefit from insight into the needs of NZE design innovators, and the NZE design community will benefit by knowing what products are available to meet the unique performance challenges posed by their projects.

A diverse roster of NZE practitioners and vendors is being assembled for this team, with Brad Liljequist of the International Living Future Institute at the helm. Other confirmed participants hail from Bosch, Zehnder, Building Science Corporation, Conservation Services Group, Cree Lighting, and Steve Easley & Associates. One of the chief aims of the team will be to establish a forum to facilitate the exchange of information among these two constituencies, both at the Summit and ongoing.

## Market Awareness

At the 2013 Summit, every discussion came back to the critical role of market awareness and the related behavior of industry players, buyers, and property owners. The lack of awareness is seen by many as the greatest barrier to widespread NZE adoption. The U.S. Department of Energy has taken the lead with its Zero Energy Ready Homes program, but work on a mass market scale is still ahead. The NZE market is still nascent, led by innovators who are risk-takers and experimental by nature. To make the leap to the mass market, the Market Awareness Activation Team seeks to understand current perceptions and behaviors in order to better communicate the benefits and intrinsic value of net-zero energy buildings.

Team members include the U.S. Department of Energy, Zero Energy Homes, New Buildings Institute, Energy Center of Wisconsin, motum b2b, and Energy Matters. Each of these organizations has already conducted some research and messaging development, and all are actively communicating with the market. Using current work as a launchpad, the



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team will scope a behavior study to meet the current gap in understanding of the market, and then use the information derived from the study to launch a national net-zero energy campaign.

## The Grid and Utilities

We are at a turning point for truly scaling NZE. New energy generation, distribution, and storage technologies need to be in place to support the next generation of building to zero. The Grid and Utilities Activation Team is exploring battery technology, utility models, community solar, and other innovations that will be needed in the future to support full NZE implementation.

With the multiple perspectives of Rocky Mountain Institute, Energy Center of Wisconsin, RENEW Wisconsin, BC Hydro, National Grid, Pacific Gas & Electric, and Northeast Utilities all at the table, the team is identifying specific areas on which these organizations can collaborate. Team members have identified opportunities in both valuation and next generation utility models that could form

the basis of joint initiatives that would have national impact.

## The Coalition's Role

The role of the Net Zero Energy Coalition, affirmed at the inaugural Net Zero Summit (held in conjunction with the U.S. Department of Energy's Solar Decathlon in Irvine, California, in October 2013), is to convene, coordinate, and support the diverse array of stakeholders in the NZE community across North America. As such, we have provided the impetus for the creation of the Activation Teams; we also maintain an active role in their continued activity, although a number of the teams are chaired by individuals in other organizations. We anticipate that at the conclusion of our second Summit in March 2015, the Activation Teams will take on more of an independent life as the team members become more accustomed to working together on larger goals than those achievable by individual organizations on their own. 

## 2015 Net Zero Summit and BuildingEnergy 15 Conference

The 2015 Net Zero Summit is a shining example of what can be accomplished through collective action. NESEA's Deputy Executive Director Mary Biddle (and several NESEA members, including former board members Nadav Malin and Bruce Coldham) participated in the inaugural Net Zero Summit in 2013, marking the beginning of a fruitful collaboration between NESEA and NZEC. After months of dialogue, the two organizations agreed to combine events: the second Net Zero Summit would be held in conjunction with NESEA's BuildingEnergy 15 conference in Boston in March 2015.

There is a strong natural synergy between the Net Zero Summit and BuildingEnergy 15: The Northeast has long been a stronghold for energy efficiency and high-performance buildings, and NESEA has been a catalyst for collaboration amongst the region's community of advanced building practitioners, among them numerous NZE pioneers. This makes BuildingEnergy 15 a natural point of convergence for NZE leaders. Co-locating the Net Zero Summit with BuildingEnergy 15 will facilitate a deeper and richer dialogue among many of the foremost contributors in this field.

Registered Summit participants have the opportunity to at-

tend a BuildingEnergy 15 pre-conference workshop on Tuesday morning, March 3, followed by the opening session of the Summit, which features keynote speakers architect-author Bill Maclay and solar innovator Steven Strong. On Wednesday, March 4, Summit and BuildingEnergy 15 participants will circulate freely among 11 concurrent tracks, four of which have been curated by NZEC and focus on NZE topics; the remainder have been programmed by NESEA and feature their reliable array of advanced efficiency topics.

On Thursday, March 5, Summit participants will spend the morning in a "Path to Zero" strategy workshop and then join BuildingEnergy 15 attendees for afternoon programming, developed by NESEA, including a closing plenary panel of industry thought leaders.

Each of the two organizations has received an enthusiastic response from its members about this unique opportunity to blend constituencies and share ideas. We look forward to a fun, exciting, and successful event.

To register, go to [netzeroenergycoalition.com/summit/register](http://netzeroenergycoalition.com/summit/register) 



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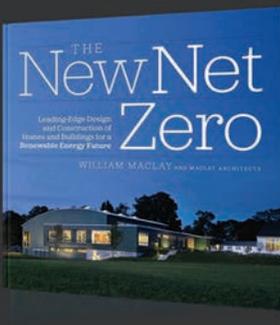
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# Lessons from Scandinavia

By Chris Benedict, Andy Shapiro, Tom Hartman, Paul Eldrenkamp, and Heather Nolen

In October 2014, NESEA members Paul Eldrenkamp, Tom Hartman, Chris Benedict, and Andy Shapiro, along with Heather Nolen (winner of the Kate Goldstein Scholarship) traveled to Sweden and Denmark. These countries were chosen in part because they have a similar climate profile to that of the NESEA region. The tours included site visits to high-performance buildings and walkable, mixed-use neighborhoods as well as meetings with the design and construction teams behind many of the projects. The travelers will share their experiences at BuildingEnergy 15 during two *Lessons from Scandinavia* sessions.



**Taking a wood-frame single-family home, wrapping it in insulation, and replacing the windows and mechanical systems is an expensive proposition that typically will have an extremely long payback almost no matter where you live.**

We visited two deep energy retrofits (DERs) of single-family homes, one near Stockholm and the other near Gothenburg. The main lesson I learned from these projects is that the laws of physics and economics are pretty much the same in Scandinavia as they are in the US. Taking a wood-frame single-family home, wrapping it in insulation, and replacing the windows and mechanical systems is an expensive proposition that typically will have an extremely long payback almost no matter where you live. That being said, there are homeowners willing to undertake such projects for a variety of reasons. Some

of those homeowners will want to make them seem like a much better investment than they might actually be, and so might get a little fuzzy about the actual numbers (both cost and performance) when pressed for details. Sweden seems to be about five or six years behind the NESEA community in figuring out how to do this type of single-family home DER. But designers there are a decade or so ahead of us (if not more) in figuring out how to do DERs of large-scale masonry multifamily buildings, which tend to be a much better economic proposition.

– Paul Eldrenkamp

## BuildingEnergy 15 Preview

Lessons from Scandinavia (Parts 1 & 2) with Chris Benedict, Andy Shapiro, Tom Hartman, Paul Eldrenkamp, and Heather Nolen.

[nesea.org/be15](http://nesea.org/be15)



In Alingsås, Sweden, we met Hans Eek, who is a most remarkable man. He has a deep understanding of building physics, and is able to teach in casual conversation. From his strong foundation of sustainable practice, he has helped create beautiful and efficient places. We were lucky to visit a few of those with him. Shown here are Andy Shapiro and Hans discussing the details of glazing properties at a kindergarten that has been certified to the Swedish Passivehaus standard, which Eek helped develop and promote. He was generous with his time and his thoughts.

Eek has the perspective to recognize the need for technical, business, teaching, and political work to achieve sustainability. He traces sustainability consciousness in Sweden to the coun-

try's first energy crisis in the 1700s, when wood was depleted due to its use in mining and smelting. This long history and the resulting long view plays an important part of the sustainability consciousness that supports Swedish advances. Eek recognizes that one must work with city planners and politicians to make change, so he is developing a training program to teach builders near-net-zero building skills. He is also looking for a business model for achieving 50 to 70 percent reduction in energy in existing buildings.

Eek took us to visit one of his retrofit projects, a low-rise, multifamily building with exterior insulation clad with glazed ceramic tiles on aluminum extrusion system. The condition of the existing walls was very bad, so they had

to removed and replaced, even though the original plan had been to leave them in place; costs rose accordingly. New windows, roof insulation, energy recovery ventilation, new kitchens and baths, and general refurbishment were part of the project. Eek's recognition of the importance of the social aspects of renovation—making the places nicer to live in—taught me the importance thinking more broadly about what sustainability means.

On the technical side, Eek has taken the complex and sometimes inscrutable German Passivehaus standard and made it beautifully simple for Sweden: if a building achieves 15-17 W/m<sup>2</sup> of peak load, it qualifies. There are a few other criteria, but the overall simplicity is beautiful. The variation in the main requirement depends on where you are in Sweden: 15 W/m<sup>2</sup> in the south, 17 in the far north. The low solar gain climate does not penalize the building, nor does a limitation on orientations. Eek is looking to move the rest of the EU to this simpler Swedish Passivehaus standard.

