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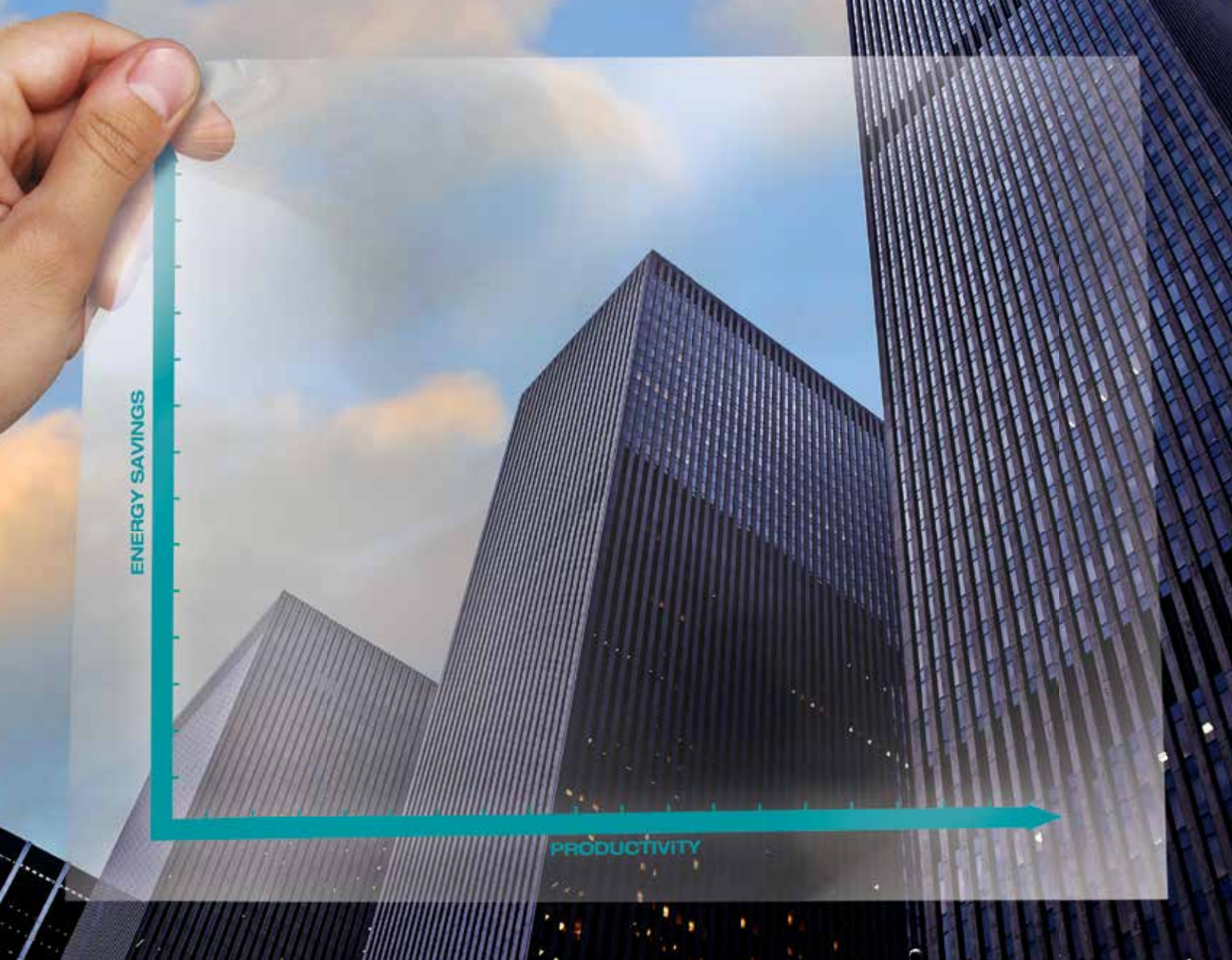
BUILDINGENERGY

THE MAGAZINE OF THE NORTHEAST SUSTAINABLE ENERGY ASSOCIATION



Zero Net Energy Building Award:
Net-plus is our new norm

BuildingEnergy NYC Conference Preview



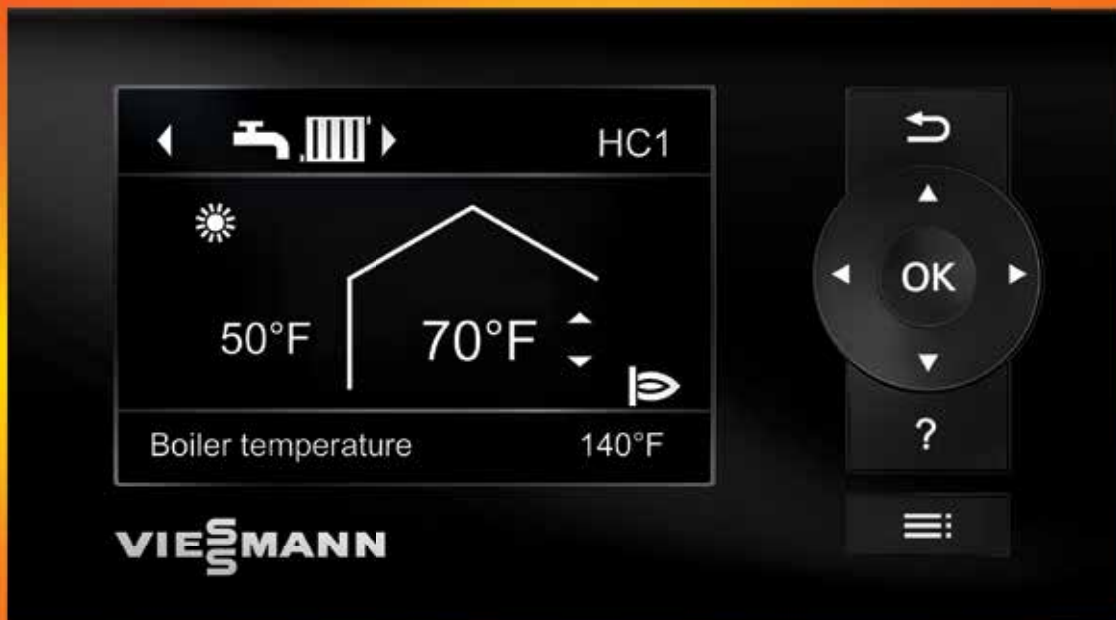
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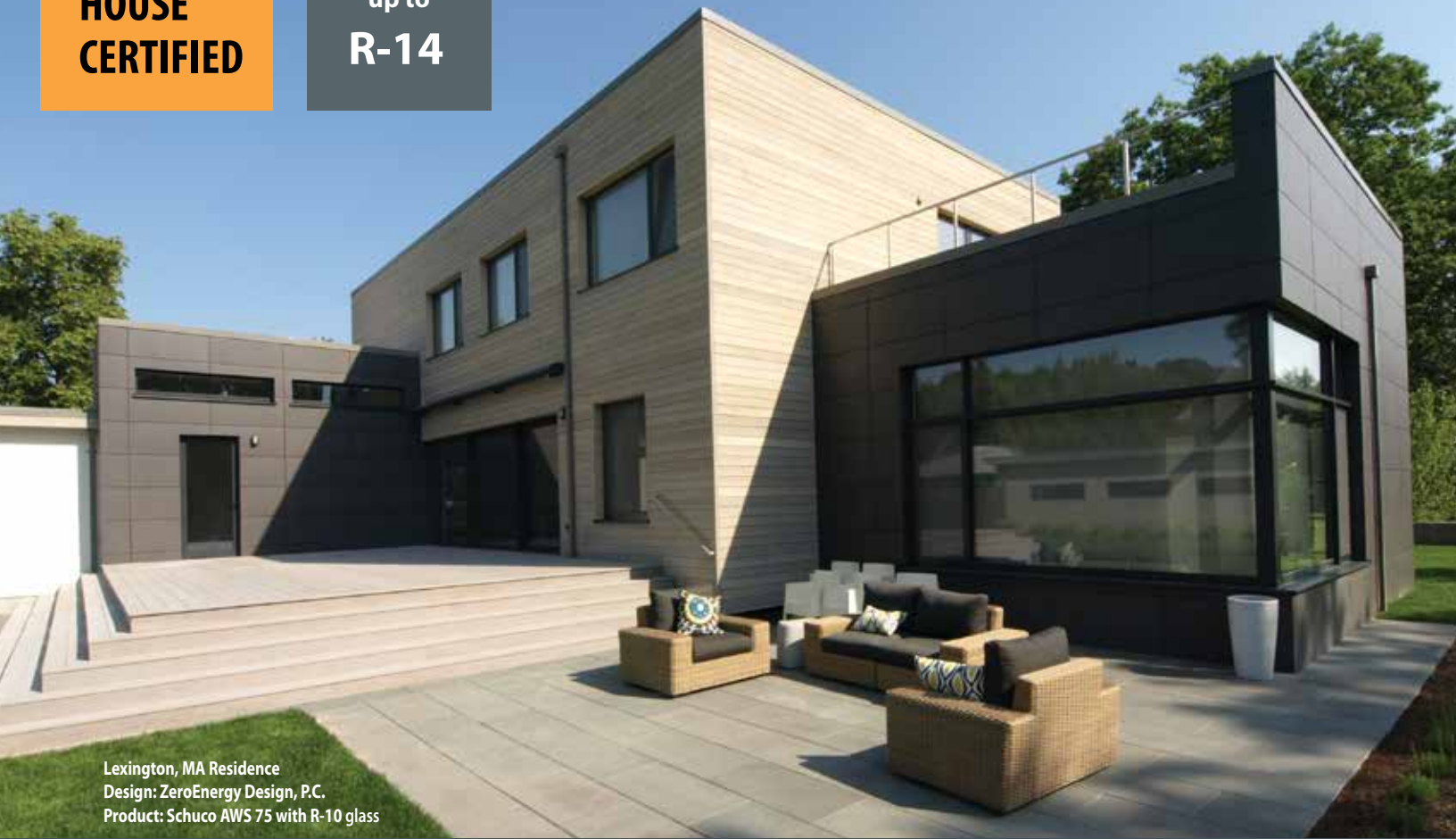
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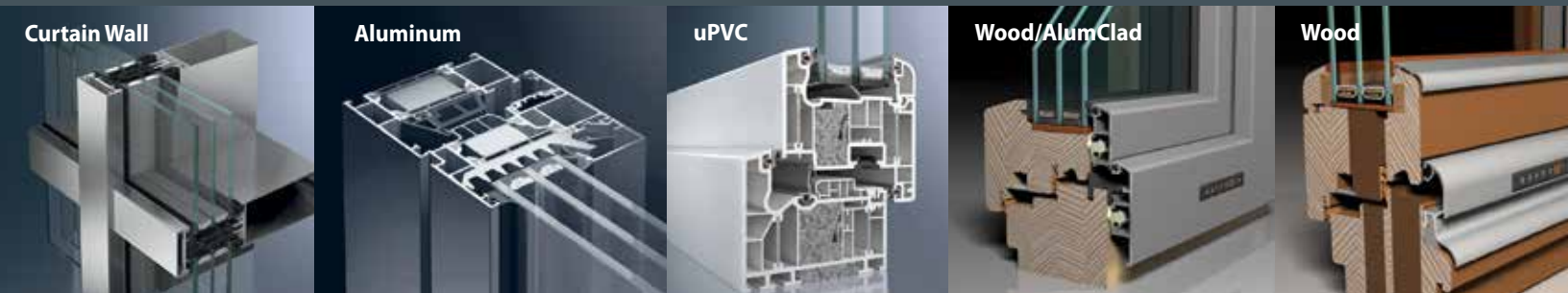
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BUILDINGENERGY



From the Executive Director

Yes to networking and development, no to advocacy

From the Vice Chair

Remembering Kate Goldstein, 1986–2014

Zero Net Energy Building Award

We've stepped up our game: net positive buildings are the new norm

By Sally Pick

October 16: BuildingEnergy NYC 2014

Explore new technologies, learn from the pros, and network with your community. Then go tackle the great challenge of our time

By Amelia Amon

13 Best Practices for Zero Net Energy Buildings

With ZNEBs becoming more common in NESEA country, we can begin to codify the strategies they share

By Marc Rosenbaum

Wood Buildings on the Rise

New technologies are making it possible to construct high-rises from renewable, low-carbon wood

By Jim Moriarty

Efficient Lighting for Commercial Buildings

Commercial retrofits are complex, with multiple barriers, but the potential for energy savings is enormous

By Pat Sapinsley

My House, My Laboratory

Can this NESEA geek stop experimenting on his dream home long enough to finish? Or at least move in?

By Steven Bluestone

5 Heat and Hot Water Included 43

A 480-unit New Hampshire community dives into energy efficiency—starting with its 64 cast iron boilers

By Jonathan Kranz

7 A New Tax Break for Commercial Building Owners 46

Those big new systems and components just got a little easier to afford

By Rich Maiolo

8 Book Reviews 47

17 Sustainable Green Pages 51

On the cover

NESEA's 2014 Zero Net Energy Building Award went to the Burk Residence, a New Hampshire home/farmstead that—like the seven other qualifying entries—generates more energy than it consumes. The building stood out for its comprehensive sustainable design, simple elegance, and strong educational component. Story starts on page 8.

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 2014 by the Northeast Sustainable Energy Association. No part of this publication may be reproduced without permission.

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using soy-based inks.**Yes to networking and development, no to advocacy**

NESEA is a nonprofit with relatively scarce resources. So it is important for us to be as clear about what we say no to as what we say yes to. Maybe more important. Saying no allows us to focus our limited time, talent, and treasure on what we do best, rather than try to be all things to all people and do a mediocre job.

At our annual retreat in May, the NESEA board considered the extent to which NESEA should weigh in on policy issues and engage in lobbying. The consensus was that, although having the right policies in place is indeed critical to the industries we support, advocacy is not the best way for our organization to advance the adoption of sustainable energy practices in the built environment. Moreover, we represent such a multidisciplinary and diverse group of practitioners that it would be difficult for us to establish a definitive party line on the issues that you, our members, care about.

So for now, we say yes to networking and professional development, and no to policy, advocacy, and lobbying. But don't let that stop you as NESEA members from connecting on these issues and making yourselves heard, either independently or as a group.

By the time this issue of *BuildingEnergy* hits the press, we (God willing) will be close to launching our new website and BuildingEnergy Online Community. We've put NESEA's resources into the quality, functionality, and usability of community features that will, among other things, help you self-organize around the issues most important to you and your practice. Without question, the blogs, conversations, Q&As, and other features will help you stay better informed and connect with each other on policy issues. More specifically:

- To keep you informed of regulatory and legislative proposals likely to affect your business, several like-minded organizations whose missions do include advocacy have agreed to provide blog content at least monthly. Among them are NEEP (Northeast Energy Efficiency Partnership), CSG (Conservation Services Group), and the NRDC (Natural Resources Defense Council).
- Through our BuildingEnergy Online Community, policy-related issues most assuredly will have a home—in featured “conversations” (our approach to discussion boards), within communities of practice, in blog posts contributed by policy leaders, and in other ways that you, as NESEA members, will determine.

It is ultimately up to you (with strong curation by staff to assure quality) to determine how, and how effectively, these tools will be used.

I'm happy to hear from you if you have comments, questions, or concerns about this particular no or, as always, anything else.

Warmly,

Jennifer Marrapese

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Remembering Kate Goldstein, 1986–2014

Kaitlin Ryan Goldstein, a NESEA board and lifetime member, died on June 14 in northern India while out for a

morning run in the mountains. She apparently slipped on loose rock, falling to her death.

Kate, age 28, was a fourth-year graduate student in architecture and in MIT's Building Technology Program. In India, she was visiting the campus of the MIT Students' Educational and Cultural Movement of Ladakh (SECMOL), located near Leh, in the state of Jammu and Kashmir. She had spent the week of June 8 to 14 participating in a workshop on energy and development. The workshop was jointly organized by the MIT-affiliated Dalai Lama Center for Ethics and Transformative Values and the Masdar Institute of Science and Technology in Abu Dhabi. She was scheduled to stay and install solar panels for an off-grid

electrical installation at a nearby Buddhist monastery.

This shocking loss is huge to the NESEA community and others, as Kate was active in multiple endeavors. She was seen by many as among the best of the next generation of building scientists. Both a young geek and a fan of the old geeks, she searched for the best knowledge from many sources

**Kate was seen by many
as among the best of
the next generation of
building scientists.**

during her brief career: Brown University, UT Austin, MIT, Fraunhofer, the Center for Energy and Environment, and Alteris Renewables, to name just a few. She was deeply committed to many other causes and friends, and was a competitive runner. In fact, she was a competitive everything.

Noting that emerging professionals in sustainable energy needed guidance, knowledge, and contacts, Kate called for seasoned NESEA members to meet and network with new people in the field, whether recent grads or seniors transitioning post-retirement. She encouraged and helped emerging professionals to attend NESEA's BuildingEnergy conferences in Boston and New York City. She cultivated her own set of mentors, which resembled a board of directors, and questioned them relentlessly—she was a voracious student of the field and constantly probed for answers to her complex questions.

More than 200 mourners attended her July 12 memorial, held at Community Church of Providence. Those eulogizing Kate uniformly referred to

her as a bright light, and a great student, runner, and friend. The next day, at two other events, acquaintances of Kate's who had never before met could be found discussing her impact on all of their causes.

Kate is survived by her parents, Dr. Jeannie Plover and Dr. Jack Goldstein, and her brother, Adam Goldstein. Our hearts go out to them.

In Kate's name, NESEA has established a fund to help emerging professionals attend either of the BuildingEnergy conferences, Boston or NYC, by picking up registration and hotels. To donate, go to nesea.org/kate.

Andrew Padian
Vice-Chair, NESEA Board of Directors
apadian@communityp.com



Kate Goldstein



Memorial Service, Community Church of Providence

Zero Net Energy Building Award

We've stepped up our game: net positive buildings are the new norm

By Sally Pick

Zero net energy buildings are becoming almost ho-hum these days. Building on a trend that became evident last year, all seven buildings that qualified for NESEA's 2014 Zero Net Energy Building Award (ZNEBA) generate significantly more energy than they use. Over the course of a year, they produced anywhere from 2,000 kilowatt-hours (kWhs) to 15,000 kWhs of energy in excess of their energy demands. The average is enough to drive a Nissan Leaf electric vehicle from Boston to Missoula, Montana!

Among these projects, described below, are a deep energy retrofit of a two-unit apartment building in an urban neighborhood near Boston; two new superinsulated and air-sealed homes with medium-size to extensive PV arrays; and a retrofit of a modular office building. One home, a Transformations Inc. design, attained an incredible HERS rating of -36, possibly a record.

The people involved came to net zero with different motivations and strategies. Most focused first on tightening up the building envelope and installing efficient electric mechanicals for heating, cooling, and other needs, making up the remaining energy loads with photovoltaics.

You can read more at nesea.org (see the "Programs" menu). Additional detail on insulation types and amounts, window U-factors, brands, mechanical systems, and more is available on NESEA's new online database, at nesea.org/zneb_database.



Upstate New York winters are no problem for the Burk House. The home/farmstead won on the strength of its comprehensive sustainable design, simple elegance, and educational component.

Winner

Burk Residence: Up Hill House

Larry Burk

These DIY owners impress with sustainability and education

Larry Burk, a software designer by trade but an architect by training, put his formal education to work in designing a new upstate New York home and farmstead for himself, his wife, Jill, and their menagerie of goats, chickens, turkeys, guinea hens, dogs, and a cat. With help from a neighboring contractor, the couple built the

house, learning lessons along the way (see the sidebar on page 10).

Larry first considered installing a Russian stove, a type of masonry stove, as the primary source of heat. Further research led him to the concept of superinsulated homes with high-performance windows and tight air sealing. "Carter Scott's homes in Massachusetts [below, among the runners-up] convinced us that net zero was the way to go," Larry says.

Larry brought in DEAP Energy Group to advise him on sizing the mini split air-source heat pump for highly efficient electric heating and cooling, to specify the ventilation needs and vent sizes, and to design a PV array (6.9 kW) that would produce more energy than they used. DEAP



Easy on the eyes and the planet: The Burks avoided sprayed foam, went easy on rigid foams, and used low- to no-VOC products for good indoor air quality and less environmental impact.

also recommended additional insulation under the slab and guided the Burks in insulating the foundation walls.

The attic space was completely filled with cellulose insulation to R-75, the above-grade walls with 12 inches of dense-packed cellulose for R-44, the foundation walls with 2 inches of expanded polystyrene and 9 inches of dense-packed cellulose for R-41, and beneath the slab with three layers of 2-inch extruded polystyrene for R-30. With close attention to air sealing using Zip sheathing and tape on the shell, the final blower door result was 131 cubic feet per meter (CFM), very close to stringent Passive House requirements. "Our home is very comfortable even in the deepest, coldest days and months of an upstate New York winter," Larry says.

Thinking that the upfront expense was too high, Larry did not initially plan to purchase solar, although he designed the house around the PV for its future installation. Out of concern that incentives would dry up, he explored his options further and found that it made financial sense to fold the cost of the PV into his mortgage.

The ZNEBA judges were so impressed with the home's comprehensive sustainable design, interior and exterior aesthetics, and educational aspects that they declared it

"Our home is very comfortable even in the deepest, coldest days and months of an upstate New York winter."

the winner. In their statement, the judges identified the building and its owners as "excellent ambassadors for the values supported by NESEA and its membership." The all-electric building's energy needs are so low, they wrote, as to be "easily met (and surpassed) by a substantial but not outrageous photovoltaic array."

The Burks included in the design the energy demands of their farm, which is intended to raise enough food for their own consumption. "In our first two years, we produced more energy than we used, despite the addition of a barn, dairy goats, chickens,

turkeys, other assorted critters, and a plug-in hybrid vehicle," says Larry. "This year, winter temperatures were much colder, and we are attempting to raise more of our own food, both of which use more energy. We still expect to generate a surplus in 2014, but it will be close."

The judges were also impressed that the full history of the project, "warts and all," is accessible on Larry's blog (uphillhouse.com) for others who want to pursue zero net energy building projects. "Sharing your work has several benefits," says Larry. "It creates opportunities for others to comment and suggest improvements; it makes it easier for others to follow in your footsteps with less risk and more confidence; and most importantly, it requires you to explain what you're doing and why, in simple and clear terms. This forces you to think things through much more carefully." Data is also posted at netplusdesign.com.

RUNNERS-UP

Southworth Residence

Garland Mill Timberframes

A family of builders become Passive House converts

When Nancy and Tom Southworth decided to build a new home for their retirement in Lancaster, New Hampshire, Tom had limited experience with net zero houses. The recently retired builder, cofounder of Garland Mill Timberframes, had been the principal designer for 85 houses, but for the design of their own home he mostly deferred to his son, Ben Southworth, now a co-owner of his company.



To build his parents' net-plus New Hampshire home, Ben Southworth of Garland Mill Timberframes taught himself the Passive House Package Planning software.

A few years before, Ben and Tom had worked with their good friend and colleague Marc Rosenbaum, PE, of South Mountain Company to retrofit a home on New Hampshire's Squam Lake to zero net specifications; Marc provided guidance on the energy design. That experience informed the Southworth's subsequent projects and inspired them to collaborate again with Marc on their new home. Marc's involvement began with a work session at the kitchen table of the Southworth's then home and continued on an informal basis throughout the project.

Ben ran with the project and called Marc when he had questions. He designed the house to Passive House specifications, teaching himself the Passive House Package

Up Hill House

Our ZNEBA winner on DIY: know when to ask for help

By Larry Burks

My wife and I designed and built our own high-performance home. Which is not to suggest that it can be done without considerable learning or prior design-build experience. Jill works in graphic design, and I work in the technology industry making online applications easier and more intuitive to use. But I studied architecture in school and paid for college in the early years by working for builders and a mason. An architect experienced in high-performance homes would likely have saved us money and time, but we wanted to do it ourselves. We knew we could do it well and would enjoy the challenge. We also knew when to ask for help.

We hired DEAP Group to estimate our peak heating load, specify our ventilation requirements, and estimate how much solar we would need to achieve net zero. They also offered recommendations that further boosted our efficiency. Please do not rely on anyone without experience in high-performance homes to do this type of work. Our Energy Star rater had zero experience with homes like ours and offered calculations that indicated a 12 kW PV system to net out. DEAP's calculations indicated 6.9 kW, which gave us a net positive house. Our first-year actuals came very close to their estimates.

One of our most important decisions was picking a contractor. Ideally we wanted someone who had experience building a net zero home, but there was no one in our rural area. We found W. R. Coolidge and Co., an experienced builder next door who was interested in high-performance homes and was eager to learn with us. Most importantly, he was willing to let us do as much of the work as we felt comfortable with, and to show us how to do it right.

Since we were involved in every decision and I had built detailed 3D models of almost every house system, it was easy for us to coordinate the work of the contractors responsible for the foundation, electrical, plumbing, HVAC, cellulose insulation, and PV installation. All of this required a great deal of time, research, and planning; it is one of the reasons it took us more than 18 months to complete the house.

So don't go it alone unless you're prepared to invest a significant amount of time researching and learning the nuances of high-performance building. If you don't have 100 percent confidence in what you're doing and why, it's too easy for contractors to convince you that it's too hard or too expensive to do it that way. Your house will suffer from a thousand small decisions that will ultimately undo your original goal: to live more sustainably in a net zero home.

Larry Burks blogs about his house at uphillhouse.com and posts further data at netplusdesign.com.

Planning software. The software's interactive Excel spreadsheet allows a builder to design to Passive House standards via the input of a wide array of data, such as U-factors of windows and walls, square footage, and orientation of the building. The designer can adjust the energy features within the spreadsheets until the entire design achieves the required specifications.

In addition to Passive House objectives, the Southworths identified design goals for simple living as they aged, by imagining themselves as 90-year-olds. They wanted the house to be easy for one person to maintain. As a result of their thoughtful planning, the home is always warm in the winter; is handicap accessible; has no basement, electric bill, furnace, or fuel tank; has almost no lawn to mow; and has cedar siding that does not require painting.

Having lived in their new home for several years, Tom is a convert to tight building structures. "This passive solar stuff really works," he says, and his new home is the tightest house he has ever built "by a moon shot." Inspired and informed by lessons learned from this project, Garland Mill Timberframes now builds houses without furnaces in northern New Hampshire.

Nakuset Way/Devens

*Transformations Inc.
Kraus Fitch Architects Inc.
Ben Nickerson*

Transformations Inc. keeps at it with four new homes

R. Carter Scott, owner and president of Transformations Inc., is still at it, submitting four net energy positive houses to the competition. To those familiar with Scott, winner of NESEA's first Public Impact Award in 2013, this comes as no surprise. Transformations has built 49 net zero attain-



In each of the last two years, Transformations Inc.'s Nakuset Way has generated excess energy averaging more than 9,000 kWhs.

able (they just need to install PV) and net positive homes; 12 more are under construction, 7 with mandatory PV; and 147 more are planned, 145 as net zero or net positive.

Scott submitted Nakuset Way (Kraus Fitch Architects), a custom-built Princeton, Massachusetts, home, last year as well. In each of the last two years, the saltbox-style house has generated excess energy averaging more than 9,000 kWhs. (See the fall 2013 issue's ZNEBA article for project details: nesea.org/magazine_be.) He's since completed three new homes in Devens, Massachusetts, that produce 10,000 to 15,000 kWhs of surplus energy yearly, even accounting for propane use for hot water. One of the homes was built on spec, the two others were custom-designed.

The state's finance and development authority, MassDevelopment, chose Transformations to build eight homes for its Devens residential community, to showcase replicable, moderately priced net zero or near net zero housing. All eight homes sold or were under agreement within a little over a year. Says Scott, "Zero

energy homes and the great Harvard [Massachusetts] public schools seemed to be a potent combination."

The three homes in Devens (Ben Nickerson, architect) were built with almost identical energy features. They used the following building envelope formula: 2 inches of extruded polystyrene (XPS) beneath the slab (R-10), 2 inches of XPS at the slab edge (R-10), 3.5 inches of closed-cell foam on the foundation walls (R-20), 12 inches of open-cell foam in the above-grade walls (R-46), 18 inches of cellulose in the flat attic (R-67), and windows with U-values of 0.20 and solar heat gain coefficients (SHGC) of 0.23.

Mitsubishi mini splits heat and cool the homes, gas-fired tankless water heaters provide domestic hot water, and there's between 16 and 18 kW of PV on the roofs. One home has Panasonic exhaust fans in the bathrooms, while the other two use either a heat-recovery or energy-recovery whole-house ventilator in combination with one or more exhaust bathroom fans.

Between the tight building envelope and 17 kW of PV, one of

the homes, 8 Cavite Street, attained an incredible HERS rating of -36, possibly a record. The sale price of this impressive 3,000-square-foot home, excluding design fees, was \$312,155—not bad for a home with a net positive energy profile, minimal energy bills, potential income from solar renewable energy credits, and enough excess electricity to power an electric vehicle for around 5,000 miles a year.



The living room of one of Davis House's apartments. A discreet mini-split (on the right) heats and cools the space.

Plymouth Village Water and Sewer District Administrative Offices

PAREI

A town office building that makes money

What does it take to make an office building net zero? Sandra Jones, director of the Plymouth Area Renewable Energy Initiative (PAREI) in

Plymouth, New Hampshire, wanted to answer that question. To do it, PAREI, the Plymouth Energy Commission, the town, and the water and sewer district applied for and received a grant of American Recovery and Reinvestment Act funds from the US Department of Energy. The grant funded a retrofit of the village's wa-

ter and sewer district administrative offices. The New Hampshire Office of Energy and Planning, the New Hampshire Electric Coop, and the Plymouth Village Water and Sewer District also helped fund the project.

As a result of the retrofit, the attic leapt from R-10 to R-80; wall insulation, from R-15 to R-43; and

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Balanced Bethlehem Yoga Studio, Bethlehem, NH
Designed and built by Garland Mill Timberframes



Post-retrofit, this Plymouth, New Hampshire, town office building consumes two-thirds less energy. It makes up the rest and then some with a 9 kW PV array.

the basement walls, from R-1 to R-30 above grade and to R-20 below grade. Air sealing and insulation reduced air exchanges by 70 percent. Administrators no longer use space heaters, and they lower the heat in the entire building.

PAREI's energy solutions advisor, Craig Cadieux, who designed and

managed the project, was pleased that the building's actual energy performance was better than modeled. The district dropped its heat load from 4,000 kWh a year to 400 kWh by replacing electric resistance heating with mini split heat pumps. Along with other improvements, such as extensive air sealing and spray-

foam insulation in the basement that eliminated the need for an energy-demanding dehumidifier, the building now consumes only a third of the energy it did before. It makes up the rest and then some with a 9 kW PV array, which covers most of the roof. In 2013, the district sold 3,587 kWh of extra electricity to the power company.

The office's efficiency and renewable energy features provide PAREI with a demonstration project that is open to the public and serving as a model. People visit during business hours to look at the building's energy-saving features and talk with staff about their experience working in the transformed space.

Since the retrofit, one of the water and sewer district administrators has installed solar hot-water and PV systems at home. In addition, the water and sewer board has taken an active interest in PV. With a grant from the New Hampshire Public

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Utilities Commission, the wastewater treatment plant is installing a 127 kW PV array.

Davis House

Amacher and Associates

Post-retrofit, this building is 100 years young

When Chungha Cha bought a 100-year-old two-family apartment building in Somerville, Massachusetts, he considered tearing it down and replacing it with an energy-efficient new building. But then he talked with Franziska Amacher, who would become the project's lead architect.

Amacher, who has a lifelong commitment to energy conservation and has been designing deep energy retrofits for 10 years, convinced a green-minded Cha that a retrofit was more sustainable. As Amacher says in the project summary, "The greenest building is the one that's already built, in almost every case. There are [over] 130 million housing units that already exist [in the U.S.]. Eighty percent will

still be here in 2050. This is where many of our efforts should be."

The envelope upgrade increased the roof to R-60–62.5, walls to R-48, basement walls to R-23, and the slab to R-20. Triple-pane windows have U-values between 0.25 and 0.21, and high solar heat-gain coefficients for southeast-facing windows increased their passive solar heat gain by 60 percent. The design also increased the number of windows on the south side by 50 percent and took out half of those on the north. Slatted shading above the exterior of the southern windows helps keep out summer sun. With tight air sealing and insulating, the house air exchanges per hour (ACH) were brought down to 0.85 to 1.2 at 50 pascals.

Drew Gillett, PE, provided energy system guidance and argued against natural gas in the home: "Go gas, go boom," he says. "Solar collectors tend not to blow up in a basement." With the solar hot-water collectors, the project qualified for more rebates, so the owner agreed to the additional expense. The resulting hybrid PV and solar hot-water system, devised



The owner of Davis House thought about tearing down the two-family, but then he learned that a retrofit was the sustainable, and doable, choice.


because of limited space, became one of the most innovative features of the house.

The system consists of SunDrum solar hot-water collectors hidden behind 12 of the 56 PV panels. The collectors recover heat from the PV panels, without direct exposure to sunlight, and send it to a storage tank inside the house that has an electric element to bring the hot water up to temperature if needed. As an added benefit, the collectors pull heat away from the PV modules, cooling them in the summer to keep them operating at more efficient temperatures.

Heated water from the collectors provides domestic hot water to both apartments, and some of the hot water is routed to a radiant heating system in the lower apartment's basement floor, covering base load heat for that space. At first, Cha was not convinced that it would be worth the \$20,000 to \$40,000 to heat and insulate the basement to bring it into the building

envelope, as advised by Gillett. Then he realized that in addition to the \$500 to \$1,000 in energy savings per year, it would also translate to more rentable space.

This is Gillett's second zero net energy project. With the tremendous drop in the price of PV, "it's entirely doable," he says. "You gotta' be nuts not to do this, especially in Massachusetts." The state has significant PV incentives.

The neighbors seem to agree. Inspired by Davis House, several have added PV, and several others have had deep energy retrofits. 

Sally Pick of SJP Environmental Consulting LLC (sjpconsulting.wordpress.com) offers western Massachusetts home owners a friendly, unbiased perspective on energy savings and renewables, advising on cost-effective ways to reduce energy bills and energy losses, qualified energy contractors, and the latest incentives. For businesses and nonprofits, her services include writing and editing

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October 16: BuildingEnergy NYC 2014

Explore new technologies, learn from the pros, and network with your community. Then go tackle the great challenge of our time

By Amelia Amon

Creating an energy balance is the great challenge of our time: reducing quantity, producing quality. It is why we are gathering for the third annual BuildingEnergy NYC conference on October 16.

Reducing the energy load of our built environment is one of the most effective strategies available for creating energy balance. Every watt that isn't consumed in buildings reduces the amount of fuel burned and carbon dioxide emitted, along with the environmental costs of the mining, transportation, distribution, and pollution associated with energy production.

The amazing part is that achieving all these benefits actually reduces costs to building owners over time and increases quality of life. Why isn't every building in New York City involved in minimizing energy usage?

We know the professionals with records of success in achieving these goals. Our speakers have designed, developed, financed, built, renovated, ventilated, heated, cooled, lit, audited, and monitored hundreds of millions of square feet of residential, multifamily, commercial, and institutional buildings. They have installed and tested innovative new technologies, from LEDs (to really change those lightbulbs) to CHP (combining heat and power).

At BuildingEnergy NYC, we'll explore why some green buildings allegedly use more energy than their equivalents. We'll find out how trends



Solar in the city: Via Verde, a 222-unit affordable housing project in the Bronx, enjoys a 66-kw building-integrated solar electric system. The urban infill project also includes a green roof, community vegetable gardens, rainwater harvesting, and more. See viaverdenyc.com.



Moving toward energy balance: Parking lots are among the solar applications that will be explored at BuildingEnergy NYC. This lot is at Whole Foods, in Brooklyn.


such as Passive House and the Green Building Challenge change design standards, while local laws change standard practices. We'll delve into best practices in commercial office buildings, hotels, hospitals and clinics, and universities and other New York schools. We'll get an inside look at which emerging technologies provide immediate energy savings with verified financial payback, and which require some back-to-the-drawing-board scrutiny and revisions.

But savings alone cannot achieve energy balance. We also need to produce clean, renewable energy to power our building systems and supply our ever-increasing electricity demands. Solar does more than make NYC more resilient. It's also affordable, incentivized, island-able, and designed to be beautiful. Our session "BIPV, Beauty & Power" will highlight local building-integrated photovoltaics. We'll illuminate solar thermal applications and monitoring, along with solar parking lots and financing mechanisms, all integral to "solar in the city." We'll also cover microgrids and energy storage for demand response/management.

Our program for BuildingEnergy NYC offers practical, hands-on solutions to financial, environmental, legal, and maintenance challenges facing NYC building owners and practitioners in every neighborhood and borough, and our local watershed. Beyond that, we'll tackle the bigger picture, comparing New York's energy policy initiatives to those in Boston and Philadelphia, Northeastern cities leading the way in the national City Energy Project. We'll hear from representatives of the NYC mayor's office and local policy makers.

If you are a developer, building owner, facility manager, utility professional, policy maker, architect, engineer, designer, contractor, renewable energy provider, or building manager, or are considering entering the field, you need to know what you'll be doing for the rest of the year and beyond. The BuildingEnergy NYC conference and tradeshow is a not-to-be-missed opportunity to see new technologies, learn from the pros, and network with your community. See you there!

Thanks to our BuildingEnergy NYC sponsors: New York State Energy

Research and Development Authority (NYSERDA), ConEdison, the Natural Resources Defense Council, and the Bluestone Organization. 

Solar products designer Amelia Amon is a 2014 co-chair of BuildingEnergy NYC. Her products have been producing power since the 1990s. Her clients include Aris Energy, Ben & Jerry's, Solar One, NY Sunworks, NYSERDA, the Smithsonian National Museum of Design Cooper-Hewitt, NYU, and numerous science and environmental centers. She has served as chair of the NESEA board of directors, on the board of the NY Solar Industries Association, and as chair of the NY Industrial Designers Society of America (IDSA), and she co-founded O2/NY.

BuildingEnergy NYC previews in this magazine:

Pat Sapinsley on **Efficient Lighting for Commercial Buildings**, page 31
 Steven Bluestone on **My House, My Laboratory**, page 37
 Register or learn more at nesea.org/buildingenergy-nyc

Don't miss at the BuildingEnergy NYC conference:

John Lee of the Mayor's Office on the **Status of the City**
 Katrin Klingenberg of the Passive House Institute US on **Rebuilding Neighborhoods After Sandy**
 Chris Benedict of Architecture and Energy Limited on **Pushing the Envelope: Passive House and Living Buildings right here in NYC**

... and much, much more

13 Best Practices for Zero Net Energy Buildings

With ZNEBs becoming more common in NESEA country, we can begin to codify the strategies they share

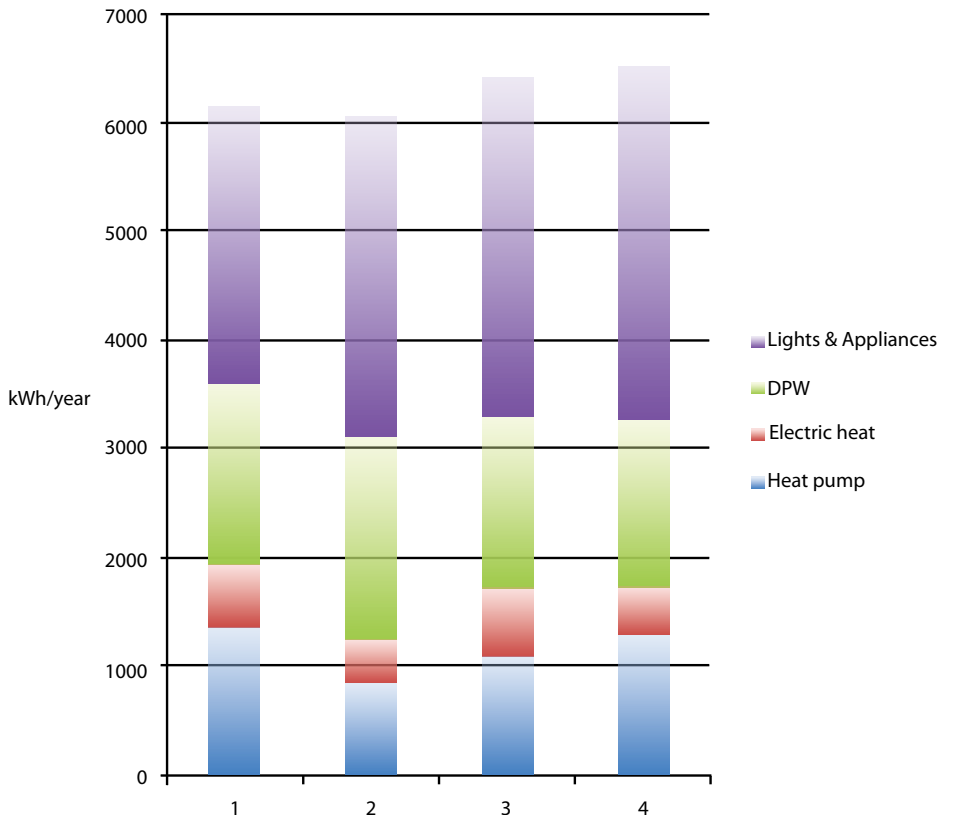
By Marc Rosenbaum

A zero net energy building is one that uses no more energy annually than its renewable energy system generates. It imports energy when site resources are insufficient, and it exports energy when what's generated exceeds the building's usage. Once very challenging to accomplish, ZNEBs are becoming more common in NESEA's region. As this happens, it's apparent that there are strategies that most of these buildings share, that permit us to begin to codify best practices for these homes and other buildings. As you'll see, the energy system itself comes last.

1. Educate and motivate the occupants

Motivating and educating the occupants in their role in the achievement of ZNE performance—the need to pay attention—is the first best practice. Building performance consultant Andy Shapiro said it best: “There's no such thing as a net zero house, just net zero families.”

In small sets of similar houses, we've measured hot-water usage that varies by a 3:1 ratio in gallons per person per day, and lighting/plug/appliance loads that vary 2:1 in terms of kWh per person per day. In larger buildings, we've seen cooling used from the first hot day in May until the first cool day in the fall, versus a pattern of lower usage that is clearly the result of people choosing to use cooling only on true



Four years of energy use data from one net zero house: lights and appliances, not heat, consume the most energy.

“dog days” and otherwise taking a windows-open approach with passive and low-energy strategies such as ceiling fans.

2. Focus on all energy uses, not just heating

I recall about 25 years ago working with a builder who had built his own house and being very impressed with how little fuel it was using. Then one day I went there. In a bedroom that

he used as an office, there were six 100-watt recessed lights. I realized that the house was significantly heated by electricity, and that to assess how well our buildings were doing, we needed to report all energy used. Heating energy in buildings following these best practices may be only 20 percent to 35 percent of total energy used onsite. So with ZNEBs, we account for all usage and design other energy-using systems such as hot water and lighting as carefully as we design the building enclosure.

3. Orient the building well and exclude or admit the sun as needed seasonally

In new construction, the building stretches out east-west, and glazing is concentrated on the south and minimized on the east and west. In houses, it's minimized on the north as well, but in nonresidential construction it may not be, as lighting is a more significant energy use and daylighting can be accomplished well with north light.

Larger buildings have narrower floor plates to maximize daylighting. South glazing is often equipped with fixed or movable shading to limit cooling loads in warmer weather. It's worth noting that as lighting gets ever more efficient and the cost of sophisticated lighting controls drops, daylighting may be harder to justify on a strictly energetic basis. The additional glazing usually adds heating and cooling load, and the energy impact of heating, cooling, and lighting must be assessed together. I predict that daylighting will come to be viewed as a way to create delightful, healthy spaces for people, rather than as a way to conserve energy.

4. Minimize cooling loads

The typical ZNEB is built with mechanical cooling (see no. 8, heat pumps), yet the load is minimized and passive- or low-energy measures are used to boost comfort. Loads are reduced as described above—with orientation, glazing distribution, and shading—and in some cases also with glazings that selectively admit much more visible light than solar heat. Efficient lighting, controls, appliances, and equipment (see no. 11 and no. 12) reduce energy consumption directly while also reducing cooling loads. Strategies like ceiling fans and operable windows aid comfort.

5. Build a superinsulated, thermal-bridge-free envelope

Superinsulation has been with us now for forty years or so, and although it's far from standard practice in the region, it's a basic component of ZNEBs.

ZNEBs have a complete thermal boundary that includes the below-grade areas. Slab-on-grade, basement slab, and foundation wall insulation values range from R-20 to as high as R-40. This ensures that subgrade spaces are fully within the thermal boundary of the building and, without heating, operate at temperatures close to that of the conditioned space, making them warm and dry and quite usable to the occupants.