– Tom Hartman and Andy Shapiro

**Eek has taken the complex and sometimes inscrutable**

**German Passivehaus standard and made it beautifully simple for Sweden: if a building achieves 15-17 W/m<sup>2</sup> of peak load, it qualifies.**

It's a NESEA "burning question"—are aesthetic delight and energy efficiency mutually exclusive? Our knee-jerk response might be to answer, "NO! Efficiency adds comfort, stalls global climate change, and reduces pollution and war!" We witnessed repeated covert and overt commentary on this question in Scandinavia, where access to daylight in the winter is a vital component of emotional well-being.

While touring the Swedish Test house at SP, the Technical Research Institute of Sweden, I noticed a funny thing, a tiny light added to the top of the window return. Curious, I asked about it, but couldn't get a coherent explanation.

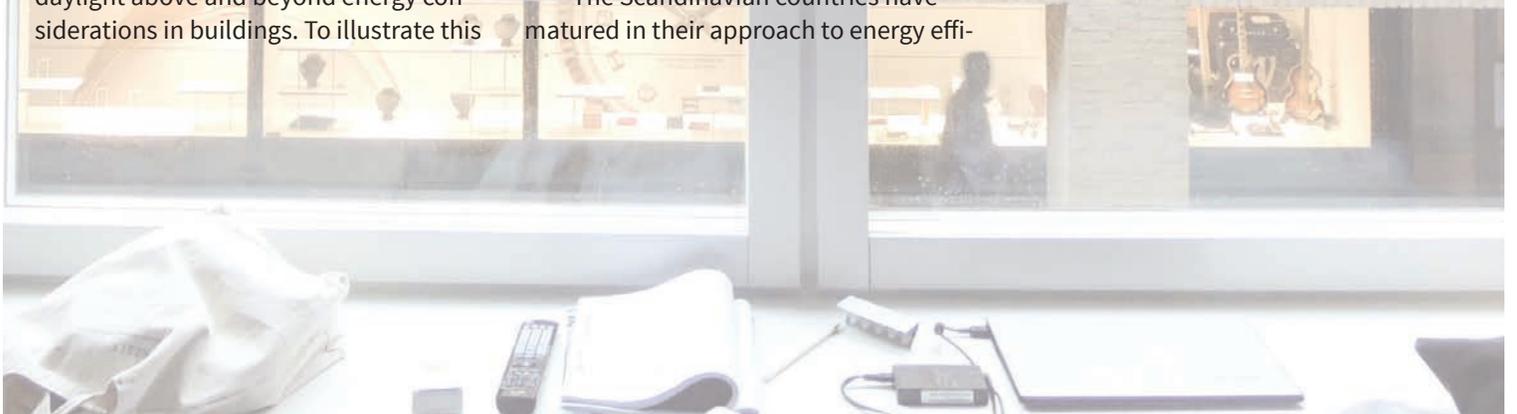
And then later at our hotel in Gothenburg, Sweden, I saw something similar. There were lighting surfaces around the large window in my room. Later, when meeting with a principal of a large architecture firm and his director of sustainability in Copenhagen, we discovered that these lit windows were part of a larger conversation. Their view of sustainability lives firmly in the realm of human aesthetic delight, rather than simple number crunching, particularly when it comes to the absolute need for daylight above and beyond energy considerations in buildings. To illustrate this

approach, they pointed us to the organization Nordic Built, which has as its mission: "We will create a built environment that is made for people and promotes quality of life."

The Scandinavian countries have matured in their approach to energy effi-

ciency practice, and have paved the way for our work in the U.S. Now we must consider where aesthetics fits into our energy efficiency picture

— Chris Benedict



Niels Jakubiak Anderson, of Krydsrum Architects, focuses on renovation projects, addressing energy reduction and historic preservation. ("Krydsrum" means the intersection of spaces and rooms.)

Denmark has an ambitious energy standard for new construction, but the existing building requirements have yet to be defined. Ryesgade 30, shown here, is an example of a multifamily housing project that added housing units to the roof. These units served as a driver for the project economics: the increase in rental income would fund the energy efficiency work. The goal is to make buildings more valuable through energy efficiency upgrades.

At Ryesgade 30, the upgrades required the building to be vacant. A

municipal program that uses tax money to pay displacement costs to residents allowed Krydsrum to relocate the residents during the renovation. The program has been in place since the 1970s, when the city was working to create more green space and renovate kitchens and bathrooms. Participating buildings must preserve 5 percent of the units for program participation. At Ryesgade, 40 percent of existing residents chose to return after renovation.

After the renovation, actual energy use for Ryesgade 30 is 60 kwh/m<sup>2</sup>, including user electric data. Because residents' usage varies by a factor of five, the next step is studying resident behavior.

– Heather Nolen



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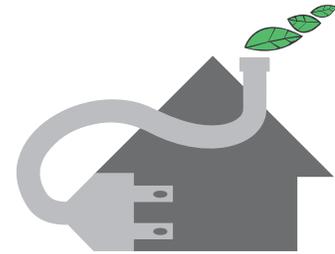
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# The All-Glass Building

## Is Energy Efficiency Possible?

By Andrea Love

Glazed towers dominate the skylines of our cities. However, most have been designed with little thought as to the climate in which they are located or the environmental impact they might have. According to the Commercial Building Energy Consumption Survey (CBECS) in 2003, 70 percent of energy use in commercial buildings is from the lighting and HVAC systems. The performance of both of these systems is directly related to the design and performance of the building envelope. Sealed, glazed façades, now so ubiquitous, lead to higher heating and cooling loads as well as glare and thermal comfort challenges.

Despite these challenges, many design teams pursuing sustainability continue to use all-glass façades because of their ability to connect interior and exterior environments. The market continues to demand, and architects to deliver, high glazing percentages for the daylight, views, and marketing potential they provide in green buildings. Such designs are difficult to make energy efficient, but many argue that fully glazed buildings, when designed correctly don't increase a building's energy usage.

The question remains: is an all-glass building a sustainable building?

## Daylight

The principal benefit of glass façades is their ability to allow natural light into living and working spaces. Daylight provides high-quality illumination with less radiation than most artificial light sources, including fluorescents. When coupled with a high-performance glazing system, natural daylighting can reduce



A modern façade with a balance of glazing and opaque wall panels.

the heat load that comes from artificial light fixtures. A lighting control system that responds to changes in daylight can yield a dramatic reduction in the building's lighting energy use.

In addition to the energy benefits from daylighting, studies have found numerous psychological benefits. A 1999 study by the Hescong Mahone Group found that students in classrooms with more natural light scored up to 25 percent higher on standardized tests than other students in the same school district. Studies looking at the effect of natural light on productivity date back to the 1920s, when they were conducted on silk weavers; even then, daylight was shown to increase productivity. Numer-

ous subsequent studies have shown improved performance and increased attention and alertness in occupants of daylight buildings.

Exposure to daylight has also been shown increase sales in retail establishments such as Walmart and Whole Foods. Walmart installed a daylighting system in one of its Kansas stores in the 1990s and had store employees rotate goods for sale under the natural light source; items sold better when under daylight.

Daylight has many benefits, but few studies have investigated how much glazing is needed to achieve good quality natural lighting. Most buildings do not need to be completely glazed to ben-

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enefit from daylighting. For example, the glazed area below a work surface in an all-glass building has minimal impact on the daylight in a space.

The rule of thumb in the industry (recommended by organizations such as Lawrence Berkeley National Laboratory) is that only 30 percent glazing is needed for optimum daylighting performance. Our findings at Payette corroborate this figure. Our computer simulations on the impact of the amount of glazing on daylighting have found in multiple projects that the Useful Daylight Illuminance (UDI) does not increase at all beyond 50 percent glazing. UDI looks at how much light a space receives above a specified target but below the threshold of lighting levels that will cause glare and discomfort. For example, a recent investigation for an east-facing office concluded that 40 percent glazing provided no any more useful daylight than 25 percent.

## Energy

A well-designed daylighting strategy can decrease a building's light energy use and associated cooling load. However, as lighting power densities decrease with more efficient lighting technologies like LEDs, lighting represents an ever smaller portion of a building's total energy use. Glazing's biggest impact on building energy consumption comes from its impact on a space's heating and cooling loads. The solar heat gain from the sun increases proportionally with the amount of glass on a façade, which in turn increases the energy needed to cool the building. A number of strategies exist to mitigate solar radiation, from external sun shading to frits and coatings on the glass. A well-designed shading system can significantly decrease but not block all heat gain, particularly on east- and west-facing façades, where low sun angles are particularly challenging.

In a cold climate like New England, the increase in heat loss in the winter as a result of high glazing percentages can significantly impact energy use. The

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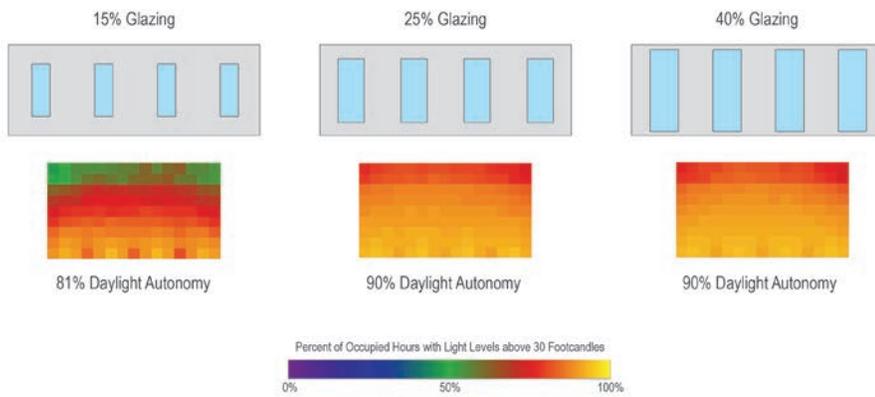


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Daylight simulation results for an east facing office, showing that façades with more than 25 percent glazing did not result in additional daylight savings.

current code requirement for maximum U-values for glazing is seven times higher than that of an opaque wall. Even with code-compliant glazing to high-performance triple glazing, the U-value is still three to four times greater than the maximum allowable for an opaque wall assembly. As a result, fully glazed buildings always have a much higher heating load than more moderately glazed buildings.