Above grade, wall R-values seem to cluster around R-40, lower in larger buildings in the less severe heating climates and higher in single-family homes in the northerly locations. Roofs are built at values at least as high, and if trusses are used, the R-values are usually at least 60 and sometimes as high as 100.

6. Build it airtight

For the first time, the building code may be getting serious about airtightness, but ZNEBs are going way beyond code requirements. Construction documents have dedicated air-barrier drawings, and project specifications set quantified airtightness targets and how and when the projects are to be tested.

People doing blower-door testing quality assurance find themselves investing in C- and even D-rings for their blower doors, so they can test very tight ZNE homes—some are coming in at below 100 CFM50. Even more fascinating is that the best retrofit projects are achieving results equal to the best new construction. Many companies building ZNEBs, like South Mountain Co., where I work, have crews that have made Passive House airtightness

standard practice—they don't break a sweat over it.

7. Use triple-glazed windows with insulated sash and frames

Windows have always been the weak point of the thermal envelope, and that is still the case, but the standards have risen. ZNEBs are using triple-glazed (or, in rare cases, quad-glazed) windows with overall R-values ranging from the mid-5s to 7 or more. Glazings with center-of-glass R-values of 8 to 9 or even more are available, using ever more sophisticated low-emissivity coatings and low-conductivity argon or krypton in the gaps between lites. In the Northeast, usually it makes sense to trade off a bit of insulating value for increased solar heat gain, especially on the south facade.

Best practice for windows extends to insulated sash and frames. Most ZNEBs use one of a handful of North American windows with fiberglass or vinyl frame components filled with polyurethane foam, or European tilt-turn windows (some tilt-turns are now made in North America) in which sash and frame are either multicellular vinyl (lowest cost), thermally broken aluminum, or beefy wood with thermal breaks of high-density foam or cork. This is the only way to achieve these high overall R-values. Compared to almost all North American wood and vinyl windows, the high-performance windows used in ZNEBs have deeper glazing pockets, from 1³/₈ inches to as much as 2 inches deep.

8. Heat and cool with electrically driven air-source heat pumps

ZNEBs are powered by onsite renewably generated electricity, principally produced by solar electric systems. In most cases, they are all-electric



The tightest net zero homes are coming in at below 100 CFM50 on blower-door tests, compelling testers to invest in C-, D-, and even E-rings (shown here).

buildings, without fossil fuels or combustion. This certainly makes the ZNE math simple: Did the building produce at least as much electricity as it consumed, or not?

Using fuels besides electricity entails some bookkeeping to claim ZNE, and a decision on whether to base the ZNE approach on site energy or source energy (aka primary energy).¹ If the latter, source energy factors for each fuel imported and exported must be calculated. Using source energy

as a basis means that less renewable electricity needs to be exported to offset, say, imported natural gas. (Assuming the grid primary energy factor is 3—3 units of primary energy used for every one unit of energy delivered to the site—then exported electricity is worth 3 units of primary energy.) It also means that different regions will have different results, depending on how clean the grid is, as the source energy factor for a primarily coal-powered grid is quite different from that

for a grid powered by a mix of natural gas, hydro, and wind.

Pioneering examples of ZNE houses used ground-source heat pumps for space conditioning. These days, best practice has evolved to using inverter-driven mini split air-source heat pumps. The tremendous cost advantage of these systems allows designers to put more resources toward the building enclosure and the renewable energy system. They are also reliable, easy to zone, and come as a complete turnkey package including sophisticated (and sometimes mystifying) controls. I have mini-splits providing heating and cooling in homes, schools, and office buildings in climates as cold as northern New Hampshire and Vermont.

9. Use heat recovery ventilation

All buildings need ventilation, and once they are superinsulated, the ventilation load looms large, especially in nonresidential buildings with higher occupancy. ZNEBs use heat recovery ventilation, with or without moisture recovery, to dramatically lower the thermal load of ventilation. In larger buildings, the usual approach is to use an enthalpy wheel; in houses, fixed-plate cores are the rule. The best equipment, which once again comes to us via Europe thanks to the Passive House movement, achieves heat recovery efficiency of as much as 90 percent while using variable-speed motors to keep parasitic electrical usage down.

10. Make hot water with heat pumps or solar thermal

As with the building enclosure, conservation is the first strategy, so ZNEBs are designed to be parsimonious with hot water. Low-flow fixtures predominate, and water-efficient

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This interior wall and foamed ceiling shows a very high-efficiency European heat recovery ventilator and associated fitting for fresh air supply.

washers and dishwashers are chosen. There is no clear winner in making hot water. ZNEBs use either a solar thermal system with (usually) electric auxiliary, or an air-to-water heat-pump water heater (HPWH). We are waiting for the state-of-the-art Japanese HPWHs to arrive in North America, as they use CO₂ as the refrigerant, put the condenser outdoors instead of in the basement, and are more efficient.

If an HPWH is chosen, additional solar electric capacity must be provided to offset the electrical usage (although capacity must be supplied for the auxiliary energy used by the solar thermal system as well). As solar electric costs have fallen, the pendulum has swung to the HPWHs, and I

predict that this trend will accelerate when the CO₂-based units arrive. Roof aperture is usually at a premium on ZNEBs, so the designer has to compare the utility of thermal versus electrical collection.

11. Use efficient lighting and lighting controls

The progress in LED lighting has been breathtaking. In ZNE homes, LEDs have been making a big dent in the niche formerly occupied by compact fluorescents, primarily due to light quality rather than straight-up energy savings. In nonresidential ZNEBs, the work-horse super-T8 fluorescent lamps and

electronic dimming ballasts are still found in most larger spaces. Controls that keep lighting off when spaces are unoccupied and dim lights when daylight is available are the norm. ZNEBs are being lit with 0.7 watt per square foot or even less, and actual peak lighting loads are lower still.

12. Select the most efficient appliances and equipment

As thermal loads are reduced and heat pumps are used to satisfy them, using one unit of energy to deliver two to three units of energy to the space or water, plug loads may emerge as the largest single energy load in homes and some nonresidential occupancies.

In homes, selecting efficient equipment for cooking (induction cooktops, convection ovens, micro-waves), washing clothes and dishes, storing food, entertainment (TVs, audio equipment), and communications (modem, cable equipment, laptops) is a clear best practice. Keeping them off when not in use is even more important. In office and school environments, the higher density of computers, screens, printers, etc. means that these items are selected to be as efficient as possible and are equipped with controls that help ensure that they are off during unoccupied hours.

That piece of equipment at the top of the efficiency ratings may seem expensive, but the calculation has to compare the incremental cost of those energy savings with the incremental cost of the larger renewable energy system needed to drive the less efficient alternative.

13. Provide a renewable energy system to power the building

Yes, this is a best practice too! The choice in most cases is solar electricity, and the falling price of this technol-

ogy helps keep it in the lead. Buildings 10,000 to 15,000 square feet and under usually mount the array on the roof; larger buildings often require some ground-mounted capacity as well, sometimes installed on auxiliary buildings or on parking canopies. As prices fall, apertures that may have some shading or don't face close to south become worth considering.

Cost comparisons: tradeoff or trap?

In an ideal process, the costs of conserving energy are traded off with the costs of generating it onsite. However, there are potential traps here. What if the cost of solar electricity fell so low that it didn't pay to superinsulate buildings? We'd lose the comfort and durability aspects of this type of construction. The sophistication of the cost comparison also has to consider the service lifetime of



Last but not least is a renewable energy system. As prices fall, less-than-perfect apertures that have shading or don't face close to south become worth considering.

the items being compared. It makes sense to compare the cost-per-unit energy of solar electric capacity against a more efficient refrigerator, because the lifespan of the two technologies are comparable. Comparing solar capacity against investments in

the thermal enclosure is different—we expect the enclosure investments to far outlast any equipment, so that needs to be accounted for. ☺

Marc Rosenbaum, PE, is director of engineering at South Mountain Company (southmountain.com) and also teaches NESEA's 10-week Zero Net Energy Homes course. He uses an integrated systems design approach to help people create buildings and communities connected to the natural world, supporting both personal and planetary health. Much of his recent work has been on zero net energy buildings, deep energy retrofits, and Passive Houses. His work has been recognized nationally by ASHRAE, AIA, EEBA, and NESEA, but, he says, they didn't see all the mistakes along the way.

Notes

1. Related article: "Getting Real About Primary Energy," by Katrin Klingenberg, in the spring 2013 issue.



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Wood Buildings on the Rise

New technologies are making it possible to construct high-rises from renewable, low-carbon wood

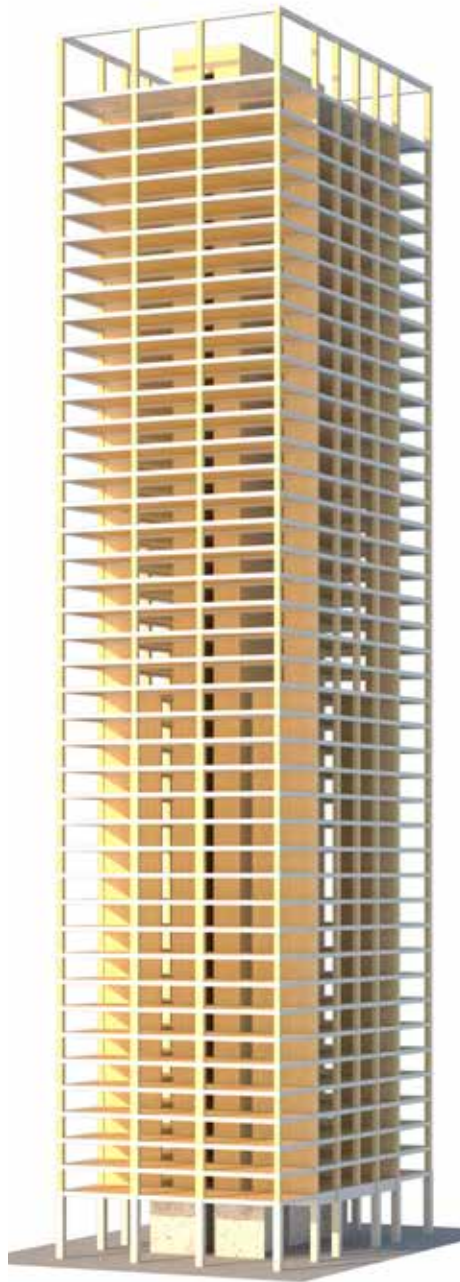
By Jim Moriarty

Three billion people will demand new affordable homes in the next 20 years, primarily in cities, UN-Habitat (unhabitat.org) estimates. High-rise buildings will continue to play a critical role in developing sustainable urban areas, as buildings over three stories are essential to creating density adequate for public transportation and thereby to reducing residents' overall environmental impact.

High-rise construction, however, relies on steel and concrete as the primary structural materials. The carbon emissions generated by the production of steel and concrete are a major factor in the embodied energy of buildings. As buildings become more energy efficient in their operation, the embodied energy of the construction process becomes more important in the overall carbon footprint. Current buildings are using steel and concrete as efficiently as possible. Another way to reduce embodied energy is to choose a structural material with less energy input: wood.

With new technologies such as mass timber, wood can be used as the main structural component for buildings of up to 30 or 40 stories. Wood is the least carbon-intensive structural material, is a renewable resource, and can sequester carbon from the atmosphere.

A 2004 study by the Canadian Wood Council found that steel and concrete designs embody, respectively, 26 percent and 57 percent more energy relative to wood, emit 34 percent and 81 percent more greenhouse gases, release 24 percent and 47 percent more pollutants into the air, discharge 400 percent and



In a feasibility study, Skidmore, Owings & Merrill demonstrates that structures up to 40 stories are possible using primarily wood supports.

350 percent more water pollution, produce 8 percent and 23 percent more solid waste, and use 11 percent and 81 percent more resources from a weighted resource use perspective. This study was done on conventional residential wood construction; however, the findings demonstrate the potential benefits of using wood as a structural replacement to steel and concrete.

Wood structures also have the potential to store atmospheric carbon, reduce overall building weight, reduce foundation size and materials, accelerate construction schedules through preassembly, reduce thermal bridging, and, where carbon taxes are implemented, set stable material pricing.

Mass timber: strong and safe

Traditional small-dimensional wood frame construction is unsuited for tall buildings due to the need for high strength and noncombustible materials. Mass timber structures, however, resemble concrete ones in assembly, massing, and strength.

Mass timber products—including cross-laminated timber, laminated strand lumber, and laminated veneer lumber—consist of staggered and laminated layers of wood that create strength in multiple directions. (The higher-strength formaldehyde adhesives used in mass timber do not have the same off-gassing properties of urea-formaldehyde and pose little risk to indoor air environments.) The wood panels and columns can be manufactured to greater dimen-

sions and therefore greater strengths. For example, a 24- by 24-inch wood column can withstand 1,200k axial load—the same as a 20- by 20-inch concrete column. Material properties have shown similar loads can be taken with the wood columns and shear walls, with a reasonable size and thickness.

In addition, wood can actually be safer in fires than steel. The burning characteristics of mass timber are much different than stick-frame construction. Thick wood panels and columns char at a predictable rate, leaving the core protected and undamaged. By adding thickness to columns and panels, the structural strength of the building can be maintained even as the outside layer of the wood chars in a fire. This is called the charring method of fire protection. Another method is encapsulation, in which a fire-resistant material surrounds the wood structure, but the extra material and weight ne-

gates some of the embodied-energy benefits of wood-based construction. Fire codes would need to be met using one of these methods.

A 24- by 24-inch wood column can withstand 1,200k axial load—the same as a 20- by 20-inch concrete column.

Making the case: two studies

From a material standpoint, mass timber has the strength to replace concrete and steel in high-rise buildings. The next step is incorporating wood into whole building designs. Two studies have come up with designs using wood as the primary structural material. Both show that wood buildings are feasible up to 15 or 20 stories. Over 20 stories, unique

loads allow wood to be used on most structural components with steel or concrete supports and connections.

Skidmore, Owings & Merrill (SOM), a leading US architecture firm for high-rise construction, has produced the "Timber Tower Research Project," a study that describes a prototype of a Chicago residential tower of 40-plus stories. SOM proposes concrete connection beams to reduce beam sizes and strengthen the floor assembly against wind loads. The introduction of concrete connections brings extra building mass to reduce uplift loads. The main columns, interior shear walls, and floor panels are mass timber. The design can compete structurally and economically with traditional concrete or steel buildings, but with a 60 to 75 percent reduction in the carbon footprint.

The second study, authored by architect Michael Green, "The Case for Tall Wood Buildings," outlines potential designs pushing to 30



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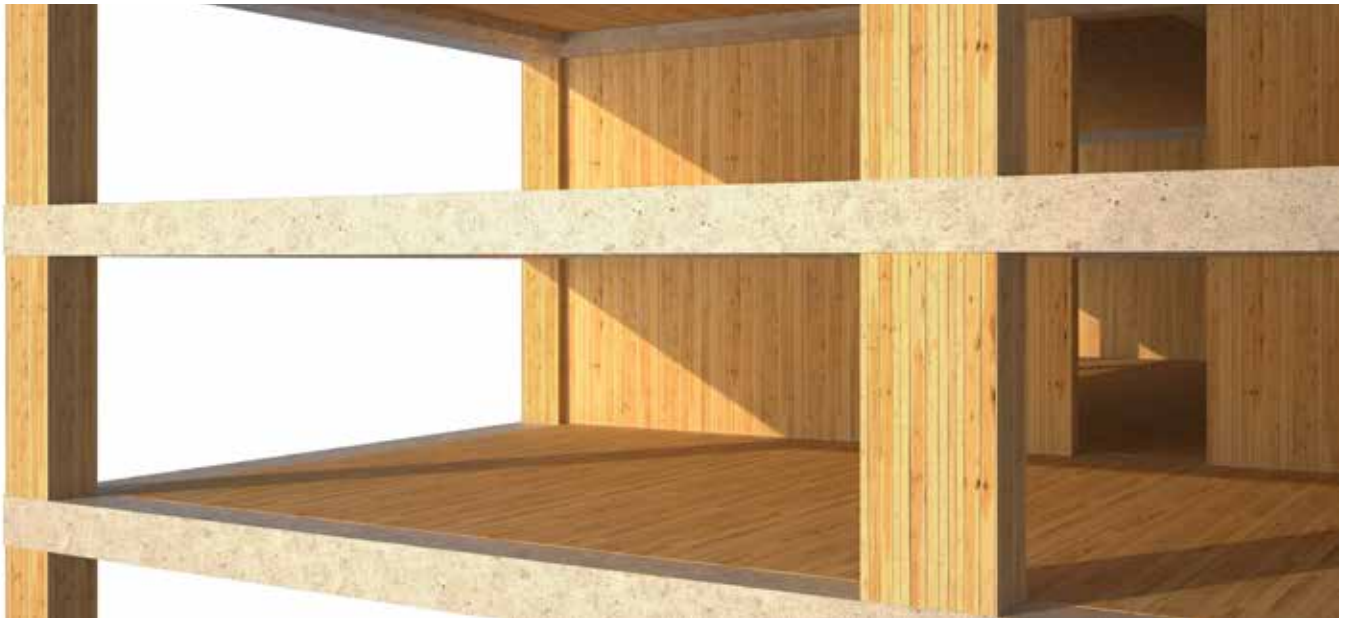
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Wood is both strong and beautiful: For designers, timber offers the opportunity to expose visually appealing structural elements in the interiors.

stories in Vancouver, Canada. Green proposes structural steel in specific locations to transmit loads using a strong column–weak beam structural approach. Again, the main columns, shear walls, and floor spans use mass timber with the added steel supports.

Both studies are preliminary but demonstrate the feasibility of tall wood construction up to 30 or 40 stories. More research and testing will be necessary to see the full adoption of these designs.

Ten all-wood stories in Melbourne

Buildings of 30 to 40 stories may be a few years away, but current buildings are showing how mass timber can be used in high-rise construction. At 10 stories (32.2 meters), the Forte apartment building in Melbourne, Australia, is currently the world’s tallest all-wood structure (see forte.living.com.au).

Built in 2012, Forte has been constructed and heavily marketed for its sustainable practices for a high-end residential market. Its most innovative aspect is the all-wood

structure. The construction team estimates that using cross-laminated timber reduced carbon emissions by more than 1,451 tonnes (1 tonne = about 2,204 pounds) compared to an equivalent building in steel and concrete.

The structure contains 485 tonnes of timber in 759 timber panels. The cross-laminated timber was selected for its reduced carbon footprint, reduced construction time, ability to be manufactured off site, and marketing potential. The timber panels were constructed in a factory off site and assembled on site by floor, similar to a concrete tilt-up construction. The building, with 23 apartments, was constructed over a period of 11 months. The timber structure was completed in 3 months.

Forte has demonstrated cost competitiveness, construction speed, and consumer awareness. Architects and developers get it, builders like it, and consumers see the benefits.

Issues and obstacles

As use of mass timber grows, adoption and code regulation will need to

be adjusted to account for the unique aspects of wood construction. The following issues and obstacles call for further research and development before mainstream adoption of tall wood construction.

Building codes. Current building code does not allow buildings over six stories to be built out of a combustible material such as wood. Using a performance-based approach, mass timber buildings can be demonstrated to perform as well as others in structural and fire considerations.

Water management. The life of any structural material is affected by water intrusion. Steel rusts, concrete degrades, and wood rots. Moisture management is essential in any building design. Research on the specifics of wood will be needed to ensure long-term durability.

Constructability. Trades do not currently exist in large-scale timber construction. However, the construction method is similar to concrete tilt-up. Existing companies specializing in concrete high-rise construction are most suited to the challenge of high-rise wood buildings.

Schedule. It is estimated that wood structures will be quicker to construct due to preassembly off

site. Efficiency will be gained through experience.

Insurance. Extra insurance may be needed during construction due to the increased risk of fire damage. This can't be known until underwriting is established in actual buildings.

Seismic loads. In locations where structural design is not controlled by seismic forces, wood can be designed with the typical considerations. In active seismic zones, more physical analysis will be needed on specific connections and details to test force resistance. Concrete or steel connections could be incorporated into wood supports for more seismic resistance.

Architectural design. Studies show that using a wood structure has no significant impact on interior architectural considerations. Additional efforts are needed to ensure protection and long-term durability of the wood structure.

Development and rental. Studies show no impact on the flexibility

of building layout or rentable space. However, as height increases, the need for interior shear walls limits the space to residential uses; office plans typically require more open floor plans.

Cost. With any new technology there will be a premium associated with risk and uncertainty in the construction market. However, models in Europe and Australia have shown cost-competitive construction when construction time and increased marketability are considered.

Sustainable forestry. If widespread wood building is to be adopted, sustainable forestry is of course essential. Otherwise, the carbon emissions benefits will be lost through deforestation.

End-of-life disposal. Carbon sequestration depends on proper end-of-life uses. If the building material is burned or landfilled, release of the stored carbon into the atmosphere will merely be delayed.

Public perception. A significant hurdle to developers taking on the additional risk of early adoption is public and industry perception of wood as a building material. With proper research and building techniques, perceptions can be shifted. Early adoption will likely occur in the public sector or in high-end residential projects promoting sustainability.

Calling all architects and designers

The technology needed to use mass timber in high-rise construction is becoming available and competitive. And as the carbon emissions benefits of wood construction become valued, more owners and developers will see the benefits of selecting wood as the main construction material.

Architects and designers will be the first advocates for high-rise wood buildings.

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An energy engineer and building consultant, Jim Moriarty has a passion for understanding the systems perspective of complex environmental, economic, and infrastructure issues. To research this article, he spent the first seven months of 2014 traveling the world to experience and study sustainability in different cultures. He blogs about his travels at nesea.org/author/jmoriarty.

Peer reviewer Newell Pledger-Shinn runs Hardwick Post & Beam (hardwickpostandbeam.com), a design-build timber frame construction company focusing on building performance and energy efficiency. He is particularly interested in high-performance solutions that use natural, nontoxic, and renewable materials. He is active in NESEA's BuildingEnergy Bottom Lines peer network group.