Double-skin façades have grown in popularity in recent years as a way to improve the energy performance of all-glass buildings. They work by capturing heat between the two glass walls to reduce winter heat loss and ventilating the same cavity in the summer to minimize heat gain. An integrated sun shading system between the two glass walls can further improve performance in the summer. While the double-skin façade can typically decrease a building's energy consumption in relation to a conventional, fully glazed façade, it still does not perform as well as an opaque wall with glazed openings.

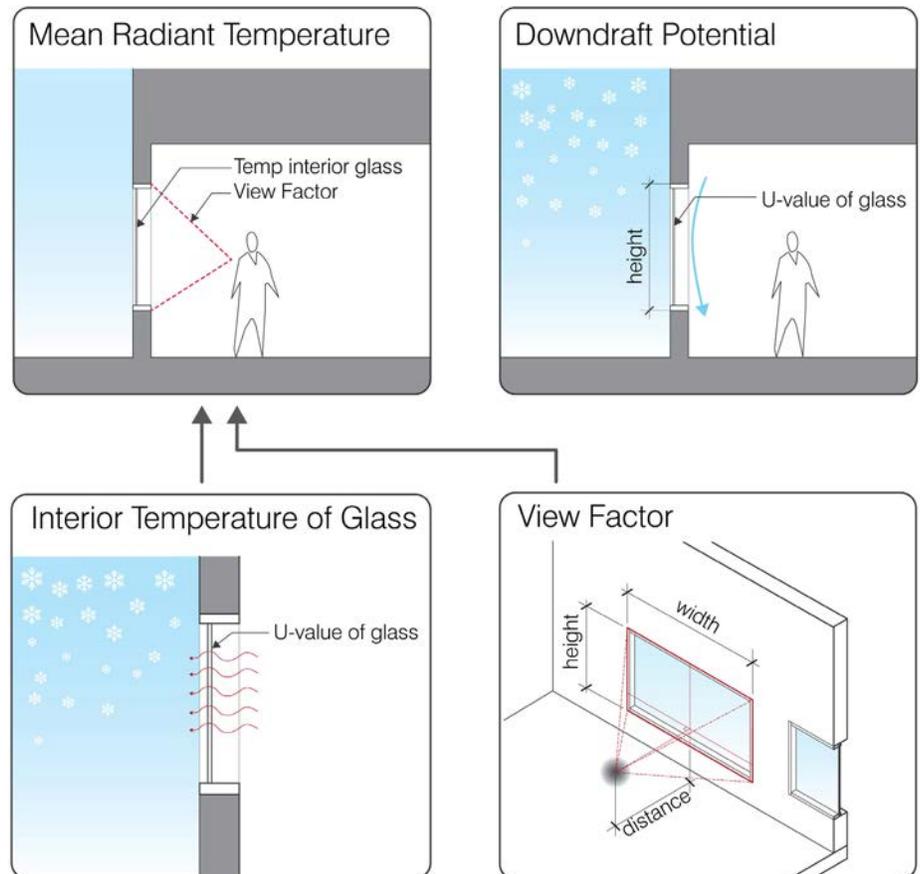
Because lighting energy loads are decreasing and HVAC energy loads are increasing as the amount of glazing increases, an energy model is often the best method to determine the optimal amount of glazing. While there is some variability based on the building type and climate, we have consistently observed buildings with a moderate amount (around 20 to 30 percent) of glazing use less energy than a fully glazed façade or one having little to no glass.

## Comfort

Creating comfortable environments for building occupants in all-glass buildings can be a challenge. Direct solar radiation, particularly in the summer, can create localized hot spots in the building. If the thermostat is not in the sun and is therefore not experiencing the raised temperatures, it will not adjust the HVAC system

to make the space comfortable for those in the sun. If the control is in the sun, the HVAC system can overcool occupants that are not directly in the sun, especially in open office spaces. A well-designed solar control strategy, using interior blinds or exterior sun shades, can mitigate this discomfort.

Winter conditions can also pose thermal comfort challenges in all-glass buildings. Because glass does not insulate well, it has a lower interior surface temperature than an opaque wall assembly. This increases the radiant heat transfer that happens between an occupant and the façade, and can make occupants feel cold even at a comfortable air temperature. The colder surface can also create a downdraft along tall vertical pieces of glass. Downdrafts occur as warm interior air hits the cold surface of the glass and falls, creating cold convective currents with temperatures and air speeds that can cause discomfort.



The geometry and U-value of glazing impact occupants' thermal comfort because they can lower the mean radiant temperature of a space and create a downdraft.

## BuildingEnergy 15 Preview

*The All-Glass Building: Is Energy Efficiency Possible? (Thursday session)*  
with John Hannum and Andrea Love.

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To combat this discomfort in fully glazed buildings, perimeter radiant heating is often added. Using a high-performance assembly, such as triple glazing, will raise the interior surface temperature, decreasing the radiant heat transfer and reducing the down-draft which can often create a thermally comfortable environment without the need for perimeter radiant heating. However, because comfort is determined by both glazing area and the U-value of the assembly, there is a limit to how low the U-value can be without needing mechanical means to create a comfortable environment. For the Boston climate, we have found that full-height glazing (60 to 70 percent glazed or higher) to be the comfort limit with a good triple-glazed window.

Visual discomfort can also be a challenge to control in fully glazed buildings.

While increased glazing increases the amount of daylight in a space, you can have too much of a good thing, resulting in overlit spaces at the perimeter that create glare problems. A well-designed exterior shading system or fritted glass can help mitigate glare, but low sun angles in the morning and evening can still pose a challenge. Interior blinds are the most common glare-control strategy. Unless they are automated, however, they frequently are lowered during a brief period of glare and are not raised again. While this controls glare, it erases all of the benefits of daylighting and exterior views that you can get from glass.

## Views

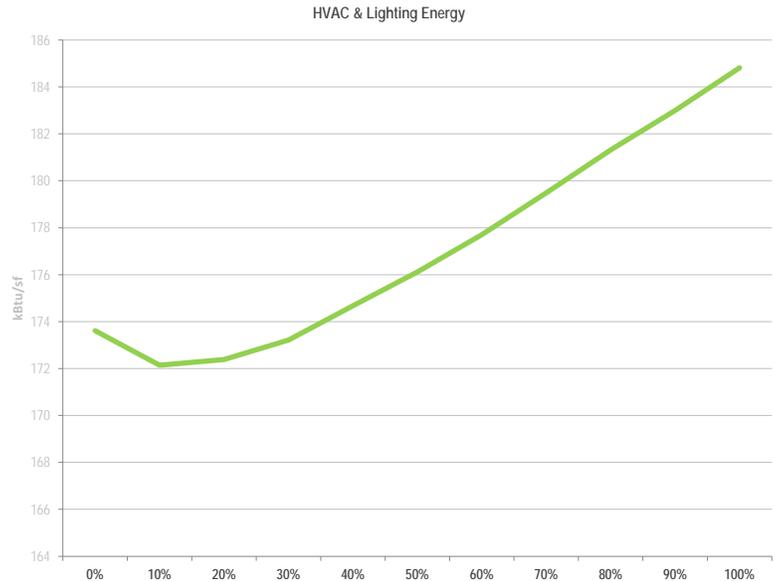
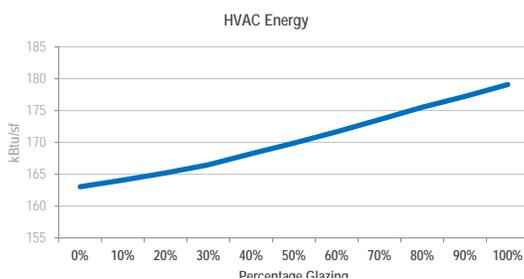
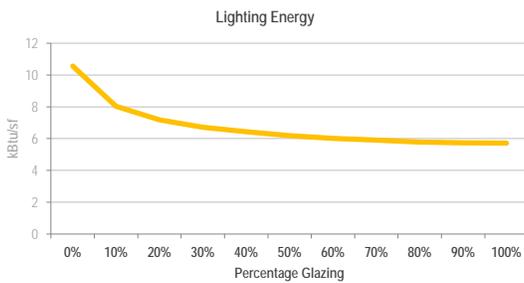
Visual connection to the exterior environment and nature is one of the biggest benefits of all-glass buildings. Views to the external environment have been shown to benefit the health and productivity of occupants because of the biophilic connection between humans and other living systems. The most famous of these is the seminal study by Roger Ulrich in 1981 that found that medical center rooms with views improved patient recovery rates by eight percent. As with the daylight studies, the

percentage of glazing needed to achieve quality views is unclear. Some argue that punched windows common in buildings with limited glazing act much like a picture frame, allowing access to views while maintaining the thermal integrity of the building envelope.