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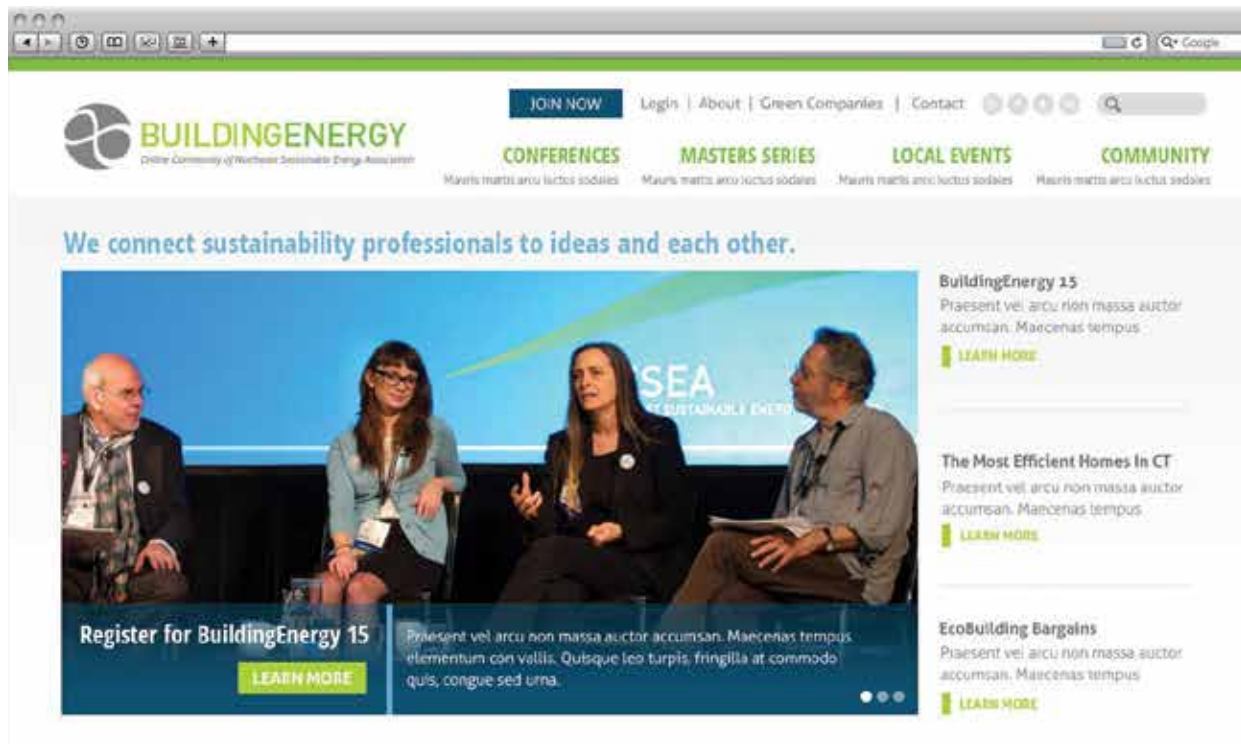
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COMING TO YOUR BROWSER FALL 2014

Efficient Lighting for Commercial Buildings

Commercial retrofits are complex, with multiple barriers, but the potential for energy savings is enormous

By Pat Sapinsley

In the United States, lighting accounts for 20 percent of the typical commercial building's energy load, according to a Navigant study for the Department of Energy (DOE).¹ This represents a tremendous opportunity for energy savings. Conservative estimates are that LEDs could save 25 percent of that energy load. Daylighting and proper control strategies could save even more. By 2030, we could be expending nearly 50 percent less energy on our commercial building lighting (see the chart).

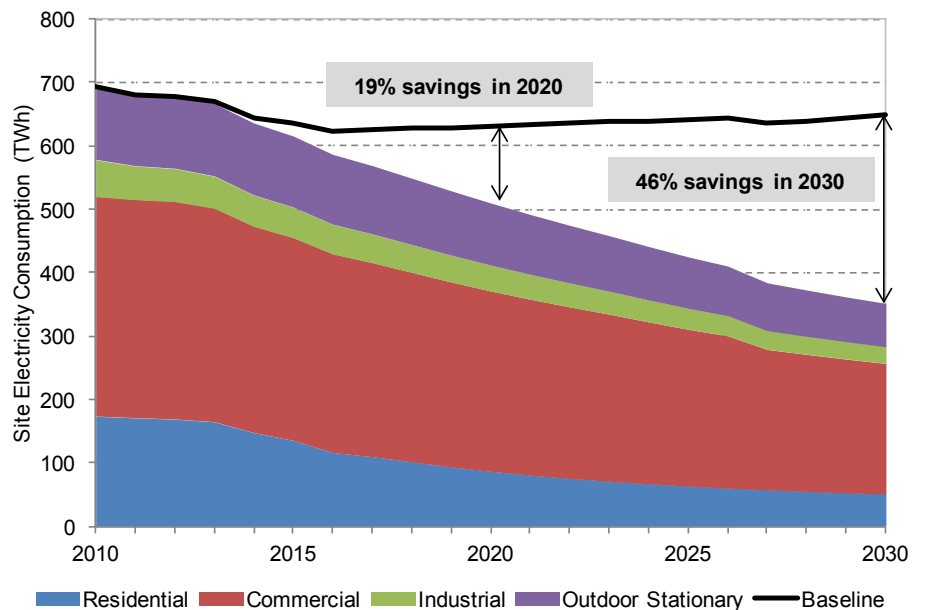
However, lighting retrofits for large commercial buildings are extremely complicated, presenting numerous barriers, and convincing building owners to implement them is an uphill battle. Yet 85 percent of the building stock we will have 25 years from now is the building stock we currently have. To have the impact we would like, we need to convince building owners to retrofit their lighting now.

Barriers and solutions

The first and most significant barrier to retrofits is that energy spent on lighting is a tiny percentage of any company's bottom line.

In New York City, the average company spends approximately \$170 per square foot on their core business, including employee salaries and benefits, manufacturing, inventory, equipment, etc., and approximately

Total US Lighting Energy Consumption Forecast, 2010 to 2030



\$5 per square foot on energy. If lighting accounts for 20 percent of the building's energy load, then we are talking about \$1 per square foot of their spend, or about 0.5 percent of their annual spend. Moreover, if we can save 30 percent of their lighting energy, we are talking about an even tinier percentage of their budget.

Countless times, reports showing large energy savings sit on a desk and are never acted upon. Customers who will do this work are either motivated by the mission of reducing energy use or by local mandates, coupled with local incentives. An important part of overcoming this barrier involves having local jurisdictions put benchmarking, submetering, and energy codes in

place. This will be the primary driver to more widespread energy efficiency in commercial building lighting.

The second barrier is the decision-making process and the risk associated with decisions.

For most commercial entities, annual budget decisions are made prior to the lighting professional's energy assessment. That means that any proposal, even if successful, will likely be postponed until the next fiscal year.

In addition, it is often unclear who the decision maker is. Is it the CFO? The facilities manager? The local building manager? Are these decisions made locally or on a portfolio-wide basis? Liability issues dominate

many decisions in US real estate and construction. The end user now has a system whose lights work. If they do nothing, there is no penalty. If they use capital expenditure dollars for a new system and it performs badly (they have heard stories of buzzing, of failed product), then their job is on the line and lawsuits loom on the horizon. If it ain't broke, don't fix it.

Solutions here include getting a good read on whom the decision maker really is and getting performance warranties on new systems.

The third barrier is market failures. These fall into three categories.

First, the split incentive between building owners and tenants means that the entity paying the upfront cost of lighting retrofit projects might not be the one that benefits from the savings. This has been addressed by the Natural Resources Defense Council's Green Lease and by new financing mechanisms that move the cost of the installation out of capital expense into operating expense.

Second is a lack of information and the wrong signals sent by utility pricing regimes and misguided incentive programs. Utility pricing programs are so confusing that no one really knows what they are paying for energy, nor therefore what they are saving with efficiency measures. Willard Warren has written eloquently and repeatedly on this subject. As an example, a commercial customer in New York City might be told that they are paying \$0.13/kWh for electricity. That is only the supply cost. A careful utility bill analysis could show the actual blended rate of \$0.33/kWh due to transmission, delivery, taxes, demand, and miscellaneous charges. Clarity in utility billing and incentive programs is a necessary component of a serious energy efficiency program.

Lastly, first cost is often a deterrent, although it need not be. Financing programs can be devised to move any lighting retrofit from capital

expense into operating expense. Standardized investment-grade auditing tools are now available from the DOE and other sources. Several geographical areas are experimenting with on-bill financing and commercial PACE (property assessed clean energy) programs. New York State has implemented a Green Bank program

Utility pricing programs are so confusing that no one really knows what they are paying for energy, nor therefore what they are saving with efficiency measures.

similar to the successful New York City Energy Efficiency Corporation, which backstops commercial loans. The New York State Energy Research and Development Authority (NYSER-DA) has implemented a small-business energy-efficiency finance loan mechanism that, in effect, provides loans at half the usual interest.

Considerations for the specifiers

As lighting specifiers, architects, and energy consultants, we have many tools for moving energy-efficient retrofits forward. The marketplace for LEDs is swirling with poor-quality product and the echo of disappointment from unsatisfactory CFL installations. It is extremely important that we educate the end users, which means arming ourselves with quality assessment metrics, good data, and clear information.

The DOE and others offer some excellent tools for quality assessment. The DOE has done an excellent job taming the former Wild West aspects of LED manufacturing, and their web-

site (energy.gov/eere/ssl/about-solid-state-lighting-program) is a good place to start.

Any quality solid-state lighting product has undergone LM79 and LM80 testing. These reports address the efficiency of the light source (LM79) and lifetime issues (LM80.) In addition, the DesignLights Consortium (designlights.org) assesses quality and maintains an ever-growing list of approved products. UL/CSA or ETL safety certifications should also be in order. Any product that does not have good ratings on all of the above should not be considered.

It is important to study the product warranty and question the manufacturer to find out exactly what is covered. A piece of paper that simply says five years may not be meaningful. Start by asking about lumen depreciation to 70 percent and color shift within a few MacAdam ellipses (a measure of color consistency). For large installations, request a warranty that states these metrics specifically.

Troffer-specific retrofits

In the United States, by far the most common source of commercial buildings' lighting load is light delivered by fluorescent troffers. The Navigant study estimates that there are 960 million of them installed in existing buildings.² With over 75 percent of commercial office building lighting provided by those troffers, replacements are an important part of a commercial office upgrade.

Again, the DOE has a very good white paper called "Upgrading Troffer Luminaires to LED"³ on their website. The three basic options, from least to most costly, are LED replacement tubes, LED retrofit kits, and new LED luminaires. In addition to all the quality control issues above, one must consider the ceiling and socket conditions, the desired light levels and distribution, and the dimming

implications. It is important to determine whether a one-for-one solution or a total redesign is the best choice. Most installations will require a mockup, no matter what is specified.

Controls and daylighting

There have been two recent, excellent reports on the benefits of controls in energy-efficient commercial lighting.

One is a soon-to-be-published case study called "Related Companies Office Lighting Retrofit," done by Related Companies, that retained the existing fluorescent fixtures but added a layer of controls and new dimmable ballasts. It is producing a 56 percent energy reduction, and the payback is approximately 3.5 years.

The other is a study called "Let There Be Daylight," done by Lawrence Berkeley National Laboratory (LBNL) and Green Light New York on

The problems with a daylighting system are related to its complexity. These programs require an informed installer, a good commissioning program, a companion shading technology, informed users, and expensive components.

the *New York Times* building daylighting project.⁴ It outlines the challenges and pitfalls, as well as the benefits and the potential for meaningful energy savings when daylighting is done correctly. LBNL documented an improved energy-use intensity for lighting, with a reduction from 5.1 kWh/sf (base system, no daylighting) to 2.1 kWh/sf. In addition, since

daylighting hours coincide with peak demand, the possibilities for kW reduction and participation in local demand reduction programs are very meaningful.

The problems with a daylighting system are related to its complexity. These programs require an informed installer, a good commissioning program, a companion shading technology, informed users, and expensive components that often get value-engineered out of the project scope. They require a real commitment on the part of the end user. A full-blown daylighting program, while effective, can be fairly difficult to implement, especially as a retrofit.

Making the case: life cycle analysis

A quality, understandable life cycle analysis is key to making a case for energy savings over the life of the



Commercial Installations

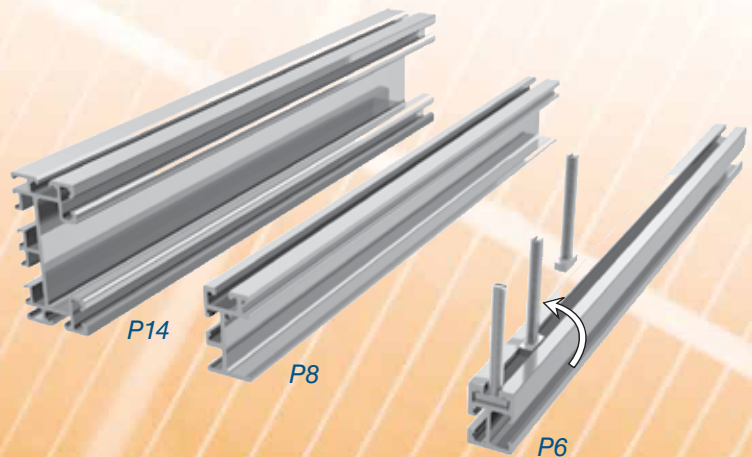


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installation. Several online tools can help with this. The EPA provides the Building Upgrade Value Calculator.⁵ It comes with a letter that puts the Excel results into a friendlier format for the end user. Another is the Acuity Visual Economic Tool.

The purpose of these tools is to compare a “business as usual” approach to an upgrade. The case can then be stated in terms of internal rate of return and return on investment, as well as tons of carbon saved. The data these tools provide can show that the cost of maintaining an existing system over time is far greater than an energy-efficient lighting upgrade. To prove that point, one must calculate the effects of the following metrics:

- First cost
- Maintenance cost (ballast, cleaning, and lamp)
- Recycling cost
- Heat/AC penalty
- Electricity cost escalation
- Inflation
- Materials and labor
- Real lifetime

The lifetime issue is one of particular concern. Many specifiers think that the new 50,000-hour fluorescent lamps have a lifetime equal to a 50,000-hour LED. This is not the case. Lumen depreciation testing for LEDs defines failure as the point at which 50 units of a 100-unit LED luminaire/lamp installation have reached 70 percent of their original output. End of life for fluorescents is measured at the point when 50 units of the 100-unit fluorescent luminaire/lamp installation have gone out. The LED ceiling installation is still quite useful. The fluorescent is not. We must adjust lifetimes in our life cycle analyses to account for this discrepancy.

The time is now

The very meaningful drop in the cost of LEDs, coupled with improvements in LED technology, means that the time has come for implementation. Currently, LED luminaires account for about 1 percent of commercial building lighting. By 2030 this number is expected to reach 65 percent. Commercial building owners and tenants who do not change out their lighting systems now are losing money annually and burning energy unnecessarily. 

LEED AP architect Pat Sapinsley is CEO of Watt Not (watt-not.com), president of Build Efficiently LLC, and co-chair of the Committee on the Environment (COTE) of the New York chapter of the American Institute of Architects. She is also a visiting scholar at Harvard University's Wyss Institute for Biologically Inspired Engineering. There, she helps translate biologically inspired technologies to commercial products through collaborations with clinical investigators, strategic corporate entities, and venture capital investors.

Notes

1. Energy Savings Potential of Solid-State Lighting in General Illumination Applications,” Navigant, January 2012: apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_energy-savings-report_jan-2012.pdf
2. Ibid.
3. DOE, “Upgrading Troffer Luminaires to LED”: apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_troffer-upgrades_fs.pdf
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5. EPA Building Upgrade Value Calculator: energystar.gov/buildings/tools-and-resources/building-upgrade-value-calculator
6. Acuity Visual Economic Tool: visual-3d.com/software/economictool.aspx
7. apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2013.pdf

Second Opinion

Commercial LED retrofits aren't complex—but incentives are

By Dinesh Wadhvani

Commercial adoption of the latest LED retrofit technologies has been slow to date. The primary reason is unfamiliarity. Most people assume retrofitting is a complicated process. Thus the most popular LED upgrade in the United States is replacement of the entire fixture. Unfortunately, most new fixtures are much more expensive and increase the time for the project to break even, typically up to five years. This perpetuates the notion that LED upgrades are either complicated or expensive, or both.

In fact, retrofits can be quick, and the better, brighter LED tubes can bring a project to break-even in two years.

Mainstream LED brands have failed early adopters

The most common types of lightbulbs used in commercial applications the United States today are fluorescent linear T8 and T5 lamps. These lamps are in fixtures that contain a ballast and typically last for about 20,000 hours, or two years. Fluorescent tubes lose 40 percent of their color and brightness within the first year of use. Furthermore, both the lamp and the ballast have their own separate life spans and need to be maintained and replaced separately.

LED T8 retrofits have become more popular as a replacement to fluorescent, but most of the mainstream brands of LED tubes have a light intensity reading of only about 100 lumens per watt (LPW). This light output is less than that of typical fluorescent lamps—not enough to replace the fluorescent counterpart. This failure has disillusioned early adopters.

Through extensive research and development, some more specialized, higher-end LED companies have created LED tubes that produce 131 LPW, replicating the illumination of a fluorescent tube while saving 50 to 60 percent of the energy. This savings can help an LED tube retrofit project break even within two years. Furthermore, the LED T8 and T5 tubes are simple, one-piece systems that do not require a ballast.

Quick installation and easy dimming

The process of retrofitting a linear fluorescent fixture is relatively simple because the Underwriters Laboratories (UL) code does not require that the fluorescent ballast be removed. It simply needs to be bypassed. As a result, the retrofit process takes five to seven minutes per unit,

allowing a quick and inexpensive installation.

A further advantage is the ability to dim. Although the technology exists to support new dimmable ballasts in existing fluorescent fixtures, the costs of implementation and maintenance are high due to the complexity required to dim fluorescent lamps through the ballast. Some LED retrofit tubes are now manufactured with a dimmable configuration. Due to the digital capabilities of LED, dimming is simple and inexpensive, so introducing dimming to LED retrofit tubes does not compromise tube lifespan and further increases the overall savings and benefits compared to fluorescent systems.

Since high-efficiency retrofit tubes can save 60 percent of energy costs with a two-year return on investment, knowing the true benefits allows organizations to make their decisions more quickly. Furthermore, such a quick payback makes organizations eligible for financing options over several months involving payments that are less than or equal to the monthly savings.

A must: help navigating incentives

Lastly, the complexity of filing for utility incentives could be a major reason for the delay in the spread of high-efficiency retrofits. The incentives are substantial—utility organizations in the United States underwrite up to 70 percent on an LED retrofit project. This further improves the return on investment. But even successful filing may encounter obstacles, because few companies are able to provide both effective high-lumen LED tubes with the correct certifications and effective filing support.

We have work to do. Our first job is to increase awareness so that the decision makers are better educated about the ease and cost benefits of retrofitting existing fixtures. Then we need to be sure that vendors providing LED retrofit lamps have the correct certifications and know the exact process for getting the incentives approved in their state.

Dinesh Wadhvani is founder and CEO of ThinkLite, USA (thinklite.com). Headquartered in Natick, Massachusetts, ThinkLite is a global lighting efficiency company that custom-designs, manufactures, distributes, and installs energy-efficient retrofit solutions for commercial customers and governments. The company's products leverage proprietary LED and induction technologies that adapt to existing infrastructures.

“Both NESEA and [instructor] Marc have given me a tremendous leg up in my work, shortening my learning curve by months, if not years in some areas.”

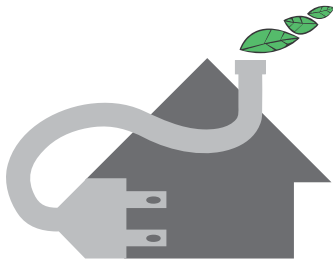
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My House, My Laboratory

Can this NESEA geek stop experimenting on his dream home long enough to finish? Or at least move in?

By Steven Bluestone

This is the story of a new high-performance house (mine) that's taken far too long to build. And of some others that are better for it.

Searching for and then buying the dream property where I would build my future vacation/retirement home took a couple of years. Then I turned to the architect I had already chosen: Bruce Coldham. After hearing him speak at BuildingEnergy conferences more than once (and overlooking his often colorful attire), I knew that search was over. Unfortunately, the last seven or eight years of designing and redesigning the home with him have earned me the dubious distinction of being the leading contributor to his 401K.

It's not Bruce's fault. I blame NESEA. This energy geek owner/general contractor, an on-and-off member of NESEA since 1979, has attended too many BuildingEnergy conferences and cannot seem to stop.

Searching for a better way to build

Between my 30-plus years of experience building thousands of units of housing of all types and shapes in New York City and Bruce's wealth of knowledge about all things "green," I knew my house was going to be an interesting project. We ended up on a 15-month roller coaster ride of permitting hoops, design decisions, and material selections before finally having "finished" construction documents in late 2012. Not quite the fast track.

I, like many others, have for years listened to some of the most in-



It took two years to find this dream property in upstate New York. And eight to build the house.

novative practitioners tell of both their failures and their successes at NESEA-sponsored events. If it weren't for all those vital, interesting conference sessions at which I learned and unlearned all too much about what worked one year and sometimes not the next, I would have finished this house a long, long time ago. Thanks a lot, NESEA. Intensive green roofs, ground-source heat pumps, hollow-core concrete planks (for floors and the roof), Durisol insulated concrete

forms for walls, foam-based concrete forms for walls, roof-mounted photovoltaics, and radiant heat all had their heyday and then went.

At my day job I was preoccupied with problems brought on by a steady decline in quality control. Whether the issues were related to poor field workmanship or poor construction documents, we had our hands full at times. It became clear that we needed to make some changes and find a better way to build, and I became more



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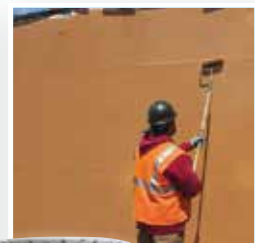
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focused on conferences and trade show floors. My goal was simple: I wanted to figure out foolproof ways to build the tightest, most energy efficient envelopes possible without raising our costs. I wanted to go with a system that used as few parts or layers as possible, hoping that fewer tasks would mean fewer places where things could get screwed up. This thought process led my company to try using insulated concrete forms (ICFs) for a full building envelope.

troleum-based ICFs was perhaps not the best thing for the environment, and that I should continue looking at alternatives. The problem is that the ICFs in an urban location solve a lot of problems. They pack a lot of performance into a tight space (which is critical because of our extremely high land costs and shortage of building property), offer a very strong bearing wall, and give us great air, water, vapor, fire, and sound barriers without having to add any extra layers to the

envelope. And this is all accomplished by one trade. Fewer tasks would hopefully mean fewer mistakes.

For my house, Bruce and I looked into various ICFs. Some were foam-based. Durisol forms were contemplated. At work, we worked almost exclusively with hollow-core precast concrete plank, and with a plank manufacturer located less than 40 miles from the site, there was a time when I thought that this house should be built using nothing but planks for walls, floors, and the roof (with added exterior insulation, of course). Somewhere along the way, I learned about autoclaved aerated concrete (AAC) and became fascinated by the product.

Love: Autoclaved Aerated Concrete

I wondered why AAC, used for over 80 years throughout the world, hadn't caught on in the United States. There are roughly 250 AAC manufacturing facilities globally, and maybe two in North America. I figured there must be something to it if hundreds of thousands of buildings had used it. Bruce

First step: insulated concrete forms

My company's first ICF building, "The Andrew" (a six-story, 50-unit rental building that we built, own, and manage), was completed in 2010. The building far surpassed our expectations in regards to energy consumption. Steven Winter Associates stated that it was the most efficient multi-family building four stories or more that they had ever seen in New York State, and it didn't cost us a penny extra to construct as compared with a "regular" building.

This was great, but I knew deep down (somewhat from NESEA conference sessions) that our use of pe-



Considering AAC? Design all openings around the available modular sizes the system offers or, as the author attests, you'll spend twice the time you should have erecting the walls.



The 8-inch AAC walls are clad with three staggered layers of 1.5-inch polyiso held to the block with a blocking/furring designed by Bruce Coldham. The cumulative R-value of the wall assembly is a true R-40 with zero thermal bridging. Next up: fiber cement siding.

suggested that it had not gained traction in our northern colder/wetter climates because of its high mass and lower R-value. "It may be a better fit for a mixed climate where the diurnal temperature swings are more

between cold and warm, as in many parts of Europe."

AAC has an extraordinary fire rating, is highly mold and water resistant, pretty much airtight, vapor permeable, lightweight (around a

third the weight of regular concrete), can be cut by hand, provides thermal mass, and has insulating properties (1 inch of AAC provides an R-value of approximately 1.25 per inch). You can drive regular nails into it and put regular screws into it. When materials are affixed to it with construction adhesive, the bond becomes stronger than the AAC block itself. What's not to like about AAC? Two things come to mind. First, if you want to use it in the Northeast, you need pay to ship it up from Florida, home to the nearest plant. Second, the material is somewhat soft and brittle and as such ideally needs to be protected with other materials such as plaster, stucco, drywall, or siding. Even so, for me I guess it was love at first sight: one product that could serve so many needs. I knew I wanted to use it to build my house—and see if it could be incorporated into structures that I help build at my day job.

I have one major suggestion to anyone who may consider using AAC: design all of your openings around the available modular sizes the system offers, as the fewer cuts you make in the field, the less material you will waste, the quicker you can build, and the more affordable the system will be. Unfortunately, we didn't take this into account in advance and probably spent twice as much time erecting the walls as we should have.

Tape, tape, and tape again

The 8-inch AAC walls are clad on the exterior with three staggered layers of 1.5-inch polyiso held to the block with an ingenious and simple blocking/furring designed by Bruce. The cumulative R-value of the wall assembly is a true R-40 with zero thermal bridging. Prior to drywall being installed in houses, an "insulation" inspection is normally required. I had to explain to the local inspector during the plan approval process that this wouldn't



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be the case with this house. For the roof, we used 12-inch SIPS panels. An afterthought to use LED hi-hat light fixtures in most rooms forced us to fur down the ceilings using 2x10s. In other rooms, the ceilings were dropped using 2x6s. Rather than leave empty space there, we added fiberglass batts, bringing the congregate insulation value of the roof to an average R-65. Below-grade walls were insulated via three staggered layers of 1.5-inch EPS rigid foam boards to give us an approximate R-18. Under the basement slab, we installed two layers of 1.5-inch EPS rigid foam boards for an R-12.

Passive House–certified windows and doors were used throughout. A painted steel roof went on up above, and fiber cement siding will cover the exterior walls. High-performance air-sealing tapes were used between the AAC and all windows and doors, and where the AAC met the SIPS panels. The first blower-door test (with tapes in place and a single scratch coat of plaster on the interior of the AAC) came in at 1.6 ACH50. This test indicated hundreds of failures of the tapes at the windows and doors, which may have been caused by operator error. When we thought we had fixed most

of the tape issues, we did another blower-door test. This time, we came in somewhere in between 0.7 and 0.8 ACH50. Leakage was still occurring at each corner of the window and door openings, where we hadn't gotten the taped joints tight. We're hoping that a final test (after a third try on the tapes, after all the drywall on the ceiling is installed and taped, and after the plaster walls receive their final coat) will show leakage of less than 0.50 ACH.

Let's tamper with the refrigerator

A multizoned VRF air-source heat pump system provides all heating and cooling, and an ERV system provides ventilation. Domestic hot water is supplied by a heat pump system located in a large storage/mechanical room in the basement. A 60-inch length of heat-recovery drainage pipe helped reduce the load on the system by upwards of 55 percent. A pair of "smart" booster pumps helps to expedite hot-water delivery to the taps (and also to evacuate hot water back to the DHW tank when hot water is not being used) in an attempt to further save on standby heat from the distribution pipes. Aside from

sourcing regular airborne heat, the room's temperature will on occasion be supplemented.

In addition, the game plan now is to remove the compressor unit from the refrigerator (immediately voiding the unit's warranty) and relocate it to the mechanical room. This will add heat to the space while removing the noise from the kitchen—something I've always dreamed about but never tried. A 10 kW PV system mounted on three manually adjustable poles will most likely make the home net zero or even energy positive.

Bruce recently asked me why I thought I "needed" to put some of the bells and whistles into this house. What was my "threshold" for judging need? A quick look at my bank account now will tell you that building the most affordable house possible wasn't high on that list of thresholds. I think I was more driven to use this house as my personal laboratory. I'm always looking to figure out better ways to



An afterthought to use LED hi-hat light fixtures in most rooms meant the ceilings had to be furred down. The empty space was filled with fiberglass batts, bringing the congregate insulation value of the roof to an average R-65.

Photos: Steven Bluestone



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build so that I can ultimately transfer the knowledge to our creation of affordable and efficient housing in the New York City area. I guess my answer to Bruce's last question was that I both needed and wanted to learn.

From the lab to Staten Island

As the home started coming out of the ground, I was inspired to replicate some of the systems in our submission to New York City to participate in their program to rebuild homes destroyed by Hurricane Sandy. Some minor tweaks (AAC panels versus AAC blocks), less aggressive insulation, and lower-cost windows and doors were integrated into the designs for the new homes, elevated high up on concrete piers, that we will soon be building in Staten Island. A great deal of storm damage came about from mold and fire. The AAC seemed to me to be a good alternative to going with traditional stick-built homes and pink stuff again. The city agreed and awarded us the contract.

Responding to a request for a peer review on the AAC wall system I had come up with for the Staten Island homes, Carter Scott of Transformations Inc. called me one day. He asked me if I'd like to make a few of these new homes reach Passive House at no extra cost to my company. To make a long story short, last winter, Transformations Inc., Katrin Klingenberg and her team at Passive House Institute US,



From up here, it looks done!

David White of Right Environments, Betsy Petit of Building Science Corp., and my firm collaborated in submitting a proposal to NYSERDA (New York State Energy and Research Development Authority) for funding to take a number of these new homes up to the Passive House standard. NYSERDA granted the funds, and we will soon be putting them to work in Staten Island. The homes will be thoroughly tested and monitored for performance results for one year of occupancy. Building Science Corp. will collate the results and issue a final report to the public after the monitoring on the last home is complete.

As for my house, I cannot wait to finish it, soon, because hopefully at that point in time I'll stop making changes to it.

Yeah, right. 🌍

New York City builder Steve Bluestone has helped lead his firm, The Blue-stone Organization, to use off-the-shelf components to construct buildings with record-low energy consumption at no extra cost. Steve lives in his passive solar home (built in 2000), which features a multitude of energy efficiency features. He says that he wants his tombstone (assuming he gets one) to read, "He helped try to save the world one BTU at a time."



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Heat and Hot Water Included

A 480-unit New Hampshire community dives into energy efficiency—starting with its 64 cast iron boilers

By Jonathan Kranz

Arthur Johnston, the lead maintenance technician for Canterbury Apartments, is an affable host, completely at ease when he speaks of his duties leading a six-person team responsible for 16 buildings. But when the conversation turns to the winters he has endured at Canterbury, his mood changes.

"We fielded at least seven or eight hot-water service calls every day," Arthur says. Residents of the Nashua, New Hampshire, community complained about poor or no heat, or a complete lack of hot water. The boilers, four in each building, and the domestic hot water they served—just one 50-gallon tank for all the occupants of each 30-unit building—were the originals, installed in 1972. Pushed to the limit, they ran 24/7, straining the circulators. Arthur and his team were replacing 12 to 15 circulators each season, with a peak of 22 in the winter of 2012–2013, at \$400 to \$700 each. And the initial

design neglected to isolate any of the heating/hot-water system's components, requiring a full system drain for every replacement.

Canterbury turned its woes turned into a success story, however, rectifying the heat/hot-water problem with a new high-efficiency system—installed throughout in just two months.

From problem to opportunity

When Jill Cunningham assumed her role as property manager for Canterbury two and a half years ago, the hot-water and heat complaints were a priority. "People have to get to work," says Jill. "If they call me at six-twenty to tell me they can't take a shower, I can't tell them to wait another twenty minutes: they need the hot water now."

Jill recognized that the old system simply was not sustainable. "There

The system, at a glance

- Adjustable ratios to changing outdoor temperatures reduce fuel consumption by as much as 15 percent
- Condensing heat exchangers capture 8,000 BTUs for every gallon of condensate
- Lambda Pro combustion controls adjust for fuel quality
- Dual-coil DHW tanks can accommodate solar
- Low-emission combustion

were three areas of costs," she says. "Obviously there's fuel—we were burning a lot of gas. Then there's maintenance. But for me, the biggest thing was residency." Each turnover cost an average of \$1,500. Worse, every unoccupied unit represented unearned revenue. Something had to be done.



Canterbury's newly spacious boiler room. The dual-coil 79-gallon Viessmann 300-B water tanks (left) can accommodate inputs from solar panels, giving Canterbury the flexibility it wants for future green investments. The Viessmann B2HA 150 condensing boilers (right), compact and easy to service, are surprisingly powerful, producing up to 530 MBH each.

But as Jill researched her options, she sensed that her problem was an opportunity. "Every time I talked to a potential contractor," she says, "I used our conversation to educate myself." She talked to seven vendors and learned that Canterbury could do more than merely catch up; it could take the lead in creating a greener, more environmentally responsible living environment.

One of the vendor representatives, Jim Bolduc, a Northeast territory manager with Viessmann Manufacturing, recommended a boiler-room survey and a commercial product evaluation program (CPEP) that would help Canterbury project fuel savings and size incoming boilers correctly.

"With the right technology," Jim says, "Canterbury had the potential to save as much as thirty percent a year in fuel costs." Jim pulled together a package based on durable titanium-stabilized stainless-steel heat exchangers, sophisticated combustion management, flexible three-way mixing valves, and intelligent controls. The top-quality design was easy on the bottom line thanks to competitive pricing and New Hampshire's generous gas rebate program.

"By the time we went out to bid," says Jill, "I knew I wanted to go with Viessmann units."

In the heart of an efficient system

Each building at Canterbury shares the same footprint. In the common area, there's a laundry room, and beside it is the boiler room, 9 feet by 11 feet. Arthur opens the door to the boiler room with evident satisfaction. With him is Tom Fullerton, a colleague of Jim Bolduc's at Viessmann. A former plumber, Tom takes obvious pleasure in serving as tour guide to Canterbury's new system, completed just as winter was beginning to be felt in November 2013.

On the left are two 79-gallon Vitocell 300-B dual-coil, indirect hot-water tanks. Facing the door, mounted on the wall, are two Vitodens 200-W, B2HA 150 gas-fired condensing boilers. At about 2 feet wide, 3.5 feet tall, and 27 inches deep, the boilers seem impossibly small—especially when one considers that they replaced four cast-iron boilers.

"A year ago we couldn't fit all of us in here," Arthur says.

At first glance, it seems there is not much to see. But Tom insists on a closer inspection. "The indirect water heaters have two coils," he points out. Today, both run water from the boilers, but should Canterbury ever want to invest in alternative energy sources, one of the coils can be piped off of solar panels. "If demand's high or there's not enough sun," Tom explains, "the boiler kicks in on the second coil to make up the difference."

Another subtlety Tom appreciates is the reverse-return piping for the parallel water heaters. In direct-return designs, the heater farthest from the boiler would always "see" less flow than its neighbor. But with reverse-return piping, a last-in/first-out arrangement means that both water heaters are supplied with a balanced flow. "It requires more pipe," says Tom, "but the balanced load is well worth the minor extra installation cost."

On the back wall between the water heaters and the boilers is a three-way mixing valve on the supply side of the heating line that Tom takes pains to explain. "You may think it's just a valve, but it's the key to ensuring that the system always operates at peak efficiency," he says. As the "traffic cop" of the system, this valve can be automatically regulated so that only the proper amount of energy is allowed to pass. In colder weather, more energy is sent to the heating system, but in warmer weather that energy is directed elsewhere—to the water heaters, for instance. This valve also ensures that,

even while the system is operating at higher temperatures to make hot water, the coolest water temperatures possible are returned back to the boilers. "One of the reasons the B2HA boilers are so efficient," says Tom, "is that reduced flue gas temperatures cause the moisture trapped within to condense to a liquid—but this can only happen when the return water temperatures are cool enough." Every gallon of condensate produced delivers about 8,000 BTUs of "free" heat that the boilers are designed to capture.

But using condensate for energy creates a new challenge: the heat exchanger must resist corrosion. Arthur and Tom turn a few screws and remove the cover from a boiler, exposing its inner workings. This is akin to lifting the hood on a European sports car: the impression is of solid craftsmanship, a thing elegantly designed and carefully executed. "Dr. Viessmann has a philosophy," says Tom. "Make boilers easy to service, and they will get serviced." The face of the heat-exchange cylinder is held in place with six bolts; all the wiring and gas inputs are linked by quick-connects that are easy to pull and replace. For service, the entire exchanger can be pulled and rinsed with a citrus solution in a matter of minutes. Returning to the issue of condensation, Tom notes that the exchanger is crafted from SA240 316 Ti, a titanium alloy that is the highest quality stainless steel available, ensuring lasting performance. The return water contacts the exchanger at three points for rapid exposure to, and exchange of, heat.

The cylinder burner at the core of the exchanger is also high-grade stainless steel, and also incorporates advanced features. The combustion management system, Lambda Pro, continuously monitors flame quality and, by reading calorific value, can automatically adjust both the fan speed and the gas valve to accommodate

variations in fuel quality—a crucial advantage in the deep winter months, when natural gas is in high demand.

Once the case has been returned to the boiler, Arthur calls attention to the control panel, the Vitotronic 200 HO1B, a red box just to the right of the door. “At first, I was intimidated by all this,” Arthur says, poking a few numbers into the graphical display. “But now, I love it. You can make a few quick adjustments, and the controls do all the work automatically.” One of the key adjustments is the ratio of outside air temperature to boiler output. After the initial installation, and in light of previous resident dissatisfaction, Canterbury played it safe, setting the heating curve at 1/1.8: for every degree of decrease in outside air temperature, an increase of boiler temperature of 1.8 degrees. “The goal,” says Arthur, “is to get the ratio as low as possible without making anyone uncomfortable.” Week after week, Arthur managed to march the curve down, from 1.8 to 1.7, 1.6, and 1.5. Next year, they’re aiming for 1.2, for maximum efficiency.

A rapid, leapfrog installation

Given the scale of the project, two firms were engaged to do the work: Total Climate Control and Denron Plumbing and HVAC. Due to unforeseeable delays, the switch-out, scheduled for June, got a late start: it was nearly October. “When we arrived,” says Jeff Warren, vice president of operations at Denron, “we had to address some major resident concerns. We had to maintain domestic hot water without interruption. Then, a month in, we brushed up against the cold—we had to provide heat too.”

The Denron team came up with an ingenious solution: temporary heaters, drawing natural gas off the meter tap usually used for testing the main. By running temporary lines through the old combustion air ducts, Jeff and



Canterbury Apartment Homes was pushing its 1972 heat and hot-water system to the limit. The result: constant complaints, high turnover, and high maintenance costs. A new high-efficiency system changed all that—and inspired a comprehensive energy-efficiency campaign.

his colleagues were able to get heat into the system without disturbing the adjacent laundry rooms or the residents. At peak operations, three temporary heaters were serving buildings simultaneously.

Jeff broke his 10-man team into clusters of two or three that approached the project in three waves: a lead team to set up the boilers outside; a demo crew to remove the old boilers and water heaters and connect the temporary heat service; and a rough-in and finishing crew to complete the installation. From start to finish, each building required a week’s work, but by “leapfrogging” the teams to initiate the next building’s work as the previous one was being completed, Denron was able to help Canterbury complete the entire project by Thanksgiving.

Today, the boilers run at 93 percent combustion efficiency, and service calls have dropped from seven or eight a day to zero—not one call all season long.

In advance of the coming winter, Jill and Arthur are engaged in an ambitious energy-efficiency campaign: insulating attics, air-sealing, replacing windows and doors, installing new aerators on faucets and showerheads.

“We got some real savings last year,” Jill says, surveying the property with satisfaction, “but we anticipate really big savings next year.”

Jonathan Kranz is the author of Writing Copy for Dummies and a past president of the Southern New England Chapter of the Society for Industrial Archeology. He sustains a lifelong curiosity for all things related to our infrastructure and the anonymous heroes who make and maintain it.

Peer reviewer Adam Kohler is a mechanical engineer with Kohler & Lewis Engineering in Keene, New Hampshire. Kohler & Lewis specialize in designing high-performance heating, cooling, ventilation, and plumbing systems for clients throughout New England. Adam is especially interested in heating systems that can be powered by renewable sources such as variable refrigerant flow (VRF) air-source heat pumps and biomass boiler heating systems. He has designed VRF heat pump systems for more than 40 buildings.

A New Tax Break for Commercial Building Owners

Those big new systems and components just got a little easier to afford

By Rich Maiolo

Thanks to recent changes in the tax code, commercial building owners who want to replace, or have already replaced, long-life systems or components with more energy-efficient or sustainable ones may have an easier time paying for them. This includes windows, HVAC systems, lighting/electrical, walls, plumbing, roofs, parking lots, and landscape features.

The IRS regulations at hand are Tangible Property Regulations—080713 v1 and IRS Revenue Section 263(a). What commercial building owners need to pay attention to is what the IRS calls “abandonment.” Abandonment allows an owner to expense the depreciation remaining on an old, “abandoned” system or component as a tax deduction, thus defraying the cost of an upgrade.


Long-life systems or components may even qualify for abandonment if they were never identified or segregated in the accounting records of the business when the building was purchased or constructed. They do have a value of their own, which is included

The new rules may apply to windows, HVAC systems, lighting/electrical, walls, plumbing, roofs, parking lots, and landscape features.

in the value or tax basis of the building. When the time comes to replace them, a tax deduction may be taken for all remaining value associated with them if they have not been fully depreciated. (Typically, a building is being depreciated over 27.5 years for commercial residential property or 39 years for commercial property.)

These regulations are complex. A professional study of the building and the depreciation status of its systems and components will most likely be needed to determine whether an abandonment deduction is possible,

as well as the remaining value of what is being replaced. A determination of value requires such information as the specifications of the existing systems or components and the date they were put into service. Note that to qualify for abandonment, the old systems or components must not be usable—they must be discarded so that they cannot be sold or reused, or rendered unusable.

To ensure that improvements are made strategically, taking full advantage of tax benefits, work with advisors who understand abandonment, cost segregation, and the various energy-efficiency tax deductions. 

Rich Maiolo is director of business development for Capital Review Group, a national consulting firm that specializes in building-related tax strategies for commercial building owners. He works with CPAs, commercial property owners, architects, engineers, energy service companies, building managers, bankers, and financial advisors.



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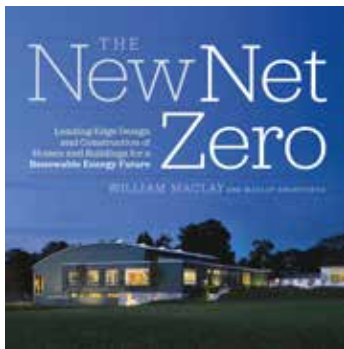
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The New Net Zero

William Maclay
Chelsea Green, 2014

By Jonathan Wright

The New Net Zero: Leading-Edge Design and Construction of Homes and Buildings for a Renewable Energy Future is the new benchmark for understanding the full scope of our predicament—and the great promise of planning, building design, and building science. This deeply inspirational book catalogs the wide variety of building uses and design interpretations that can carry forward the net zero model. While the setting of the conversation is national and global, the many examples of New England architecture and place make this a regional must-read.


Maclay and his team at Maclay Architects begin with a broad review of where we are, actually, in the universe and the solar system, a theme of place and orientation that is

consistent throughout the book. We are reminded that Germany, with less solar potential than any of the lower 48 states and Hawaii, now derives 38 percent of its energy from renewables. We are reminded gently, again and again, about the truth of Andy Shapiro's comment, "There are no net

integration of boots and minds on the ground is welcome and timely. It reflects a newer, evolving insight into the nature of elegant process and efficiency.

The New Net Zero is also handsome in format and overall design, and beautifully illustrated: envelope design detailing is stunningly clear, and sustainability site plans are drawn with an artist's hand. Even when it discusses design failure, for example the multilayered cantilevered canopies and balconies on the Aqua Tower in Chicago, with its miles of thermal bridging, the damning infrared scan is accompanied by a beautiful photo of the building's arresting sculpture.

Throughout, the tone is precise, detailed, kind, and probing. You can read this as a survey, use it as a textbook, return to it again and again as a reference, or keep it by your side almost all the time because it's just so interesting. This last is what I did for a couple of weeks.

The book ends with "12 Steps to a Net Zero Building," which organizes the tasks and commitments that a net zero building—and by extension a sustainable future—entails. The Maclay team shows us that this high bar is within reach for each of us. 