## Aesthetics

Because large panes of glass weren't commonly available until the mid-twentieth century, fully glazed buildings are associated with modernism. Both designers and building owners demand highly glazed buildings to give the image of transparency and modernity.

But in an age where we must think about the environmental impact of the built environment, many argue that it is time to end our collective passion for all-glass buildings. Fully glazed buildings have become so ubiquitous that we as designers should embrace the challenge of creating a new image for what it means to be modern in this age. Design is about embracing constraints to create a new and beautiful building, and working with materials other than glass should be embraced as part of our design challenge. 🌐



This graph shows the results of increasing the percentage of glazing on energy models run for a cold climate. The optimal percentage glazing for energy performance was found to be less than 30 percent.

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# Energy Recovery Ventilators in Multifamily Buildings

## Does Location Matter?

By Matt Root

Peer Reviewed by Sean Maxwell

Multifamily ventilation is changing. The standard practice of exhausting from the residential units and pressurizing the hallways while undercutting the unit entry doors is becoming a strategy of the past. This evolution is occurring because of code improvements (2009 IMC), requirements by optional programs like LEED for Homes Midrise, and a growing focus on more effective delivery of ventilation air.

Design teams in greater Boston are increasingly turning to energy recovery ventilators (ERVs) with fully ducted exhaust and supply air to each residential unit. From a fresh air delivery perspective, this strategy is a significant improvement over the traditional practice, in which the pathway of makeup air is largely unknown. But what about the energy performance of this technique?

The ERV for most buildings is located on the roof or in a ventilated attic because it is easy to locate and does not consume valuable conditioned space. In theory, this placement compromises the energy performance of the ventilation system in a number of ways:

- The duct runs in unconditioned space provide an opportunity for duct leakage and conductive heat loss.
- When the ERV is located farther from the target spaces, there are longer duct runs, and more electric fan power is required to supply and exhaust air.
- The unit is operating in a colder space than that for which it is rated (according to ASHRAE 84) and may not achieve the rated efficiency.

- If boost heat is integrated into the system, a non-condensing, 80 percent Annual Fuel Utilization Efficiency gas furnace is typically used, even when the residential units' heat source is a high-efficiency system.
- If the ERV is located in a ventilated attic, the catwalks to the unit need to be built up so that the attic insulation is not compromised.

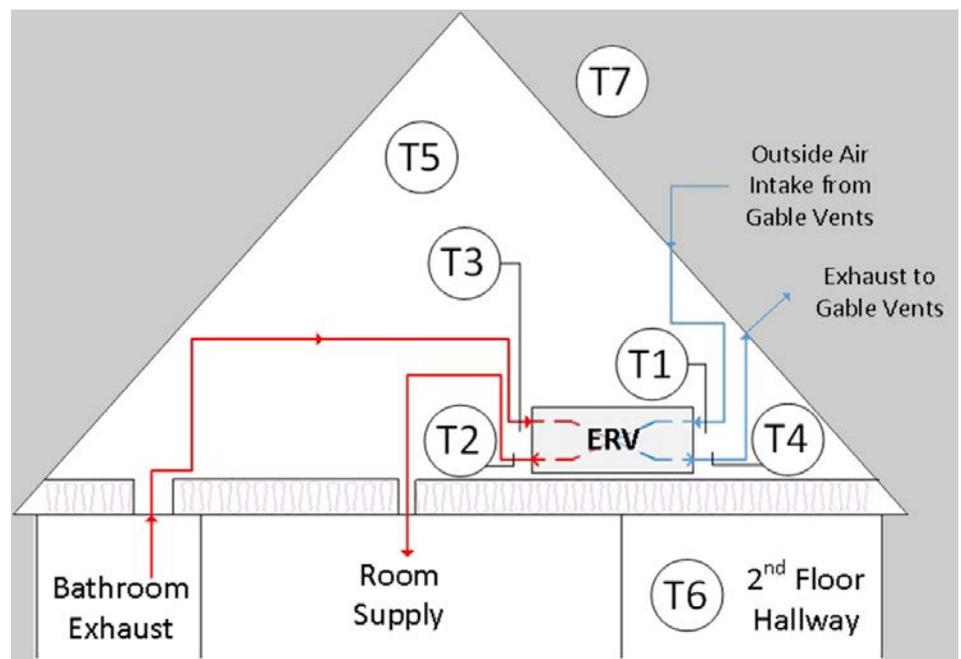
Conservation Services Group (CSG) has initiated a study to try to add some actual numbers to the conversation about the energy performance of ERVs.

One system we have monitored is located in a ventilated attic, and serves 10 out of 26 units in the building.

The average sensible efficiency of the ERV unit was calculated to be 0.72. This efficiency represents the ratio of the heat recovered by the ERV to the total possible heat recovery at the unit, including heat from fan motors. This ratio was calculated using the following equation:

$$\eta_1 = \frac{T_s - T_{OA}}{T_{Room\ ex\ @\ ERV} - T_{OA}}$$

The AHRI certificate for this model lists a sensible efficiency of 72 percent



T1 Outside air entering ERV ( $T_{oa}$ )

T2 Supply air leaving ERV going towards residences ( $T_s$ )

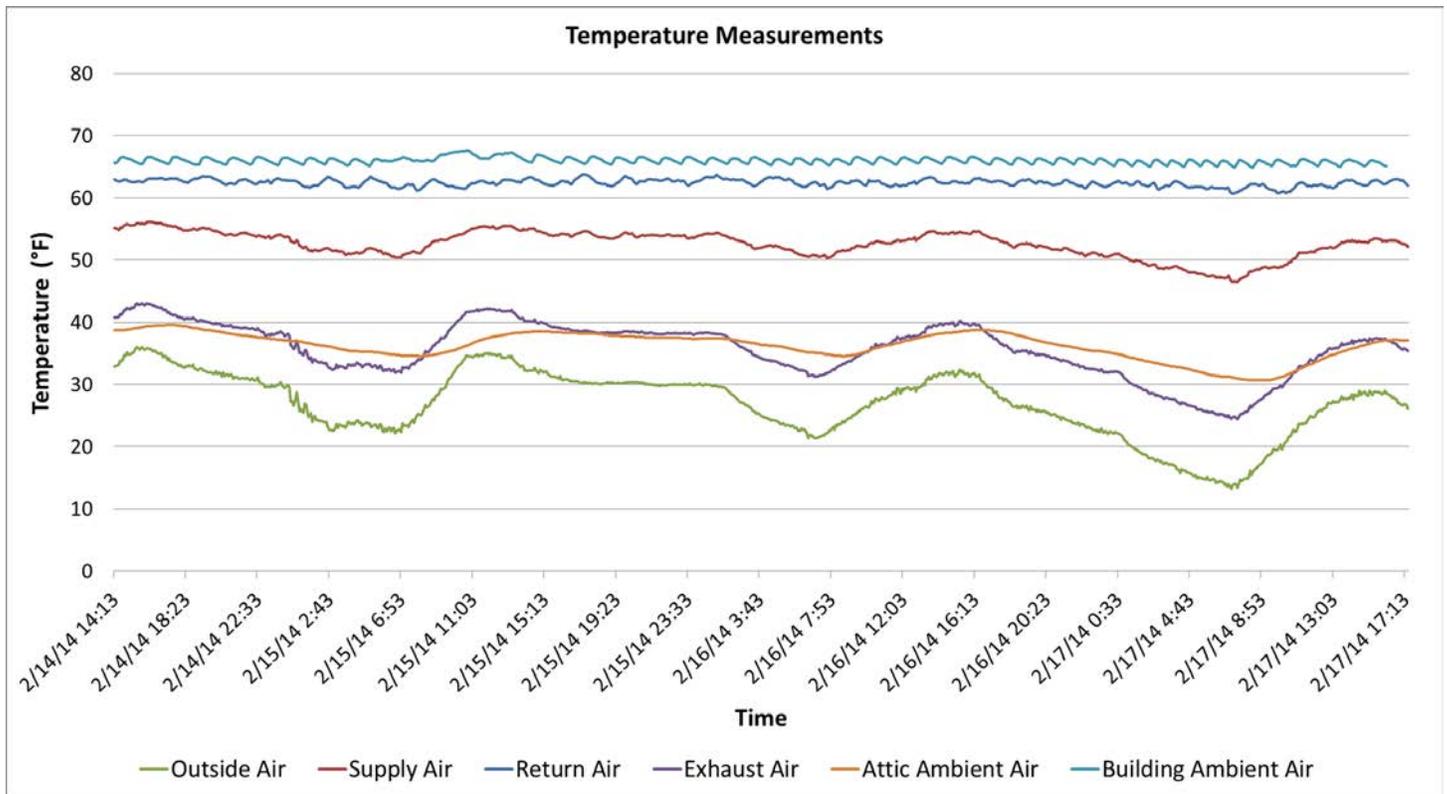
T3 Exhaust air into ERV from residences ( $T_{room\ ex\ @\ ERV}$ )

T4 Exhaust air leaving ERV going to outside

T5 Attic air temperature

T6 Building space air temperature (2nd floor hall)

T7 Outside air temperature



This graph depicts the temperature measurements during the analyzed period.

at 100 percent air flow and 77 percent sensible efficiency at 75 percent air flow. According to the Testing and Balancing report (generated by a third-party contractor), the system is operating at 59 percent of capacity.

We have not drawn any definitive conclusions yet, however we have identified some interesting results in the data that will require further investigation:

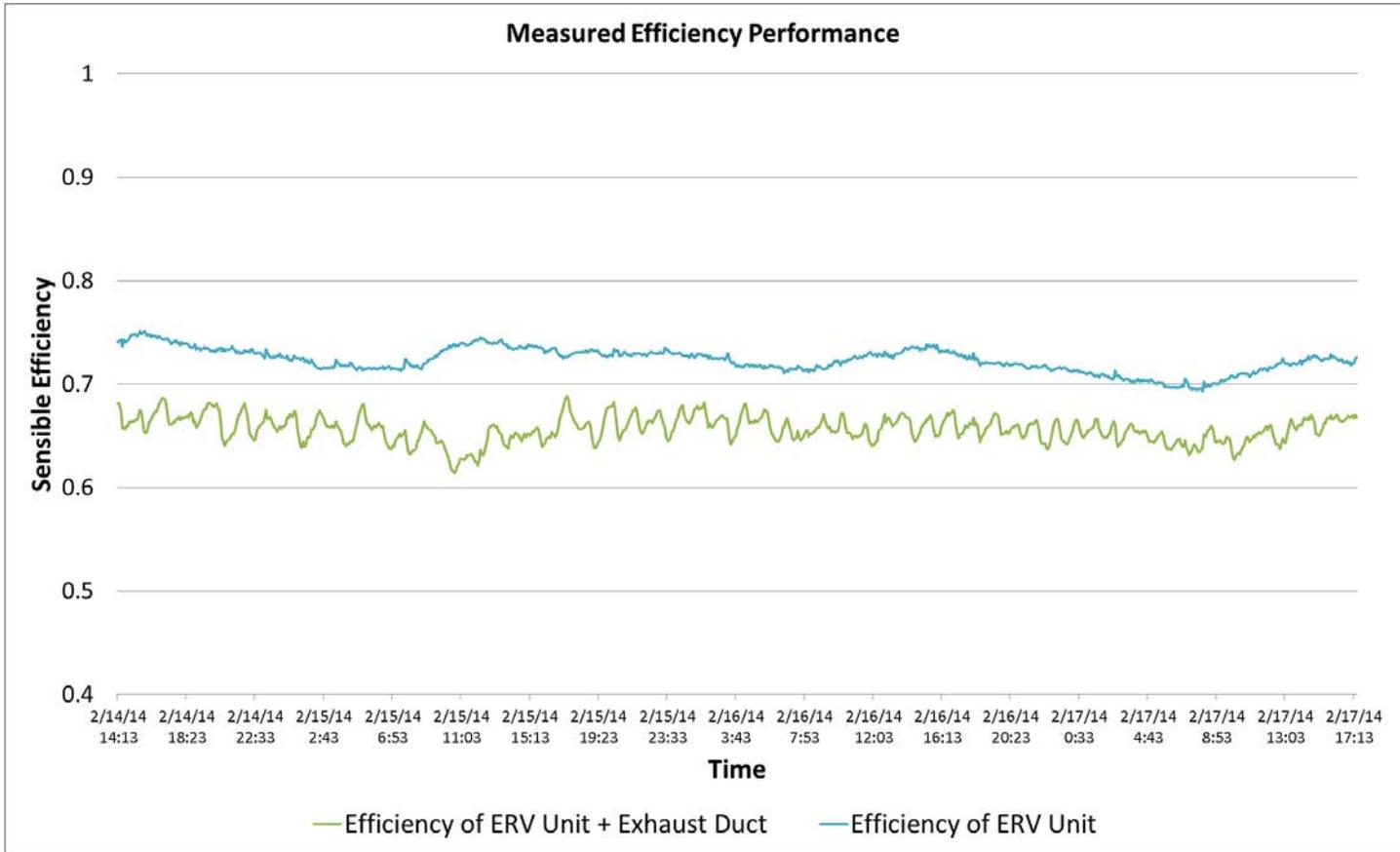
- The duct losses can significantly impact the overall performance of the system. Note the average 3.6°F difference between the residential space temperature and the exhaust air entering the ERV (two lines in the chart above). This exhaust duct system heat loss reduced the overall sensible efficiency by 6 percent. This performance reduction does not include the heat loss in the distribution system on the supply side.

- The recovery efficiency of the ERV unit varies between 70 percent and 75 percent and is strongly correlated to the outdoor air temperature and attic air temperature.

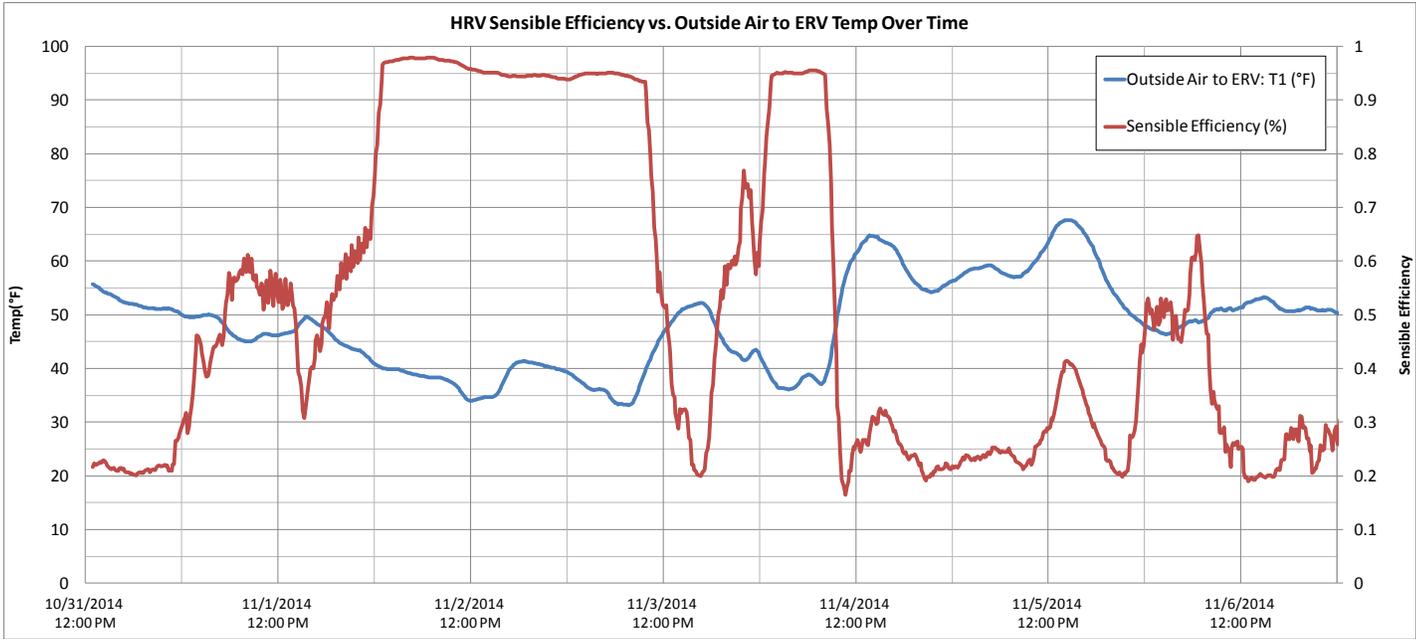
Another system we have monitored is located in the conditioned attic of a multifamily building. We had hypothesized that this system would perform better because of its location in conditioned space. However, a graph of the sensible recovery efficiency versus the outside air temperature demonstrates the need for commissioning. The data suggests that the sensible efficiency of the ERV varies between an average of 95 percent when the outside air temperature is less than 35°F and 32 percent when the outside air temperature is greater than 45°F. We believe this dramatic swing in efficiency is due not to a change in the actual performance of the system, but to boost heat

from the central boiler being added to the system upstream of our temperature probe when the outside air temperature is below 50°F. The important observation is that the ERV is only operating at around 32 percent efficiency, which is not good.

The limited data we have gathered so far is not enough on which to base definitive conclusion, but it suggests that the ERV and ductwork location should be a consideration, and proper commissioning is critical. An important next step is to quantify the ventilation energy load and compare it to the building's total energy consumption. We look forward to sharing more of our findings as we continue to collect and analyze data across a range of buildings, installation locations, and equipment types. 🌐



Sensible efficiency over three days in February.



Sensible efficiency plotted versus outside air temperature.