Read this as a survey, use it as a textbook, return to it again and again as a reference, or keep it by your side almost all the time because it's just so interesting.

zero buildings, just net zero families." What Marc Rosenbaum calls "possibly net zero buildings" focuses on the intentionality, planning, and collaboration that is at the core of sustainable design, construction, and living.

One of the most persistent themes revealed and reinforced here is a holistic design and construction process. Integrated design, as the authors explain it, offers up the use of the industry's best knowledge banks in design, engineering, construction, and management. From a builder's perspective, this embracing of the

Jonathan Wright is principal at Wright Builders Inc. (wright-builders.com), Northampton, Massachusetts.

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Aegis will design and install a solar electric or solar thermal system ideally suited to your needs. We are fully licensed in CT and an approved CCEF installer.
Specialties: *Photovoltaics, Solar Hot Water, Solar Pools*

The Sustainable Green Pages print edition provides an alphabetical listing of all companies in the directory, along with their description and specialty areas. This information is also available, with more search options, online at nesea.org/sgp. Businesses are joining or renewing all the time, so be sure to check in! Listings are current as of August 1, 2014 and are member generated. If you would like to purchase or update a Sustainable Green Page listing, go to nesea.org/members.

Air Barrier Solutions, LLC

Larry Harmon
257 Middle Road
Crown Point, NY 12928
877-226-2641
lharmon@
airbarriersolutions.com
airbarriersolutions.com
Specialties: Consultant

Alap Contractors

Mike Sidney
444 Francisco Street
San Francisco, CA 94133
alapcontractors@gmail.com

Alfandre Architecture, PC

Rick Alfandre
231 Main St. Ste 201
New Paltz, NY 12561
845-255-4774
info@alfandre.com
alfandre.com
Alfandre Architecture specializes in the design of energy, resource-efficient, healthy buildings. **Specialties:** Building Design/Construction, Consumer Information, Remodeling

Alpine Solar Heat and Hot Water

Stu Besnoff
189 North Street
Windsor, MA 01270
413-684-3950
stu@AlpineSolarHeat.com
AlpineSolarHeat.com
Evacuated tube solar hot water collectors for sale. Visit and see: operational domestic hot water, whole house heating, and swimming pool heating systems. Affordable prices! **Specialties:** Solar Hot Water, Solar Thermal, Solar Pools

altE Store, Inc.

Sascha Deri
330 Codman Hill Rd
Boxborough MA 01719
877-878-4060
altEstore.com
Founded in 1999, AltE, Inc. has catered to customers on every continent of the globe. An award winning company, AltE aims to continue to fulfill its motto, Making Renewable Do-able, offer Solar Installers

& DIY'ers great price on solar gear **Specialties:** Photovoltaics, Solar Thermal, Wind

Anar Solar, LLC

Matthew DeAvila
2 Chester Road, Suite 101
Derry, NH 03038
603-818-4123
anarsolar14@gmail.com
anarsolar.com
Anar Solr LLC is a designer and installer of PV Fields that complete the work with Low Environmental Impact by reducing the need for heavy equipment excavation to install our PATENTED system. Not only do we reduce heavy construction but we reduce use of fossil fuels and we utilize Eco-friendly materials in all ballast in-fill products. We design and build with Simplicity in Mind: Completely streamlined, the system does not use any nuts, bolts or unnecessary fasteners. Clevis pins are used instead. The design is extremely user-friendly and no specialized equipment or training is needed for assembly. We Install Rapidly and Proficiently: We use our PATENTED system which can be installed in a fraction of the time it currently takes traditional array systems. Clean and simple engineering, and limited equipment makes Anar Solar the least labor intensive and most efficient PV field installation. Adaptable and Quicker "Return on Investment". The system is specifically designed for landfill installations, but is also suitable for residential and commercial septic fields, as well as rooftops. The ballast design can conform to existing elevation and contour variations, making it possible to install on almost any terrain or location. **Specialties:** Building Design/Construction, Green Electricity, Photovoltaics

Andelman and Lelek Engineering, Inc.

1408 Providence Highway
Norwood, MA 02062
781-769-8773
mike@andelmanlelek.com
andelmanlelek.com
Specialties: Engineering Services, Energy Efficiency

Antioch University New England

Janet Fiderio
40 Avon Street
Keene, NH 03431
603-283-2107
jfiderio@antioch.edu
antiochne.edu
Antioch University New England graduate school offers a transformative education to every student who yearns to make a difference in the world. **Specialties:** College/University, Environmental Education

Appleton Corporation

Paul Stelzer
57 Suffolk St.
Suite 200
Holyoke, MA 01040
413-536-8048
pstelzer@oconnells.com

Aquapol New England / Game Changing Techs

Sandra Read
140 Island Way #106
Clearwater, FL 33767
727-798-2916
office@aquapol-USA.com
aquapol-USA.com
The Aquapol system is a revolutionary solution to risen damp. Rising damp is a major cause of decay to masonry materials such as stone, brick and mortar. For centuries now, the subject of drying out walls and keeping them dry has been a major challenge. The alternative and eco-friendly Aquapol system is an innovative, natural technology for building dehydration and damp control. It is easily installed without cutting masonry and operates without electricity, without chemicals, and with zero maintenance. Read about the 43 plus points of the Aquapol system. Aquapol is the brainchild of award-

winning Austrian engineer Wilhelm Mohom. The name Aquapol comes from 'aqua', the Latin word for water, and 'pol', which is short for polarization. Aquapol reverses the polarity of the water molecules found in the walls and causes the damp to flow downwards, leading to dehydration. **Specialties:** Alternative Technologies

Artisan Builders

Jonathan Fulford
127 Stovepipe Alley
Monroe, ME 04951
207-525-7740
Specialties: Building Design/Construction, Remodeling

Atelier Ten

Martine Persico
195 Church Street
New Haven, CT 06510
203-777-1400
martine.persico@
atelierten.com
atelierten.com

Austin Design, Inc.

Bill Austin
16 Call Road
Colrain, MA 01340
413-624-9669
office@austindesign.biz
austindesign.biz
Austin Design, Inc. provides architectural design services for homes, businesses and communities. We advocate a team approach between client, builder and architect that encourages the sharing of expertise and a passion for good design. **Specialties:** Building Design/Construction, Landscape Design/Construction, Architecture

Bakker & Lewis Architects

Margaret Bakker
243 Jackson Road
Shavertown, PA 18708
570-675-8843
mbakker@bakker-lewis.com
bakker-lewis.com
We are a small architectural firm specializing in designing new and retrofitting existing buildings which are both responsive to individual needs and that contribute to a greener environment. **Specialties:** Build-

ing Design/Construction, Energy Conservation, Remodeling

BASNETT Design/Build/Remodel

Jim Basnett
14 Gilson Road
Littleton, MA 01460
978-952-2552
jim@basnettdbr.com
basnettdbr.com
BASNETT Design/Build/Remodel has extensive experience in all phases of residential construction. We are passionate about energy efficiency, durability, low maintenance, and indoor air quality and bring that passion to every project that includes repair or modification to the building envelope and/or mechanical systems. **Specialties:** Building Design/Construction, Remodeling, Deep Energy Retrofits

Baukraft Engineering

Cramer Silkworth
Brooklyn, NY 11215
347-674-4287
cramer@baukraft.com
baukraft.com
Baukraft Engineering provides design and consulting services for high-performance buildings in the residential and small commercial market, focusing on HVAC systems and enclosure design & detailing for both new construction and renovation projects. Certified Passive House Consultant (CPHC) and Professional Engineer (PE) on staff. **Specialties:** Consultant, Home Inspections, Building Design/Construction

BETTERP3

Robert Conboy
7 Kilburn Street
suite 201
Burlington, VT 05401
802-373-4606
rob@betterp3.com
betterp3.com
BETTERP3 is a public private partnership of BETTER, Inc., The Intertribal Council on Utility Policy, The Green Energy Council, and the Native Alaskan firm of KIC-FM, and we are allied to John Todd Ecological Design. **Specialties:** Deep Energy Retrofits, Engineering Services, Workforce Development

Beyond Green Construction

Sean Jeffords
13 Terrace View
Easthampton, MA 01027
413-529-0544
info@beyondgreen.biz
beyondgreen.biz
Beyond Green Construction, **Specialties:** Deep Energy Retrofits, Insulation, Remodeling

Boston Community Capital

DeWitt (Dick) Jones
56 Warren Street
Boston, MA 02119
617-427-3580
djones@bostoncommunitycapital.org
bostoncommunitycapital.org
Boston Community Capital (BCC) is a community development financial institution whose mission is to build healthy communities where low-income people live & work. BCC develops PV systems for those communities & their residents. **Specialties:** Finance/CPA, Photovoltaics

BPC Green Builders

Michael Trolle
523 Danbury Road
Wilton, CT 06897
203-416-6399
mike@bpcgreenbuilders.com
bpcgreenbuilders.com
Green building for new and existing homes based on building science and sustainability criteria. Award-winning builder with extensive local experience. 100% Energy Star. Certified Passive House, Multiple LEED homes. **Specialties:** Building Design/Construction, Deep Energy Retrofits, Consultant

BPVS, Berkshire Photovoltaic Services

Christopher Derby Kilfoyle
46 Howland Ave
Adams, MA 01220
413-743-0152
info@bpvs.com
bpvs.com
Since 1985, the highest quality design and installation of efficient and durable photovoltaic systems for residential, commercial & institutional customers. **Specialties:** Green

Electricity, Photovoltaics, Energy Conservation

Building Science Corporation

Betsy Pettit
3 Lan Dr.
Suite 102
Westford, MA 01886
978-589-5100
betsy@buildingscience.com
buildingscience.com
Specialties: Consumer Information, Consultant, Energy Education

Building Shelter, Inc.

PO Box 2297
Vineyard Haven, MA 02568
508-693-7734
info@buildingshelter.com
buildingshelter.com
We build homes that are beautiful, durable and sustainable. Our commitment to craft and buildings that accord with nature give our clients homes that are comfortable and healthy to live in, easier and less expensive to maintain, and provide refuge from angry weather. **Specialties:** Building Design/Construction, Consultant

BuildingGreen, Inc.

Jerelyn Wilson
122 Birge St.
Suite 30
Brattleboro, VT 05301
802-257-0019 x 102
jerelyn@buildinggreen.com
BuildingGreen.com
BuildingGreen provides building industry professionals with well-researched information on environmentally sound building practices and green products. **Specialties:** Alternative Technologies, Energy Conservation, Energy Education

BuildingLogic, Inc.

Lillian Maurer
PO Box 210
Gardiner, NY 12525
845-443-0657
lillianmaurer210@gmail.com
BuildingLogicInc.com
We design and build beautiful high performance homes. By integrating traditional craft, science, and modern design, we create durable efficient homes that people love to live in. Certified Passive House

Consultant and Tradesperson. **Specialties:** Building Design/Construction, Remodeling, Energy Conservation

Burrington's Solar Edge

Gail Ann Burrington
6 Reed Circle
Windsor Locks, CT 06096
860-623-0159
solaredge@yahoo.com
solaredge.biz
Solar electric and energy efficient appliances, sales, and service; site evaluations, solar workshops, and consulting including PV roofing materials. CT Elec#0195608-PV1 **Specialties:** Building Design/Construction, Environmental Education, Photovoltaics

Byggmeister

Paul Eldrenkamp
667 Sawmill Brook Parkway
Newton, MA 02459
617-527-7871
byggmeister.com
Byggmeister is a residential design/build remodeling firm founded in 1983. Our priorities for each project are comfort, durability, and efficiency – and a unique level of accountability **Specialties:** Remodeling, Building Design/Construction, Energy Conservation

Caldwell and Johnson Custom Builders

Dave Caldwell
6500 Post Road
North Kingstown, RI 02852
401-885-1770
dave.caldwell@
caldwellandjohnson.com

Casaceli Construction, LLC

Michael Casaceli
55 West Street
Northborough, MA 01532
508-351-9400
michaelcasaceli@gmail.com
Casaceli Construction, with over 29 years of experience, builds and remodels homes. Leveraging our experience, we are focusing on building in ways that are healthy for our clients and the Earth. **Specialties:** Building Design/Construction, Remodeling, Deep Energy Retrofits

CED Greentech

15 Commerce Way
South Windsor, CT 06074
860-289-7711
solarteam@
cedgreentecheast.com
cedgreentecheast.com
CED Greentech East works closely with installers and has excellent service and extensive experience in the electrical and photovoltaic fields. Give us a call and see what the CED Greentech experience can do for you! **Specialties:** Photovoltaics, Other

Celtic Energy, Inc.

Christopher Halpin
701 Hebron Avenue
Glastonbury, CT 06033
860-882-1515
chris@celticenergy.com
celticenergy.com
Celtic Energy is an independent consulting firm founded to help energy users and associated organizations maximize their cost reduction and productivity benefits in the ever-changing energy marketplace. Celtic Energy utilizes an Industry Best Practices **Specialties:** Alternative Technologies

Center for EcoTechnology

Denice Hallstein
320 Riverside Drive
Northampton, MA 01062
413-586-7350
denice.hallstein@
cetonline.org
cetonline.org
Since 1976, we've been helping builders, homeowners and businesses save energy and reduce waste. We provide Home Energy Ratings and design consultation for residential new construction and retrofit projects. **Specialties:** Energy Conservation, Energy Audit Services, Energy Education

Centerbrook Architects & Planners, LLP

James Coan
67 Main Street
P.O. Box 955
Centerbrook, CT 06409
860-767-0175
coan@centerbrook.com
centerbrook.com
Centerbrook has been a leading firm in the practice of green and sustainable design since the 1970s. These are essential components of all its projects. **Specialties:** Architecture, Building Design/Construction

Certified Building Analysis, LLC

Joshua Jacobs
31 Randall St
North Easton, MA 02356
508-238-2835
josh@certifiedbuilding
analysis.com
certifiedbuildinganalysis.com
Specialties: Consultant, Energy Audit Services, Building Design/Construction

Clark & Green

Stephan Green
113 Bridge Street
Great Barrington, MA 01230
413-528-5180
info@clarkandgreen.com
Specialties: Architecture

Clean Energy Design, LLC.

Tom Wineman
11 Oak Lane
Osterville, MA 02556
508-563-6990
info@cleanenergydesign.com
cleanenergydesign.com
Clean Energy Design founded in 1996, provides a comprehensive and well-balanced approach to the design and implementation of renewable energy systems. Our extensive research and experience enable us to provide our clients with the most innovative, integrated solar systems. CED handles every aspect of the design, construction, installation, and maintenance of residential and commercial solar photovoltaics and solar thermal panels and systems. In addition, we provide

small wind energy solutions for residences, farms and businesses. **Specialties:** Photovoltaics, Solar Thermal, Wind

Clean Energy Finance and Investment Authority

Gladys Rivera
845 Brook St.
Rocky Hill, CT 06067
860-257-2351
gladys.rivera@
ctinnovations.com
ctcleanenergy.com
Specialties: Finance/CPA, Photovoltaics, Solar Hot Water

Coldham & Hartman Architects

Thomas Hartman
49 S. Pleasant Street
Suite 301
Amherst, MA 01002
413-549-3616
tom@coldhamandhartman.
com
coldhamandhartman.com
Coldham&Hartman Architects is a full service architectural practice designing residential, commercial, and institutional buildings for mission-driven public, non-profit, and private clients. We create transformative designs for a renewable future, making buildings that are loved in the region where we live. **Specialties:** Architecture, Energy Conservation, Deep Energy Retrofits

ConEdison

4 Irving Place
New York, NY 10003
212-460-1246
info@coned.com

Conservation Services Group

Cara Russell
50 Washington St. Ste 3000
Westborough, MA 01581
508-836-9500
cara.russell@csggrp.com
csggrp.com
CSG works with professionals to achieve high performance buildings. We provide mechanical and enclosure technical assistance through a project's lifespan--from initial assess-

ment & design, to construction & post-occupancy monitoring. **Specialties:** Consultant, Engineering Services, Energy Audit Services

Cornerstone Architecture

Richard Hammond
700 Richmond St
Unit 110
London, Ontario N6A5C7
519-432-6644
rhammond@cornerstone
architecture.ca
cornerstonearchitecture.ca
Established in 1991, our firm has developed a wide range of experience in a variety of sectors from children's facilities to seniors' communities; as well as educational, administrative, healthcare, and community projects. These projects include new facilities as well as additions and renovations to existing buildings. **Specialties:** Architecture

Cotuit Solar

Conrad Geyser
P.O. Box 89
64 Old Shore Road
Cotuit, MA 02635
508-428-8442
conradg@cape.com
cotuitsolar.com
Solar thermal, photovoltaics, wind and wastewater alternative engineering, installation and service. In business since 1988. **Specialties:** Domestic Water Heating, Photovoltaics, Wind

Cozy Home Performance, LLC

Mark Lantz
Mill 180 -
180 Pleasant St.
Easthampton, MA 01027
413-529-0200
info@mycozyhome.com
mycozyhome.com
We provide energy assessments and performance contracting services to benefit health and comfort, while maximizing energy savings. Serving MA, VT, CT. **Specialties:** Energy Audit Services, Insulation
Cushman Design Group, Inc.

Milford Cushman
100 Mountain Road
P.O. Box 655
Stowe, VT 05672
802-253-2169
inquiry@cushmandesign.com
cushmandesign.com
Offering personalized residential design services for those who value elegant design, natural materials and environmental consciousness in their home.
Specialties: Building Design/Construction, Interior Design

CWS Architecture
383 Carlton Avenue 10E
Brooklyn, NY 11238
718-502-9379
cwsarchitecture.com
CWS Architecture, P.C. is a multi-disciplinary architectural firm providing full services in architecture, green and sustainable solutions, urban design, landscape design, interiors and custom furniture.
Specialties: Architecture

DEAP Energy Group
Paul Eldrenkamp
667 Sawmill Brook Parkway
Newton, MA 02459
617-775-4716
peldrenkamp@deapgroup.com
deapgroup.com
DEAP Energy Group provides comprehensive consulting services to improve the quality of life and energy efficiency of homes. Our work encompasses both new construction and existing home retrofits.
Specialties: Building Design/Construction, Energy Conservation, Remodeling

Delta Products Corp.
Rita Carbone-Lawson
4405 Cushing Parkway
Fremont, CA 94538
860-872-0425
rita.carbonelawson@delta-corp.com
deltabreez.com
DeltaBreez Bathroom Fans are ENERGY STAR-qualified, quiet, with high energy efficiency. Fans consume up to 85% less energy than other leading fans; energy efficiency exceeds ENERGY STAR requirement by up to 835%; annual energy cost when run continuously is as low as \$4.20.

Specialties: Energy Conservation, Indoor Air Quality

Dietz & Company Architects, Inc.
Marc Sternick
17 Hampden St.
Springfield, MA 01103
413-733-6798
marcs@dietzarch.com
dietzandcompanyarchitects.com

Planning and design of beautiful, energy efficient buildings for educational institutions, affordable housing developers, commercial projects and healthcare facilities. New construction and historic renovations, sustainably designed.
Specialties: Architecture, College/University, Building Design/Construction

DMI
Alec Stevens
300 Chestnut St.
Suite 150
Needham, MA 02492
781-449-5700
astevens@dmiiinc.com
dmiiinc.com

DMI specializes in providing expert consulting and engineering services to improve energy efficiency and operation of commercial, industrial, institutional, and large-scale residential facilities. DMI has established itself as one of the most respected energy engineering firms in New England with unsurpassed attention to detail and quality.
Specialties: Energy Audit Services, Energy Conservation, Energy Monitoring

Dominic Paul Mercadante Architecture
Dominic Mercadante
70 Waldo Avenue
Belfast, ME 04915
(207) 338-4089
info@dpmercadante.com
dpmercadante.com

With over 20 years of experience I bring creativity and attention to detail to my practice of residential architecture creating buildings that perform well environmentally, functionally and aesthetically.
Specialties: Architecture, Building Design/Construction, Consultant

E2 Solar, Inc.
Jason Stoots
831 Main St
Dennis, MA 02638
508-694-7889
jason@e2solarcapecod.com
e2solarcapecod.com
In 2008, E2 Solar was established to deliver high quality photovoltaic systems to residents and businesses on Cape Cod and the South Shore. Since then E2 has installed over 100 mW of photovoltaic production.
Specialties: Photovoltaics, Solar Hot Water

Ecolibrium Solar
Jonathan Young
340 W. State Street
Unit 22
Athens, OH 45701
740-249-1877
jyoung@ecolibrumsolar.com
ecolibrumsolar.com
Ecolibrium Solar is the leading supplier of simple, fast, and cost effective mounting systems. Our solution saves installers countless hours from planning and installing more complicated systems. Our research and development teams prides itself on designing smart solutions, at an industry leading cost. Not wavering on quality, our revolutionary products will stand up to nature's wrath.
Specialties: Manufacturing

EcoRealty
Dave Hopkins
P.O. Box 3007
Amherst, MA 01004
413-259-9800
dave@ecorealty.org
ecorealty.org
EcoRealty is an environmentally friendly buyer brokerage with a special interest in green building, farming, and living local economies.
Specialties: Real Estate

Energy Circle
Peter Troast
Sparhawk Mill
81 Bridge Street
Yarmouth, ME 04096
207-847-3644
info@energycircle.com
energycircle.com
Energy Circle PRO is a complete web and marketing platform

designed for energy efficiency professionals. No matter your niche in the industry--remodeling, HVAC, auditor or home performance contractor--we can help grow your business.
Specialties: Marketing, Public Relations, Energy Monitoring

Energy Efficiency Associates
Mike Duclos
3 Birch Hill Road
Stow, MA 01775
978-793-3189
mike_duclos@ieee.org
Our consulting services specialize in Zero Net Energy, Passive House and Deep Energy Retrofits.
Specialties: Building Design/Construction

Energy Federation, Inc.
John O'Connell
40 Washington Street
#2000
Westborough, MA 01581
800-876-0660
efi.org
EFI is a wholesale distributor of Evergreen PV Panels, Infrared Cameras, HVI certified ventilation equipment, air sealing products, water conservation materials, and energy efficient lighting. We ship direct to customers' homes, businesses and job sites.
Specialties: Building Design/Construction

Energy Opportunities, Inc.
Marcus Sheffer
1200 East Camping Area Road
Wellsville, PA 17365
717-292-2636
sheffer@sevengroup.com
sevengroup.com
Energy Opportunities provides services focused on energy issues and the interface of nature and human enterprises. Founded in 1993, EO is also a part of 7group, LLC.
Specialties: Building Design/Construction, Energy Conservation, Environmental Education

Enterprise Community Partners

Bomee Jung
1 Whitehall Street
11th Floor
New York, NY 10004
212-284-7195
bjung@enterprisecommunity.org
enterprisecommunity.org
Since 1982, Enterprise has raised and invested more than \$14 billion to help finance nearly 300,000 affordable homes across the United States. Our award-winning Enterprise Green Communities initiative offers the first national framework for green affordable housing and inspires us to achieve sustainability across all of our activities and operations. Enterprise's recently launched PartnerPREP service (Partner Portfolio Retrofit Engagement Platform), helps owners of multifamily affordable housing developments to retrofit their buildings. **Specialties:** Social Services, Finance/CPA, Public Policy

Enviro Energy Connections

Henry Link
45 Mountain Street
Hartford, CT 06106
860-953-7611
hlinkage@alum.mit.edu
Enviro Energy Connections advocates for energy conservation, and renewable energies, promotes design of green buildings, overall sustainable strategies, proper waste management, and testifies at utility and legislative hearings. **Specialties:** Consumer Information, Energy Conservation, Environmental Education

Fred Davis Corporation

Fred Davis
120 North Meadows Road
Medfield, MA 02052
800-497-2970
Fred@FredDavisCorp.com
FredDavisCorp.com
Leading national independent wholesaler of all efficient lighting products. Fred: former NESEA boardmember; worked

on national lamp efficiency standards; chaired first conference on lighting and energy, 1987 (a NESEA conference). **Specialties:** Lighting Supply, Energy Conservation, Educator

G & G Construction, Inc.