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# Unfolding Community Resilience

By Robert Leaver

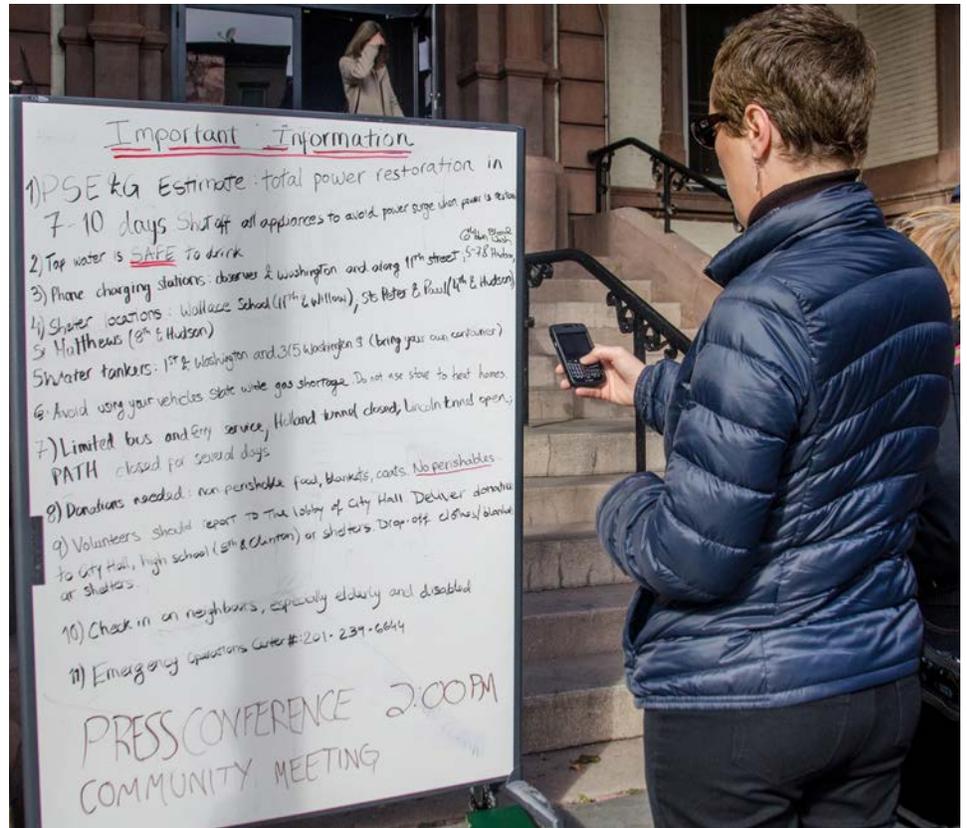
"May we live in interesting times," goes the ancient Chinese saying, conveying both a blessing and a warning. In the face of extreme weather conditions—unusual and repetitive water, heat, and wind events—and severe depletions of natural resources, the landscape that NESEA practitioners face differs greatly from that of our predecessors. In these interesting times we think we know what to do—make tighter buildings—but in reality we must begin to address much larger issues in the resilience of the communities around our buildings.

At the BuildingEnergy conferences in 2013 and 2014, I served as a co-chair for the Resilient Cities track. This article was inspired by those rich conversations, which made it clear that sustainability thinking and practice will not be enough to make our communities thrive. We must move beyond sustainability and embrace resiliency.

Resiliency means not just rebuilding, but learning from disaster to create a better future. One disaster prepares a community for others. As the community leaders of Newtown, Connecticut said: "Without the experience of the previous hurricane and snow storm, the town would not have come through, with resilience, the shootings at the Sandy Hook elementary school." What the town learned from severe weather, it was able to apply to an entirely different sort of tragedy. It was, in a word, resilient.

## Unfolding

Making energy-efficient buildings—even net-zero energy ones—will not maintain our communities in the face of a radically different adverse conditions. Going forward, we must think and



Hoboken, New Jersey 2012—A message board outside City Hall displays information for residents affected by Hurricane Sandy. Most still have no power and no access to news or other information.

practice beyond the building by using whole-systems thinking to build resilient communities.

"Unfolding," a core idea of architect Christopher Alexander's thinking, will serve as a useful guide to this discussion.<sup>1</sup> Unfolding occurs when one walks the land to discern what the land wants built. This process meanders and is non-linear. It takes time. We can see ourselves as being in the same unfolding process with the shift from sustainability to resilience. We must observe and sit with the earth and the concept of resilience so we can determine what to do next.

Sustainability has served as the NESEA mantra for many decades. I believe it is time to envision a new, more holistic mission. Sustainability is about

limiting adverse impacts of people on the the planet through reduction of our natural resource use. By contrast, as C.S. Hollings said, "Resilience is a way of conceptualizing the ability to change and adapt. The best resilient systems don't just bend and snap back. They get stronger because of stress. They learn."<sup>2</sup>

We think most often about resilience in terms of our response to natural disasters. Andrew Zoll<sup>3</sup> describes resilience as the product of the response of various professions. For the emergency responder, the focus is getting people safe and critical systems back up. The psychologist helps people deal with trauma. Businesses install redundant systems so the doors stay open for customers. Although their specific responses differ,

## BuildingEnergy 15 Preview

*Building Community Resilience in Cities* (3 Wednesday sessions) with Robert Leaver.

[nesea.org/be15](http://nesea.org/be15)

these three professions—emergency responder, psychologist, and business person—employ a common approach. They adapt, aim to foster continuity, and learn from adversity. Resilience does not mean a community returns to its original state. Both people and systems must anticipate what to change so the community might better withstand future shocks.

## Four Moves Toward Resilience

We can explore our move toward resilience in four areas: community, build-

ings, infrastructure, and the "soul of the world." Already part of our practice, the areas of buildings and infrastructure will come easily to NESEA members. Fostering community and soul, although harder goals to grasp, are vital for improving the human condition. These two areas are discussed in depth below, as they are the least familiar to most of us and arguably the most important to understand.

## Resilient Communities

Research demonstrates<sup>4</sup> that communities with tighter ties among people—regardless of age, sex, race, or class—survive threats of extreme weather, heat, or flooding better than those with loose ties.

We must create people and neighborhoods that can survive and even thrive after a disaster. Yes, the buildings must be resilient, but so must the people living in and around them. As design-

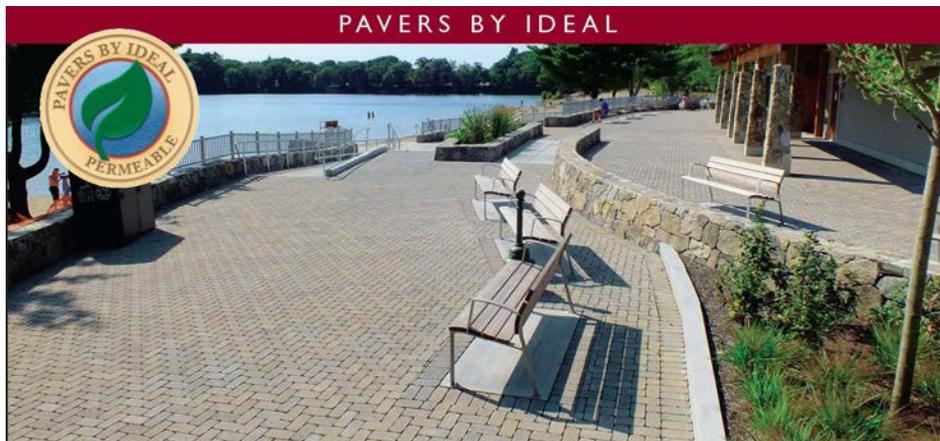
ers, we must keep asking: where are the areas of public community refuge?

Developing community resilience requires a network of local businesses that agree to stay open when disaster hits to provide for basic needs like food. We must develop an information infrastructure to disseminate this information. Think about your neighborhood. In the face of a disaster, does the social fabric come together or tear apart? What is the community connectivity rating or altruism index? (This can be measured by the presence of community gathering places such as farmers markets, spiritual places, and bars.) The presence of known community resources tempers hostile resource wars in the face of scarcity. Neighborhoods need known public places of community refuge that have the basic resources for survival, places where people know they can go in a disaster. Distribute lists of mobile phone numbers of people in your neighborhood. What is the walking score to reach the basic amenities of your place? If there is no gas for your car or transportation, where are the amenities you need that you can walk to?

After a disaster, members of a community are the brains for directing and organizing recovery and learning. The recovery effort has to be collaborative and consensus-based or we all suffer. Communities can identify the natural neighborhood conveners and organize them in advance. Build community resilience peer-to-peer, one person at a time. In Connecticut, for example, volunteer Community Emergency Response Teams go house to house after a disaster to check on people's well-being. Their work supports first responders and frees them for work requiring higher levels of training. In Boston, the Jamaica Plain New Economy Transition holds an emergency preparedness pie-eating party to inform community members about available resources.

## Resilient Buildings

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PopTech City Resilient conference at Brooklyn Academy Of Music (BAM).

rebuild on or retreat from land hit by a natural disaster? Going forward, we must learn from building performance in natural disasters, then use that intelligence to determine where to build. We should not automatically rebuild what was there before, because the risks of the past are not the risks of the future. Instead of rebuilding, we ought to analyze the conditions to establish criteria for retreating or rebuilding.

## Resilient Infrastructure and Systems

A resilient community must have flexible infrastructure, both for information and services. Smart phones, for example, can be used in emergency communication mode by disabling data downloads and camera use. This emergency approach maximizes the life of the phone and provides access over a longer period of time.

When designing, we can think about what utilities and resources are underground, and try to get them moved above ground. In an emergency situation with limited fuel and electricity, getting to underground utilities becomes very difficult. We should consider all hazards such as wind, heat, and flooding in both

buildings and communities. How does a building operate? How does its landscaping interact with the forces of nature? We should look at the vulnerability of assets in the face of multiple hazards.

## Resilient Soul of the World

Soul is a slippery notion. It is murky, squishy, and even, at times, dark. One might say soul is what is underneath our culture: the underground, muddy, the underbelly. But soul holds up the culture; it keeps us unfolding in community. With soul comes intimacy and reflection.