23 Winthrop Avenue
Revere, MA 02151-5024
781-289-2977
info@ggconstructioninc.com
ggconstructioninc.com
G & G Construction, Inc. is a family-owned general contracting business that offers all-in-one remodeling and renovation services to residential and commercial. You can always count on us to handle every aspect of your general contracting project. **Specialties:** Building Design/Construction, Remodeling

Geoffrey H. Richon Company, Inc.

Tobias Richon
19 Duncan Street
Gloucester, MA 01930
978-283-6063
tsrichon@ghrichon.com
ghrichon.com
The Geoffrey H. Richon Company specializes in delivering high quality construction, remodeling and consulting services to Cape Ann and Essex County. Our experience is based on over 35 years in residential construction and remodeling. Through a whole-system approach to design and construction, we provide our clients with a high level of energy efficiency, comfort and durability for their projects. **Specialties:** Building Design/Construction, Consultant, Remodeling

George Penniman Architects

George Penniman
35 Pratt Street
P.O. Box 338
Essex, CT 06426
860-767-2822
george@pennimanarchitects.com

com
pennimanarchitects.com
George Penniman Architects LLC is a New England based, full-service, client oriented firm working on large and small scale projects that emphasize contextual design, high performance building practices and environmental stewardship. **Specialties:** Architecture, Interior Design, Landscape Design/Construction

Goody Clancy

420 Boylston St.
Boston, MA 02116
617-850-6651
arch@goodyclancy.com
goodyclancy.com
Specialties: Building Design/Construction, Architecture

Green Mountain College

Griswold Library
One Brennan Circle
Poultney, VT 05764
Specialties: Library

Grid Be Gone, LLC

Marc Spinale
127 Concord St
Peterborough, NH 03458
866-373-3630
sales@gridbegone.com
gridbegone.com
Grid Be Gone LLC offers sales and service for US-made biomass heating systems, on or off-grid PV systems, solar thermal, wind turbines and more. **Specialties:** Alternative Technologies, Energy Monitoring, Other Renewable Energy Generation

GridWerks Consulting, a US Clean Power Company

Thomas Thompson
306 Amherst Rd.
Pelham, MA 01002
917-886-4793
Tom@GridWerksPV.com
gridwerkspv.com
GridWerks Consulting, Inc. (GridWerksPV), a NYS clean power company, dedicated to making alternative energy an economic reality. GridWerksPV advances distributed power systems and renewable power

markets in the US and around the globe. **Specialties:** Consultant, Energy Audit Services, Photovoltaics

Hands-On Construction

25 Upland Road
Concord, MA 01742
978-369-4605
lise@handsonconcord.com
handsonconcord.com
Hands-On Construction is a full-service, design/build residential remodeling company specializing in kitchen and bath remodel, additions, whole house renovation as well as new home construction. Established in 1982, our mission is to deliver excellent design, expert craftsmanship and superior service while adding value and beauty to your home. **Specialties:** Building Design/Construction, Remodeling, Windows

Hardypond Construction

Deirdre Wadsworth
1039 Riverside St.
Portland, ME 01403
207-797-6066
Deirdre@hardypond.com

Healthy Home Builders, LLC

Jan C. Flanzer
Box 282H
Scarsdale, NY 10583
914-723-0200
jan@healthyhomebuilders.com
healthyhomebuilders.com
HHB creates properties that are distinguished by understated elegance, thoughtful floor plans, and meticulous detail. The guiding principles for the firm's projects are to be mindful of how their buildings will become part of the fabric of their community. We believe that indoor air and water quality are overlooked aspects of sustainable development. The firm's core principle is to pioneer the use of materials, systems, and design to protect the health and wellness of its occupants through improvements in indoor air and water quality. **Specialties:** Building Design/Construction, Indoor Air Quality, Insulation

Heartwood Group, Inc.

Fred Unger
165 Evergreen Street
Providence, RI 02906
401-861-1650
Unger@hrtwd.com
HeartwoodSolutions.com
Our company was founded in 1983 to create environmentally responsible buildings. Today we provide consulting and development services in the renewable energy and building industries. **Specialties:** Energy Conservation, Photovoltaics, Wind

Heliocentrix, Inc.

J. Craig Robertson
281 Henderson Road
Williamstown, MA 01267
413-458-2255
info@heliocentrix.com
heliocentrix.com
Specializing in the design and installation of solar hot water systems for water, pool and space heating. Installing Thermomax evacuated tube and Stiebel Eltron flat plate collectors. **Specialties:** Domestic Water Heating

Higgins Energy Alternatives

140 Worcester Rd.
Barre, MA 01005
978-355-6343
higginsenergy.com

Home Energy Technologies

Peter Harding
PO Box 364
Chester, CT 06412
877-800-6440
peter@homeenergytechnologies.com
homeenergytechnologies.com
Home Energy Technologies is a RESNET- accredited Home Energy Rating System Provider. Our services include HERS ratings, ENERGY STAR & NGBS certification, comprehensive home energy audits, building performance testing and other energy diagnostic and analyti-

cal services. Our clients include architects, builders and owners of single-family and multi-family homes in Connecticut and adjoining areas. **Specialties:** Consultant, Energy Audit Services, Energy Conservation

Huber Engineered Woods

10925 David Taylor Drive
Suite 300
Charlotte, NC 28262
800-933-9220
Beth.Blount@huber.com
huberwood.com
Huber Engineered Woods LLC continually strives to create innovative products that suit their customers' needs. Each one delivers outstanding performance, easy installation and greater strength in single family, multifamily and light commercial projects. Huber's ZIP System Sheathing & Tape are structural wood panels with built-in protective barriers, eliminating the need for building wrap or felt and providing a continuous rigid moisture and air barrier that optimizes energy efficiency. Additionally, Huber's AdvanTech Subflooring product is proven to achieve a superior combination of strength and moisture resistance for subflooring that won't swell, cup, delaminate or bounce even under the toughest conditions. To learn more, visit www.huberwood.com
Specialties: Manufacturing, Insulation, Roofing

Hudson River Design

Chuck Silver
120 Lighthouse Drive
Saugerties, NY 12477
845-246-0725
csilver@hvc.rr.com
ChuckSilver.com
Hudson River Design has been designing low energy-use and net-zero homes in NY's Hudson Valley for over 30 years. We create extraordinary buildings, including the Greenest Build-

ing in NY. **Specialties:** Building Design/Construction

Hudson Valley Community College -TEC-SMART

Penny Hill
345 Hermes Road
Malta, NY 12020
518-629-7075
p.hill@hvcc.edu
Hudson Valley Community College's LEED Platinum Malta facility, TEC-SMART, stands for Training and Education Center for Semiconductor Manufacturing and Alternative and Renewable Technologies. **Specialties:** College/University, Workforce Development, Energy Education

IBACOS

Duncan Prael
2214 Liberty Ave
Pittsburgh, PA 15222
412-765-3664
dprahl@ibacos.com
ibacos.com
IBACOS generates innovative solutions for the homebuilding industry - both in the U.S. and abroad. For nearly 25 years, IBACOS has partnered with production builders, manufacturers, governments, and industry to improve home quality and performance. Our vision is homes that are safe, healthy, comfortable, durable, efficient, responsible and affordable. **Specialties:** Building Design/Construction

InCommN, LLC

Rick Feldman
31 Olive St
Northampton, MA 01060
413-570-0223
rick@incommn.com
incommn.com
IncommN exists to advance and develop collaborations, enterprises, resilient communities and businesses through economic and policy analysis, business and organizational development and education.

Specialties: Public Policy, Educator, Consultant

Infrared Diagnostic, LLC

Flemming Lund
9 Elaine Road
Sudbury, MA 01776
978-440-9900
info@infrareddiagnostic.com
infrareddiagnostic.com
Infrared energy audit, Duct Blaster and Blower Door testing. Certified Infrared Thermographer, RESNET/HERS Rater. Provide consulting to builders, home owners to reduce energy. **Specialties:** Consumer Information, Energy Audit Services, Energy Conservation

Innovative Building & Design

Henry Clement
54 Porter Street
Granby, MA 01033
413-552-9771
henry.ibd@gmail.com
We are a residential general contracting firm which has been designing and building energy efficient, healthy homes for 25 years using a wide range of sustainable technologies. **Specialties:** Building Design/Construction, Deep Energy Retrofits

INTEGRATA Architecture + Construction

Andrew Borgese
419 Palmer Avenue
Falmouth, MA 02540
508-495-6575
info@integrata-ac.com
integrata-ac.com
INTEGRATA is an architecture and construction company based in Falmouth, MA serving the greater New England area. From site development to material selection, all our work is guided by sustainable design and construction practices. **Specialties:** Architecture, Interior Design, Building Design/Construction

Integrated Solar Applications Corp.

Andrew Cay
121 Spring Tree Road
Brattleboro, VT 05301
802-257-7493
info@isasolar.com
isasolar.com

We specialize in the design, service & installation of renewable energy systems, including solar thermal hydronic, photovoltaic, small wind, micro-hydro, biomass & hybrid systems. **Specialties:** Domestic Water Heating

Jack Miller Contractors

Jack Miller
291 White Oaks Rd.
Williamstown, MA 01267
413-441-3568
jackmillercontractors@gmail.com

Residential Contractors specializing in high-performance homes and remodeling. **Specialties:** Building Design/Construction, Remodeling, Deep Energy Retrofits

Jim Godbout Plumbing & Heating

Jim Godbout
48 Elm St.
Biddeford, ME 04005
207-283-1200
jim@jimgodbout.com
jimgodbout.com

We are a plumbing heating air conditioning company that has been around thirty years providing service to southern Maine. Our goal is to provide innovative, efficient, comfortable mechanical systems for our clients with professional service in mind. **Specialties:** Space Heating/Cooling, Ground Source Heat Pumps
John Fülöp Associates, Architects & Planners

John Fülöp

103 East Alford Road
West Stockbridge, MA 01266
413-232-7122, 212-219-2121
john@fulopassociates.com
fulopassociates.com

John Fülöp Associates, Architects provides design services for all building types, creating aesthetically pleasing, economic

green architecture throughout the Northeast. **Specialties:** Building Design/Construction, Energy Conservation, Remodeling

Johnson Braund, Inc.

15200 52nd Avenue South
Seattle, WA 98188
206-766-8300
info@johnsonbraund.com

Jones Whitsett Architects

Margo Jones
308 Main Street
Suite 3A
Greenfield, MA 01301
413-773-5551
office@joneswhitsett.com
joneswhitsett.com

Formed in 1984, we specialize in schools, civic/cultural buildings & historic preservation.

We share a commitment to a collaborative design process, respect for the architectural traditions of our region & concern for future generations. **Specialties:** Architecture, Building Design/Construction

Kaplan Thompson Architects

424 Fore St.
Portland, ME 04101
207-842-2888
info@kaplanthompson.com
kaplanthompson.com

Our mission is to bring beautiful, sustainable and attainable buildings to the world. From your home to your business, we can design the sustainable building you have been looking for. **Specialties:** Architecture, Building Design/Construction, Deep Energy Retrofits

Kent Hicks Construction Co.

Kent Hicks
P.O. Box 57
West Chesterfield, MA 01084
413-296-0123
khicksconstruction@verizon.net

KHC offers a wide range of options for achieving high energy efficiency along with fine craftsmanship. Our team has extensive experience in historical restoration, DERs, & passiv haus building. Any Project is

an Energy Project. **Specialties:** Building Design/Construction, Deep Energy Retrofits, Remodeling

Kolbert Building

Dan Kolbert
90 Gray Street
Portland, ME 04102
207-799-8799
dan@kolbertbuilding.com
kolbertbuilding.com

Our team's decades in home construction & renovation include a strong focus on energy efficiency & sustainable design. We have significant experience with LEED for Homes. **Specialties:** Building Design/Construction, Consultant, Remodeling

Kraus-Fitch Architects, Inc.

Mary Kraus
110 Pulpit Hill Road
Amherst, MA 01002
413-549-5799
mkraus@krausfitch.com
krausfitch.com

Integrating architecture with community, environment, and life quality, Kraus-Fitch Architects offers a full range of services emphasizing ecologically sound and socially responsible design. Our work ranges from deep energy retrofits and zero net energy buildings to cohousing communities and other smart-growth projects. Our interactive approach allows us to realize your vision with practical, innovative, and cost-effective solutions. Skilled in group process facilitation and active listening, we build consensus within families, communities, and building committees. We have received numerous awards for green design and smart growth development, are internationally recognized for our expertise in cohousing, and were named one of the Top Ten Green Architects for 2005 by *Natural Home and Garden* magazine. Principals Mary Kraus and Laura Fitch are LEED AP BD+C accredited. We focus on sustainability throughout our projects, from initial programming and master planning to construction details. Our structures are well insulated and

carefully detailed, engineered, and sited to reduce energy use for the life of the building. We emphasize quality and durability while meeting budget constraints. All this within a process that is enjoyable and supportive. **Specialties:** Architecture, Building Design/Construction, Deep Energy Retrofits

Kringle Candle

220 South Street Rt. 5
Bernardston, MA 01337
kringlecandle.com
Specialties: Other

Lewis Creek Builders

Mark Boudreau
771 Long Point Road
N. Ferrisburgh, VT 05473
802-999-6942, 802-355-0271
mark@lewiscreekbuilders.com
lewiscreekcompany.com
Specialties: Building Design/Construction, Energy Conservation, Educator

Liberty Utilities

Bob Reals, Jr.
15 Buttrick Rd
Londonderry, NH 03079
603-216-3634
Bob.Reals@LibertyUtilities.com
libertyutilities.com/efficiency
Liberty Utilities-NH is a regulated energy distribution company serving 87,000 natural gas and 43,000 electric customers. Efficiency programs listed at NHSaves.com. For Deep Energy Retrofit & Near Net Zero building incentives call or email. **Specialties:** Marketing, Energy Audit Services, Deep Energy Retrofits

Lipidex Corporation

Sales@AirCycler.com
411 Plain Street
Marshfield, MA 02050
781-834-1600
sales@lipidex.com
lipidex.com
AirCycler provides innovative ventilation solutions to builders, contractors, architects, raters and weatherization professionals, to help meet all their mechanical ventilation needs including, ASHRAE 62.2, IMC 403.4, LEED & Indoor Air Plus

Specialties: Energy Conservation, Indoor Air Quality, Manufacturing

Little Green Homes, LLC

Chris Redmond
23 Autumn Pond Park
Greenland, NH 03840
603-319-8095
chris@littlegreenhomes.com
littlegreenhomes.com
Little Green Homes, LLC is a residential design-build company focusing on healthy, durable and energy efficient new homes and renovation/addition projects. **Specialties:** Building Design/Construction

M.G. Kane Properties, Inc.

Michael Kane
162 Pond St.
Ashland, MA 01721
508-881-8882
Specialties: Real Estate

Maclay Architects

William Maclay
4509 Main Street
Waitsfield, VT 05673
802-496-4004
bill@maclayarchitects.com
maclayarchitects.com
Recognized as a leader in innovative, healthy, and ecological planning and architectural design since 1971, Maclay Architects specializes in net zero energy design and recently authored *The New Net Zero*, published by Chelsea Green. **Specialties:** Architecture, Building Design/Construction, Energy Conservation

Maine Association of Building Efficiency Professionals

Robert Howe
11 Columbia St.
Augusta, ME 04330
207-620-8214
info@mabep.org
mabep.org
Specialties: Energy Conservation

Maple Hill Architects, LLC

Doug Sacra
55 Glezen Lane
Wayland, MA 01778
508-561-2233
Doug@maplehillarchitects.com
maplehillarchitects.com
Maple Hill Architects is a full service design firm specializing in green design work in a variety of project types including educational, religious, and residential. **Specialties:** Building Design/Construction

Mass Audubon

Bancroft Poor
208 South Great Road
Lincoln, MA 01773
781-259-2110
bpoor@massaudubon.org
massaudubon.org
Mass Audubon works to protect the nature of Massachusetts for people and wildlife. Together with 100,000+ members, we care for 35,000 acres of conservation land, provide educational programs, and advocate for sound environmental policies. **Specialties:** Environmental Education, Public Policy, Consumer Information

Massachusetts Clean Energy Center

55 Summer St.
9th Floor
Boston, MA 02110
617-315-9355
masscec.com
Massachusetts is leading the way in innovative and comprehensive energy reform that will make clean energy a centerpiece of the Commonwealth's economic future. The Green Jobs Act of 2008 created the Massachusetts Clean Energy Center (MassCEC) to accelerate job growth and economic development in the state's clean energy industry. This new quasi-public agency serves as a clearinghouse and support center for the clean energy sector, making direct investments in new and existing companies, providing assistance to enable companies to access capital and other vital resources for growth, and promoting training

programs to build a strong clean energy workforce that capitalizes on the job opportunities created by a vital new industry. **Specialties:** Alternative Technologies, Energy Education, Workforce Development

McCauley Lyman, LLC

10 Speen Street
Framingham, MA 01701
508-665-5801
inquiries@mccauleylyman.com
mccauleylyman.com
McCauley Lyman advises people about energy and business law and represents them in business-related transactions. We have a particular focus on the energy industry, including energy regulatory agencies, and have done a great deal of work with all aspects of developing, financing and operating independent energy projects. We help people negotiate letters of intent and contracts, arrange financings, buy and sell businesses and their assets, resolve disputes, and do the myriad other things business people (and government officials who deal with business people) need to get done in order to accomplish their business objectives. **Specialties:** Legal

Menck Windows

Alan Wall
77 Champion Drive
Chicopee, MA 01020
508-509-3140
alanwall@menckwindows.com
menckwindows.com
High performance, finely crafted tilt turn, wood and wood clad windows and doors. German engineered, built in US for residential and commercial projects, with detailing and options to meet contemporary and traditional designs. **Specialties:** Windows

Mitch Anthony

Mitch Anthony
23 Chestnut Hill
Greenfield, MA 01301
413-530-6978
mitch@clarity-first.com
mitchanthony.us
Organizational cat herder and brand guy. My sweet spot is

positioning, brand strategy, communications design and ideation/concept development. I work where mission meets message to get organizations moving in harmony. **Specialties:** Communications, Marketing, Workforce Development

Mitsubishi Electric Cooling & Heating

Susan Pickett
150 Cordaville Rd.
Southborough, MA 01772
978-988-5571
spickett@hvac.me.com
Specialties: Space Heating/Cooling, Energy Conservation

Mulberry Tree Builders, LLC

Paul Liscord
24 Old Amherst Road
Mont Vernon, NH 03057
603-801-6938
mulberrytreebuilders@gmail.com
mulberrytreebuilders.com
Mulberry Tree Builders has been a leader in high performance architectural design and construction since 1981. We achieved Passivhaus infiltration standards in 1988, in a modest Cape in Standish, Maine, employing Canadian Double Walled building techniques. We are now one of 150 firms in the US to have earned Passive House Certified Builders status. Our first Deep Energy Retrofit, employing an exterior applied 4" poly-isocyanurate "jacket" to a home in Cape Elizabeth, Maine was completed in 1985. We are currently working closely w/ some of the top building science firms in the Northeast, in an effort to build on these early ground breaking accomplishments. Our hope is to collaborate w/ our clients to construct attractive, comfortable and environmentally resilient homes and business venues in Southern NH, Northeastern Mass, Greater Portland, and the Hallowell/Augusta, areas of Maine. **Specialties:** Building Design/Construction, Consultant, Remodeling

National Grid

Paul Cantello
1 Metrotech Center, 13th
Brooklyn, NY 11201
718-403-6963
paul.cantello@us.ngrid.com
nationalgridus.com
National Grid (LSE: NG;
NYSE:NGG) is an international
electricity and gas company
and one of the largest investor-
owned energy companies in the
world. Our core business is the
delivery of electricity and natu-
ral gas. We are committed to
serving customers **Specialties:**
Green Electricity, Consumer In-
formation, Energy Audit Services

Natural Resources Defense Council

40 West 20th St.
New York, NY 10011
212-460-4489

Neighborhood Housing Services of New Haven, Inc.

333 Sherman Ave.
New Haven, CT 06511
203-562-0598
nhsofnewhaven.org
Specialties: Social Services, Re-
modeling, Energy Conservation

Net-Zero Energy Coalition

4137 Nakoma Road
Madison, WI 53711
415-336-3621
info@netzeroenergycoalition.
com
netzeroenergycoalition.com
The Net-Zero Energy Coalition is
a member based change agent,
catalyzing and championing
a transformation of the built
environment to NZE by execut-
ing initiatives that UNITE THE
INDUSTRY and ACCELERATE THE
MARKET. **Specialties:** Building
Design/Construction, Workforce
Development, Other

New Commons

Robert Leaver
545 Pawtucket Avenue
Suite 106A
Pawtucket, RI 02860
401-475-6762
rleaver@newcommons.com
newcommons.com
New Commons is a whole new
kind of think tank which helps

clients move from thought to
action by helping them build
a network and then mobi-
lize that network to get the
job done. **Specialties:** Con-
sultant, College/University,
Communications

New Ecology, Inc.