Our experience of soul might occur as we walk on the street and stop in our tracks, arrested by the face of an elder or the patina of an old building. Soul does its work when it slows us down to experience another face or look at a parking meter. It is the continuous layering of memories, of our collective stories as well as our tales of rogues and community leaders. Memories are honored in what was built at different times, for different purposes, and with different architectural styles. A building does not have to be classical or traditional to reveal soul. Soul is what is unknown, ei-

ther longing to be revealed or to remain unknown, or what is unfinished, what is to come next in a place.

To experience soul, we must let go of our rational minds and drop into it. We can't fully know the soul of a place through our head. To glimpse the richness of soul in a place, we must feel it. The soulful way is slowly attending to the particulars of a place: —*that* lamp post, *this* curb, *that* storefront—all arresting us in profound imagination. The door into soul is not the mind, but aesthetics. Here we are, at the root of aesthetics, breathing in through our senses, noting an arresting image or experiencing the presence of another person on the street. The heart is opened, the body tingles—that is the aesthetic response. Beauty is present.

Soul reveals beauty, which is what must be present in a neighborhood for us to bond with the place and each other. Resilience requires these tight bonds. And without a deep sense of soul, community resilience is a fleeting potential.

## Coda

As practitioners and thinkers we have much to learn about resilience of communities, buildings, the infrastructure, and the soul of the world. It will be a whole system in action. We are in for bigger and bigger shocks. Right now we need less science and a bit more art until the science beyond building science is better known. And even as we evolve the science, art and aesthetics must be present shaping our places. 🌐

1. Unfolding is a core idea of Alexander's that keeps showing up in his writing. The best insights into what happens in an unfolding will be found in: *The Timeless Way of Building*. Oxford University Press. 1979.
2. Hollings is the originator of resilience thinking initially using the lens of ecology.
3. Andrew Zolli and Ann Marie Healy. *Resilience: Why Things Bounce Back*. Free Press. 2012.
4. The most engaging piece on this topic... Adaption: How can Cities be Climate Proofed? Eric Klinenberg. *The New Yorker*, January 7, 2013.



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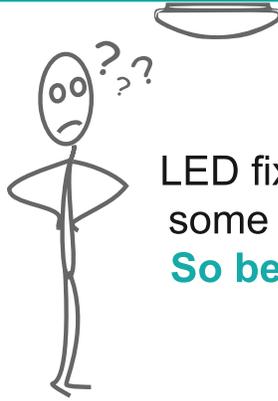
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# NESEA Conferences Through the Years

By Alex Wilson

When I became executive director of NESEA (then the New England Solar Energy Association) back in the fall of 1980 as an inexperienced, 25-year-old kid, fresh off several years working in the solar Mecca of Santa Fe, New Mexico, things were looking pretty rosy for the organization. We had just finished running the largest renewable energy/sustainability conference in history—Passive 80 at UMass, a national conference co-sponsored with the American Solar Energy Association—from which, I was told in my job interview (at the conference), NESEA would emerge with a \$100,000 in net revenue ("profit," except that we were a nonprofit organization). And the organization's bread-and-butter was ongoing organizational funding from the U.S. Department of Energy that covered half of our annual budget, which supported our Brattleboro, Vermont, office of a half-dozen.

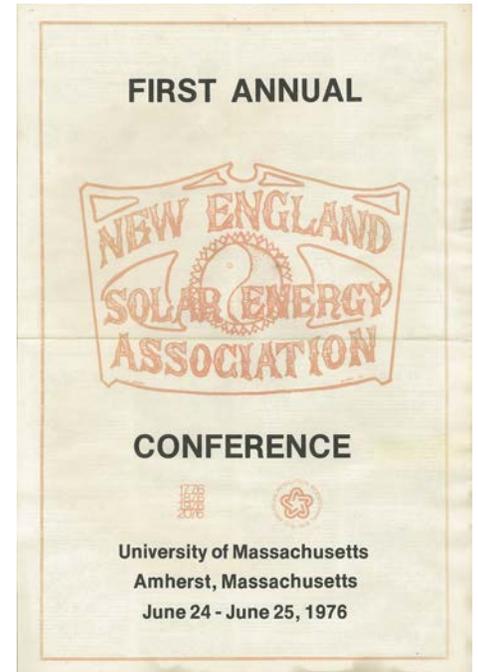
Pretty great! What could go wrong? Well, as I quickly learned, a lot could go wrong. For starters, after I added up the bills that were coming in following Passive 80 (including rather prodigious bills for a hospitality suite that included an open bar for conference organizers—those were the days, I guess!), that \$100,000 in profit dwindled to more like \$10,000. And then, a month after landing in my new job, the Democratic president, Jimmy Carter, lost his reelection bid to Ronald Reagan. Among the first actions of Reagan following his inauguration, was to defund the Regional Solar Energy Centers, including the Center in Boston that provided half of NESEA's budget.

On top of those immediate woes, the price of oil was plummeting—ultimately dropping to less than \$20 per barrel—and the solar industry had given itself a huge black eye as a result of outright scams to

profit from the solar tax credit. (That's a longer story, but basically, many companies were selling incredibly shoddy solar water heating systems for \$10,000 so that homeowners could reap the full \$4,000 (40 percent) tax credit; the solar systems weren't worth anything close to \$10,000, so companies gave kickbacks to buyers to induce them to buy—sometimes a cash bonus for new customer leads, sometimes a trip to Bermuda.) Homeowners ended up with crappy systems that failed in a few years, solar companies made out like bandits, and taxpayers footed the bill. I made a lot enemies in the solar world when, as director of a regional solar energy organization, I didn't support the extension of those tax credits.

While we went through some painful belt-tightening following the loss of DOE funding, including my having to lay off a third of our staff, I think that loss of funding was actually a good thing. It forced us to re-think our organizational model and it launched us on a course of a) broadening our focus away from only solar, and b) relying on conferences as a mainstay of a financially sustainable future. Following a long deliberative process in sometimes-heated board meetings, we changed the name of the organization to the Northeast Sustainable Energy Association (cleverly retaining the same acronym, which members had come to know and love). We felt that to grow (or even survive) we needed to have an agenda that extended beyond just solar energy.

On the conference front, we began offering smaller, regional conferences that focused on various aspects of solar energy and energy-efficient building in the early '80s with a skeleton staff. The Solar Hot Water Conference in March



1982 in Hartford, Connecticut, and *Photovoltaics: From Research to Reality* in March 1983 at MIT in Cambridge, Massachusetts were reasonably successful. The latter, co-chaired by Steven Strong of Solar Design Associates and Ed Kern of MIT, was a breakthrough event that attracted coverage by *Popular Science*. We were making the statement, in the conference title, that solar electricity was emerging from the space program and obscure research projects and was ready for prime time in powering houses and terrestrial communications towers.

Prior to my arrival, NESEA had presented other conferences, but unlike those held after we lost Department of Energy funding, they weren't integral to the organization's survival. These earlier conferences included NESEA '76: *Decision Making in Solar Technology* at UMass-Amherst in June 1976; the 1977 *Better Thermal Utilization* (BTU) Conference in Hartford, Connecticut; two conferences on energy-conserving solar

greenhouses, one in Marlboro, Vermont, in 1977 and the other in Plymouth, Massachusetts, in 1979; and the *Solar Realities Forum: Learning From Experience* in 1979 in Worcester, Massachusetts.

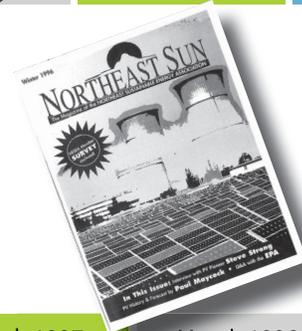
But the real breakthrough for NESEA was the Mount Snow, Vermont, conference, *Energy-Efficient Construction Prac-*

*tices*, held in late October 1983. Rather than focusing on solar, the conference was all about energy-efficient building practices, including construction details, moisture management, indoor air quality, and other aspects of building science—though I don't think we were then referring to it as “building science.”

I remember with the Mount Snow Conference that I had succeeded in negotiating incredibly affordable lodging rooms and meeting space because it was after the foliage season—then, as now, a big season for Mount Snow—but the foliage season was incredibly late that year, so we had this beautiful venue really



<p>1976: NESEA '76: Decision Making in Solar Technology, Amherst, MA (UMass)</p>	<p>1977: Energy Conserving Greenhouses, Marlboro, VT 1977: Better Thermal Utilization (BTU) Conference, Hartford, CT</p>	<p>1979: Solar Realities Forum: Learning from Experience, Worcester, MA 1979: NESEA Solar Greenhouses Conference, Plymouth, MA</p>	<p>1980: Passive '80, Amherst, MA</p>	
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March 2000: BuildingEnergy and Renew 2000: Buildings, People and Planet, New Haven, CT

March 2001: BuildingEnergy Conference, Boston, MA

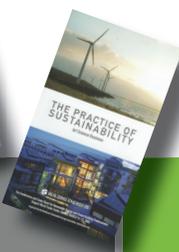
March 2002: Building Energy Conference, Boston, MA

June 2002: Mid-Atlantic Sustainable Conference, Rutgers, NJ

March 2003: Building Energy Conference, Boston, MA

June 2003: Mid-Atlantic Sustainable Conference, Rutgers, NJ

<p>June 1999: Growing the Market: The National Solar and Quality Building Conference, Portland, ME</p>	<p>July 1998: The Toward Tomorrow Festival (Triple Event): Quality Building Conference, 14th Annual Timber Framers Guild Conference and Renew '98 Promoting a Renewable Energy Future, Westfield, MA</p>	<p>March 1997: BuildingEnergy 1997: (Double Event) Insuring a Sustainable Future, Quality Building Conference and Renew '97, Cromwell, CT</p>	<p>March 1996: (Triple Event), Quality Building Conference, Renew '96, First International Solar Electric Building Conference, Boston, MA</p>	
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<p>March 2004: Building Energy Conference, Boston, MA September 2004: Mid-Atlantic Sustainable Conference, Rutgers, NJ</p>	<p>March 2005: BuildingEnergy Conference, Boston, MA</p>	<p>March 2006: BuildingEnergy Conference, Boston, MA</p>	<p>March 2007: BuildingEnergy Conference, Boston, MA</p>	<p>March 2008: BuildingEnergy Conference, Boston, MA</p>
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cheaply. Attendees had a great time, and we went on to hold an annual conference on energy-efficient construction, now called BuildingEnergy, that has been going on for 30 years.

As the NESEA conference chronology below shows, NESEA's various energy-efficient construction conferences moved

around for a while before gradually landing in Boston, first at Tufts and then at the Seaport World Trade Center

What has made BuildingEnergy so successful over the years, in my opinion, has been the reliance on a broad group of amazingly perceptive, smart, forward-looking NESEA members who form the

planning committee each year. Themes emerge, cutting-edge innovations are profiled, and visionary national leaders are invited in from around the country and world to share their wisdom and offer inspiration. 



**March 1982:** Solar Hot Water Conference, Hartford, CT

**March 1983:** Photovoltaics from Research to Realty, Cambridge, MA

**November 1984:** Energy Efficient Retrofits, Newport, RI

**November 1985:** Heating Today's Buildings: Creating Comfort, Value and Profit, Hyannis, MA

**March 1986:** Advanced Residential Construction: Building on Experience, Hartford, CT

**November 1986:** Cogeneration: Making the Right Decision, Cambridge, MA

**March 1987:** Advanced Residential Construction: Building for the Future, Monticello, NY

**June 1987:** Using Photovoltaics: Opportunities for Action, Boston, MA

**March 1988:** Advanced Residential Construction Conference, Cromwell, CT

**June, 1988:** Solar Technologies Conference, Cambridge, MA

**March/April 1989:** Advanced Residential Construction Conference, Sturbridge, MA

**April 1994:** Renew '94, Stamford, CT

**November 1994:** Making Sustainable Building Standard Practice: Practical Solutions for Good Business, Springfield, MA

**March 1993:** Building Solutions—Uniting Excellence and Innovations, Boston, MA

**March 1992:** 9<sup>th</sup> Annual Quality Building Conference, Leominster, MA

**September 1991:** Energy Opportunities '91 Conference, Boxborough, MA

**March 1991:** Quality Building Conference of the Quality Building Council, West Springfield, MA

**March/April 1990:** Advanced Residential Construction Conference: Building for a Changing World, Leominster, MA

**March 2009:** BuildingEnergy Conference, Boston, MA

**March 2010:** BuildingEnergy Conference, Boston, MA

**March 2011:** BuildingEnergy Conference, Boston, MA

**March 2012:** BuildingEnergy Conference, Boston, MA

**December 2012:** BuildingEnergy NYC Conference, New York, NY

**March 2013:** BuildingEnergy Conference, Boston, MA

**October 2013:** BuildingEnergy NYC Conference, New York, NY

**March 2014:** BuildingEnergy Conference, Boston, MA

**October 2014:** BuildingEnergy Conference, New York, NY

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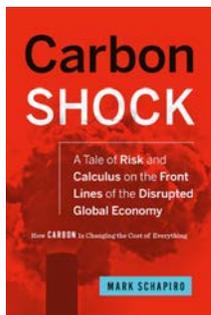
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## Carbon Shock: A Tale of Risk and Calculus on the Front Lines of the Disrupted Global Economy

**Mark Schapiro**

*Chelsea Green Publishing, 2014*

by Rebecca Owens

In *Carbon Shock*, Mark Schapiro highlights loopholes in the greenhouse gas reduction strategies that global governments and markets have used since the Kyoto Protocol was adopted in 1997. He aims to reach several audiences: the individual considering buying carbon offsets for her flights; the policymaker reevaluating the 'optimal' price-setting mechanism for carbon; and the CEO accounting for rising present-day climate change costs. Nuggets of climate science and historical context are interwoven with Schapiro's repeated calls to develop solutions that reduce the social and environmental costs of fossil fuel extraction and burning.

Pricing carbon puts invisible costs into accounting books, and helps both corporations and individuals shift investments and plan better for the future. Such pricing is not without tension, however. Schapiro shows how the Chinese government and European coalitions have fumbled for ways to integrate externalities—the environmental and social costs of oil extraction, for example—without alienating the responsible industries.

He argues that a partial pricing solution like market-based carbon offset trading has noble objectives but

fails to adequately fund climate change mitigation and adaptation projects, cap emissions, and transition the industry to a cleaner energy mix. Penalizing carbon emitters, says Schapiro, would give others the opportunity to invest in new technologies that compete with fossil fuels, creating more of a "clean dark spread" portfolio that bets against carbon. He relates the stories of oil spills in Spain and

**Carbon Shock concludes that regulations and mandatory pricing are needed to compel a meaningful price for carbon.**

the Gulf of Mexico as examples of fossil-fuel-dependent corporations shirking responsibility for short-term investments in risk prevention at a huge cost to common people for clean-up costs and loss of livelihood in the wake of a disaster.

Schapiro asks two questions. First, who pays this penalty: producers at the helm of fossil fuel use, consumers via embedded carbon prices, or victims through collateral damage? Second, what is the most effective use of these funds? Schapiro's sharp investigative journalism uncovers disturbing legal and ethical abuses in carbon trading schemes despite attempted oversight by the United Nations. Schapiro prods the reader to prioritize the risk calculations of carbon over immediate profits. Through visits to climate negotiators and avant garde ecocities, he reports how even the greenest governments are blanching at the costs of droughts and floods in the present. The government of Brazil, for example, is reconsidering the suitability of foreign investment in its forests as a means of slowing climate change, prioritizing economic development instead.

We have learned a lot in the past 25 years, argues Schapiro, and offsets are

not the elixir they were once thought to be. The lack of standards in offset quality, measurement, and verification mean that apples-to-apples comparison is impossible, and debates continue over what constitutes a one-to-one ratio of carbon pricing to offsets. In other words, if a company in a developed country buys offsets to conserve carbon-rich rainforest in a developing country, a) is that carbon being undervalued if we do not set a baseline price that fully encompasses ecosystem services, b) could or should that company have more directly offset its emissions through upgrading its operations (without resulting in non-additionality, if it seeks to claim such projects as offsets), and c) does the offset investment assure both fair compensation to the host community abroad and long-term enforcement and implementation of the offset project?

*Carbon Shock* concludes that regulations and mandatory pricing are needed to compel a meaningful price for carbon. Specifically, taxes could be more effective than offsets at rewarding smart infrastructure and more directly reconciling resulting funds with real offset impacts. China, the world's biggest emitter, recently shocked the world by moving in this direction and announcing its own mandatory cap-and-trade system. This will affect costs for the country with the largest overall footprint, the U.S., if one includes embedded carbon from imports. Schapiro outlines a new geopolitical order in which world leadership is defined by carbon management. The agreement between the U.S. and China on greenhouse gas limits and goals announced in November of 2014 substantiates his evaluation of changing paradigms and a future of leaders defined by political will, accountability, and carbon disclosure versus political instability, volatile pricing, and polluter subsidies. 

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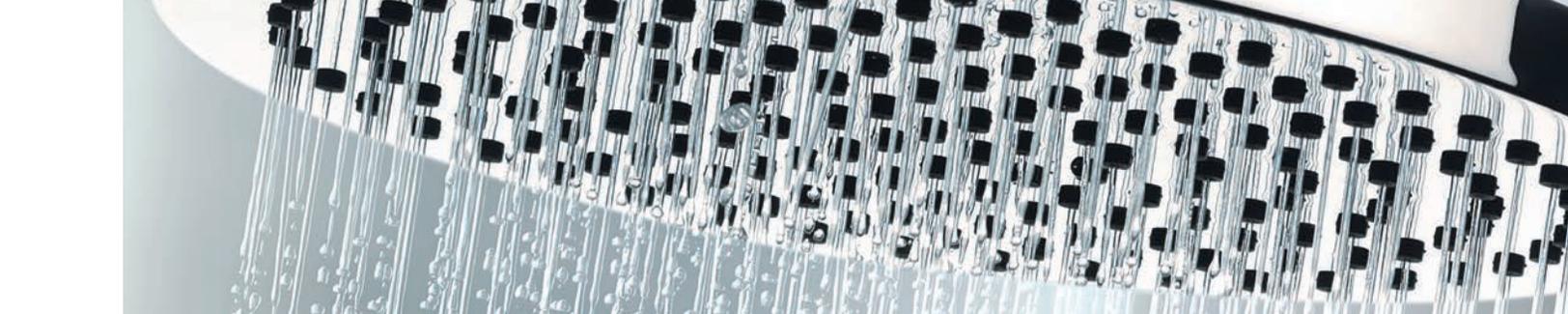
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