Edward F. Connelly
15 Court Sq.
Suite 420
Boston, MA 02108
617-557-1700
connelly@newecology.org
newecology.org
NEI's mission is to catalyze sus-
tainable development and bring
its benefits to under-served
populations, maintaining a
focus on greening the construc-
tion of affordable housing,
training residents to understand
the advantage of green hous-
ing. **Specialties:** Energy Audit
Services, Energy Conservation,
Energy Monitoring

New England Geothermal Professional Association

44 Bradstreet Rd.
N. Andover, MA 01842
800-236-8215
info@negpa.org
negpa.org
NEGPA is a regional non-profit
association formed to address
issues with geothermal that
are specific to New England.
Our mission is to educate the
public and advocate with state
and federal officials, as well
as utilities, to give Geothermal
Systems the same consideration
and incentives as other renew-
able technologies. **Specialties:**
Ground Source Heat Pumps,
Geothermal, Energy Education

New York State Energy Research and Development Authority (NYSERDA)

17 Columbia Circle
Albany, NY 12203
866-NYSERDA
info@nyserdera.ny.gov
nyserdera.ny.gov
NYSERDA offers objective infor-
mation, innovative programs,
technical expertise, and funding

to help New Yorkers increase
energy efficiency, save money,
use renewable energy, and
reduce reliance on fossil fuels.
A public benefit corporation,
NYSERDA has been advanc-
ing innovative energy solu-
tions since 1975. **Specialties:**
Workforce Development, Energy
Education, Energy Efficiency

Newport Solar

Doug Sabetti
14 Vernon Avenue
Newport, RI 02840
401-787-5682
doug@newportsolarri.com
newportsolarri.com
Newport Solar is a Rhode Island
based business specializing in
the design and installation of
residential and small commer-
cial photovoltaic systems. New-
port Solar provides free roof
analyses and cost estimates
including financial analysis.
NABCEP certified. **Specialties:**
Photovoltaics

NMIC

Daniel Rieber
76 Wadsworth Ave.
4th Fl Weatherization Dept.
New York, NY 10033
212-822-8340
danriber@nmic.org
nmic.org
NMIC Has been providing
weatherization services for over
30 years. If you have a multi-
family building in Manhattan
we can help you reduce your
heating/hot water costs. We
have helped dozens of build-
ings save as much as 35%.
Specialties: Energy Conserva-
tion, Energy Audit Services,
Domestic Water Heating

Noble Home, LLC

Noah Grunberg
P.O. Box 476
Shelburne Falls, MA 01370
617-694-7253
info@noble-home.net
noble-home.net
The modern, all natural, af-
fordable home. The Noble
Home is a house kit designed
for each building site, eas-
ily assembled by an owner-
builder. **Specialties:** Alternative
Technologies, Building Design/
Construction, Research

NorthEast Electrical Distributors

Nate Pedro
560 Oak Street
Brockton, MA 02301
781-401-8500
nate.pedro@needco.com
needco.com
Specialties: Photovoltaics,
Lighting Supply, Manufacturing

NorthEast Solar Design

Ann Bronner
136 Elm Street
Hatfield, MA 01038
413-247-6045
info@northeastsolar.biz
northeast-solar.com
NorthEast Solar provides pro-
fessional design and turnkey
installation of commercial,
municipal, residential and
village solar electric systems.
Specialties: Photovoltaics, Pho-
tovoltaics, Photovoltaics

Northeast Utilities

Emily Buffum
One Nstar Way
Westwood, MA 02090
800-286-5000
www.nstar.com
nu.com
Northeast Utilities (NU) operates
New England's largest energy
delivery company. NU and its
companies are focused on
delivering reliable energy and
superior customer service. This
mission also includes helping
customers manage their energy
through a comprehensive por-
tfolio of highly effective energy
efficiency programs and services
for its more than 3.5 million
electric and natural gas custom-
ers in Connecticut, Massachu-
setts and New Hampshire. NU
is traded on the New York Stock
Exchange under the symbol NU.
Learn more about NU and its
family of companies at www.
nu.com. **Specialties:** Utilities

Nova Consulting Group

Andrew Calise
59 Middle St.
2nd Floor
Portland, ME 04101
800-939-8339
andrew.calise@

novaconsulting.com
Strategic-Energy-Group.com
Strategic Energy Group is the energy efficiency division of Nova Consulting Group. We provide real estate investors, developers, and managers with insight into the effects of energy on the financial performance of real estate. Specialties: Consultant, Energy Audit Services, Energy Conservation

October Engineering, LLC

Robert Morrison
 16 October Rd.
 Sudbury, MA 01776
 508-561-7553
 rlm@octoberengineering.com
 octoberengineering.com
HVAC systems design; commercial energy audit and energy services project development
Specialties: Engineering Services, Energy Audit Services

Optimal Energy Solutions, LLC

Henry Spindler
 64 Peg Shop Road
 Keene, NH 03431
 603-283-0366
 hcs@optimalenergysolutions.net
Comprehensive building system analysis and design, including: building envelope, high-efficiency HVAC (esp. hydronic), customized control systems and renewable energy. Specialties: Biomass, Engineering Services

Partners for Architecture

Stephen Grasso
 48 Union Street
 Bldg. 1
 Stamford, CT 06906
 203-708-0047
 lagrasso@pfarch.net
 pfarch.net
Partners For Architecture Inc. was inaugurated in 1999 to provide comprehensive and environmentally sensitive architectural services. Specialties: Architecture, Building Design/Construction, Energy Conservation

Pavers by Ideal

Patti Feeley
 P.O. Box 747
 45 Power Road
 Westford, MA 01886
 978-692-3076
 info@IdealConcreteBlock.com
 IdealConcreteBlock.com
Ideal manufactures a full line of interlocking concrete pavers and retaining wall systems. Products include Eco-Stone, Aqua-Bric, and Turfstone, environmentally friendly, permeable pavers. Pavers by Ideal offers a GREEN solution. Specialties: Landscape Design/Construction, Pavement

Pella Products, Inc.

Greenfield, MA 01301
Performance Building Supply
 Steve Konstantino
 111 Fox Street
 Portland, ME 04101
 207-780-1500
 info@mainegreenbuilding.com
 mainegreenbuilding.com
Performance Building Supply provides construction products and information to make buildings high performing, energy efficient, durable, resilient, healthy and more comfortable for the occupants. Specialties: Windows, Solar Thermal, Space Heating/Cooling

Peterson Engineering Group

Donald Peterson
 25 Van Zant Street
 Suite 7D
 Norwalk, CT 06855
 (203) 810-4191
 info@peg-eng.com
 peg-eng.com
Mr. Donald C. Peterson, PE is a LEED AP with certifications in Energy Management and Commissioning. He is involved in projects from commercial to residential and that are related to increased energy efficiency and renewable energy sources. Specialties: Engineering Services, Consultant

Picton Brothers, LLC

Jim Picton
 10 Titus Road
 PO Box 438
 Washington Depot, CT 06794
 860-868-5007
 info@pictonbrothers.com
 pictonbrothers.com
We are a construction & general contracting co. interested in progressive projects that incorporate practical & pleasing design geared to long-term sustainable use of resources. Specialties: Building Design/Construction, Remodeling

Pill - Maharam Architects

David Pill
 P.O. Box 1300
 Shelburne, VT 05482
 802-735-1286
 dpill@pillmaharam.com
 pillmaharam.com
Pill-Maharam Architects, founded in 1991 by David Pill offers comprehensive architectural services for institutional, commercial and residential clients. With hands on experience in the construction field, our staff brings to each project a realistic body of knowledge to create a buildable innovative solution. We are continually doing research into and incorporating sustainable strategies so that our finished projects are environmentally responsible. We fuse creative ideas with functional, budgetary and programmatic requirements to create finely detailed sculptural spaces and buildings. Specialties: Architecture, Building Design/Construction, Energy Conservation

Pioneer Valley Photovoltaics Cooperative (PV Squared)

311 Wells St.
 Greenfield, MA 01301
 413-772-8788
 pvsquared.coop
PV Squared is a worker-owned cooperative dedicated to making our shared community a better place to work and live. We are based out of two offices in western Massachusetts

and central Connecticut. Our organization is committed to the highest quality service for you, while providing jobs at fair wages in our community. We are eager to move toward a sustainable society by learning and adapting to new circumstances in ways that nurture and restore, rather than harm, natural systems. We're a local company operating year round; PV Squared is here to help you to own and maintain your renewable energy systems. We provide advice, equipment and assistance. Specialties: Photovoltaics, Solar Hot Water, Wind

Pioneer Valley Planning Commission

Catherine Ratte
 60 Congress St.
 1st Floor
 Springfield, MA 01104
 413-781-6045
 cratte@pvpc.org
 pvpc.org
The Pioneer Valley Planning Commission (PVPC) is the legally designated regional planning agency for the Pioneer Valley region in Western Massachusetts. PVPC was organized in 1962 under Massachusetts enabling legislation to serve a planning district comprising 43 member cities and towns and more than 621,570 residents. Our Mission is to preserve and enhance the quality of life for its individual member communities and for the region as a whole by: Working to develop policies, programs, and projects that support public and private efforts throughout the region to resolve issues, solve problems, meet needs, and exploit opportunities whenever and wherever such efforts can benefit from sound regional planning. Serving as an advocate for the regional community as needs and circumstances dictate. Engaging an open and broadly participatory planning process solidly grounded in ethical principles and a commitment to dedicated, high-quality public service. Specialties: Public Policy, Energy Education, Other Transportation Technologies/Services

Placetaylor

51 Heath St.
Roxbury, MA 02110
617-639-0633
placetaylor.com
Specialties: Building Design/
Construction

Polanik Architects

Gregory J. Polanik AIA
6 Pine Cone Dr.
East Sandwich, MA 02537
508-833-6540
mr7b7@aol.com
polarch.com
Specializing in environmen-
tally appropriate architecture,
planning and consulting, we
strive to design efficient, healthy
buildings, that preserve the
local community and are a del-
ight for their users. **Specialties:** Architecture, Consultant, Build-
ing Design/Construction

Powers Air

Drew Powers
68 Hamilton Dr.
Conway, MA 01341
413-539-7032
powersair@comcast.net
HVAC and Indoor Air Qual-
ity. Designing, installing and
servicing all types of systems.
Including Ductless units. LEEDS
Certified. From the beginning
planning stages to the end
use. Feel free to call/text me at
413-539-7032. Drew Powers
Specialties: Space Heating/
Cooling, Indoor Air Quality,
Deep Energy Retrofits

Precision Decisions, LLC

Chris Vreeland
PO Box 179
West Stockbridge, MA 01266
413-269-4965
cjb@precdec.com
precdec.com
Providing engineering services
for renewable energy, conserva-
tion and green construction. We
service contractors, archi-
tects and directly to industry,
commercial and residential
clients. Professional Engineer-
ing licensed in MA, CT, NY, RI.
Specialties: Engineering Ser-
vices, Photovoltaics, Alternative
Technologies

Project Planning and Management

Paul H. Lapointe
224 Follen Road
Lexington, MA 02421
781-861-9545
paul@paulhlapointe.com
paulhlapointe.com
Plan and manage construction
projects for environmentally
conscious educational and
cultural institutions; represent
institutions throughout the
project delivery process; assist
institutions in selecting archi-
tects, consultants, and con-
tractors. **Specialties:** Building
Design/Construction

Quigley Builders, Inc.

Mary Quigley
PO Box 2008
Ashfield, MA 01330
413-625-2301
maryquigley@
quigleybuilders.com
quigleybuilders.com
Quigley Builders is a woman-
owned construction and
renovation firm located in the
hills of Western Massachusetts.
We specialize in deep energy
retrofits of historic buildings,
using new materials and tech-
niques in traditional configura-
tions that respect and honor
the vernacular architecture. Our
goal is to achieve elegance and
efficiency not just in appear-
ance but also -- especially -- in
the function of every project we
undertake. This means conserv-
ing resources in materials and
labor, as well as investing in
the life of the building over the
next hundred years. **Specialties:**
Building Design/Construction

R.H. Irving Homebuilders

Bob Irving
543 West Salisbury Road
Salisbury, NH 03268
603-648-2635
bob@rhirvinghomebuilders.
com
rhirvinghomebuilders.com
Building fossil fuel free high
performance homes with con-
stant fresh air supply for excel-
lent air quality and low energy
bills. Deep Energy Retrofits for
existing homes. Design-build;
on site or modular. Certified

Passive House Consultant.
Specialties: Building Design/
Construction, Deep Energy
Retrofits

R.J. Aley Building Contractor

Judson Aley
185 Wilton Rd.
Westport, CT 06880
203-226-9933
rjaley.com
R.J. Aley is a General Contractor
specializing in energy efficient
home remodeling, kitchen
remodeling, green building,
historic preservation and home
repairs. Our projects include
additions, bathrooms, kitchens
and whole house renovations
that blend seamlessly with the
architectural style and period
details of your home while
enhancing its energy efficiency,
functionality and comfort. R.J.
Aley does not take shortcuts.
We pride ourselves on atten-
tion to detail, and reinforce our
commitment to high standards
through ongoing education in
energy efficiency and sustain-
able building materials and
methods. We strive to establish
a relationship with our clients
based on trust and integrity so
we are always ready to explain
how we can accomplish the
results you desire within the
parameters we have learned
to trust. The more you know
about what is involved and
how it is done, the more likely
you can confidently make an
informed decision. Whether an
addition, historic renovation,
energy efficiency improvements
or new Energy Star home, we
maintain the highest standards
and see each project through,
from inception to completion,
with an unerring eye to detail.
Specialties: Building Design/
Construction, Energy Conserva-
tion, Remodeling

R.L. Benton - Builder

Rich Benton
154 Schoolhouse Road
Center Sandwich, NH 03227
603-284-6860
rlbenton@cyberpine.net
Full service builder/designer
for energy-efficient residential
construction in the NH lakes re-
gion. Timber-framing as well as

advanced hybrid construction,
with expertise in solar thermal
system design and installa-
tion since 1978. Our Sandwich
Cabinet Shop can furnish your
project as well. **Specialties:**
Building Design/Construction,
Energy Conservation, Other
Renewable Energy Generation

RBI Solar, Inc.

Harman Kaur
5513 Vine Street
Cincinnati, OH 45217
513-618-7214
hkaur@rbisolar.com
RBI Solar is the leading turn-key
supplier of solar mounting sys-
tems. As a specialist in ground
mount, roof mount, landfill
and custom designed specialty
solar structures, RBI focuses on
providing the most robust solar
racking systems. **Specialties:**
Photovoltaics

Real Goods Solar-CT

523 Danbury Rd.
Wilton, CT 06897
888-567-6527
solar@realgoods.com
realgoods.com
Specialties: Photovoltaics

Real Goods Solar-MA

888-567-6527
solar@realgoods.com
realgoods.com
Serving Western MA, Cape Cod,
Southeast MA, Boston Metro,
North Shore, South Shore, and
Worcester County **Specialties:**
Photovoltaics

Real Goods Solar-VT

64 Main St.
Montpelier, VT 05602
888-567-6527
solar@realgoods.com
realgoods.com
Specialties: Photovoltaics

Renewable Sales, LLC

Kevin Price
35 Jeffrey Avenue
Holliston, MA 01746
508-309-4437
kprice@renewablesales.com
renewablesales.com
RENEWABLE SALES is your
one stop Solar Energy product
source featuring the very best
Solar Panels, Mounts, Inverters
and Thermal Collectors for com-
mercial, government and resi-

dential properties. **Specialties:** Photovoltaics, Solar Thermal, Energy Education

RevoluSun

Chad Stern
1 North Ave.
Burlington, MA 01803
781-270-6555
nss.marketing@
revolusun.com
revolusun.com/ma

RevoluSun offers customers the opportunity to go solar through direct purchase as well as lease options in order to provide the solution that is best fit for each situation. Our customer service is second to none and our team at Northeast Electrical Inc is trained to the highest standards in safety and continues ongoing electrical training to be at the top of their field. We have the knowledge, ability and resources to get the job done right, on time and within budget. Our goal is to exceed every customer expectation and set the bar for the highest level of customer service. **Specialties:** Photovoltaics, Green Electricity, Roofing

Rhode Island Commerce Corporation

Shauna Beland
315 Iron Horse Way
Suite 101
Providence, RI 02908
401-278-9100
sbeland@commerceri.com
commerceri.com

The Commerce RI Renewable Energy Fund (REF) is dedicated to increasing the role of renewable energy throughout the state. The REF provides grants and loans for renewable energy projects with the potential to create electricity. **Specialties:** Other, Educator, Consumer Information

Ridgeview Construction

Shane Carter
43 North Rd.
Suite 303
Deerfield, NH 03037
603-303-7206
scarter@
ridgeview-construction.com
greenbuildernh.com

At Ridgeview, we offer a sustainable approach to home building, harmonizing the intricate systems within the home and property to minimize the environmental impact and improve the overall efficiency and health of a home. **Specialties:** Building Design/Construction, Remodeling, Deep Energy Retrofits

Robert L. Spencer, AICP - Environmental Planning Consultant

Robert Spencer
15 Christine Court
Vernon, VT 05354
978-479-1450
spencebbc@aol.com
Professional planner specializing in organic waste management & project development. Assessment of on-site & off-site recycling of food waste, manure, yard waste & biosolids. **Specialties:** Other Renewable Energy Generation, Research

Rocket Construction

William Murray
321 Route 139
Abercorn, Quebec JOE 1B0
450-204-2625
wil@vivocom.ca

Rodman & Rodman CPAs

Steve Rodman
3 Newton Executive Park
Newton, MA 02462
617-965-5959
steve@rodmancpa.com
rodmancpa.com
The Rodman & Rodman Green Team is a specialty accounting practice dedicated to providing alternative energy producers and other businesses that pursue energy efficiency initiatives with expert counsel and services in green energy tax accounting and business strategy. Rodman & Rodman's experienced Green Team CPAs are domain experts

in alternative energy finances. The firm offers tax advisory, financial and accounting services for companies involved in solar, wind, biomass, and energy efficiency projects. The Rodman & Rodman Green Team provides clients with a sustainable financial roadmap through: expert partnership/corporate structuring for optimal tax benefit; grant qualification assistance and auditing; ongoing advisory services for federal, state and local tax incentives; and specialized strategic financial planning and management for alternative energy and sustainability projects. **Specialties:** Finance/CPA

RST Thermal

Mary Ellen Hickey
372 University Avenue
Westwood, MA 02090
781-320-9910
mehickey@rstreps.com

Specialties: Domestic Water Heating, Space Heating/Cooling

S&H Construction
Jamie Leef
26 New Street
Cambridge, MA 02138
617-876-8286
jamie@shconstruction.com
sandhsolar.com

An award-winning general contractor delivering sustainability and quality to residential renovations. Our Renewable Energy Division designs and installs solar electric, hot water, and geothermal systems, and offers energy management consulting. **Specialties:** Building Design/Construction, Photovoltaics, Solar Hot Water

Sage Builders, LLC

Jonathan Kantar
672 Chestnut Street
Newton, MA 02468
617-965-5272
info@sagebuilders.com
sagebuilders.com
Award-winning, full service Boston area residential design-build company committed to responsible design and construction practices. Experts in energy efficiency and weatherization. **Specialties:** Building Design/

Construction, Energy Conservation, Remodeling

Saltonstall Architects, Inc.

William Saltonstall
380 Wareham Street
Marion, MA 02738
508-748-1043
will@saltonstallarchitects.com
saltonstallarchitects.com
Providing architectural services to residential, commercial and institutional clients the firm is committed to sustainable design practices; focusing on working closely with our clients to design thoughtful, innovative, healthy and energy-efficient places to live and work. **Specialties:** Architecture

Sandri Energy, LLC

Jake Goodyear
400 Chapman St.
Greenfield, MA 01301
800-628-1900
jgoodyear@sandri.com
sandri.comrenewable-energy
Specialties: Biomass, Photovoltaics, Solar Thermal

Sellars Lathrop Architects, LLC

Ann Lathrop
1 Kings Highway North
Westport, CT 06880
203-222-0229
ann@sellarslathrop.com
sla-arch.com
Small, woman-owned firm designing upgrades, additions and renovations for 21st century living. Primary projects are residential and light commercial work in Fairfield County, CT., emphasizing energy efficiency and smart building technologies to create high quality solutions with character and style. **Specialties:** Building Design/Construction

SIGA

8001 Irvine Center Drive,
Suite 400
Irvine, CA 92618
855-733-7442
info@sigacover.com
sigacover.com
Build airtight. SIGA develops, manufactures and distributes high performance adhesives for air sealing and moisture

management. The products are acrylic based, free of residential toxins and VOC. They can be used individually or combined in the SIGA system with SIGA membranes to create a high performance building envelope. For decades the products have been successfully incorporated in energy efficient homes (Passive House, Net Zero, etc) around the world and across all climate zones. SIGA Cover Inc is the wholly owned North American subsidiary of SIGA AG. Based in Switzerland, SIGA AG is the developer and manufacturer of the SIGA adhesives. The company has over 350 employees worldwide, providing technical support and training in the field. **Specialties:** Indoor Air Quality, Windows, Manufacturing

Sirois Solar, division of Sirois Electric, Inc.

Chris Sirois
6 Duncan Road
Suite 6
Burlington, MA 01803
781-229-9988
chris@siroiselectric.com
siroiselectric.com
A full service electrical contractor performing energy audits and installations of solar voltatics for home or business. Master electricians. **Specialties:** Energy Audit Services, Photovoltaics

SJP Environmental Consulting, LLC

Sally Pick
PO Box 303
Montague, MA 01351
413-559-7257
SJP@crocker.com
sjpconsulting.biz/
Helps residents prioritize cost-saving steps for a cozy home w/ less wasted energy, lower climate impact. Guidance on options, contractors, incentives, financing, renewables. For companies & nonprofits: writing; managing projects; outreach. **Specialties:** Energy Education, Consumer Information, Communications

Smart Energy Of New England, LLC

David Belanger
4 Titus Hill Rd.
Colebrook, NH 03576
603-496-3504 or 800-608-5840
david@smartenergyne.com
smartenergyne.com
Smart Energy of New England is a six-year-old corporation located in Colebrook, New Hampshire. We serve New Hampshire, Vermont and Maine as well as undertaking several large projects in the Bahamas. We are an up-and-coming provider of energy efficient systems, both commercial and residential. Our main focus is on Solar Photovoltaic Systems and we are becoming well-known for our attention to detail and our satisfied-customer business model. We are currently increasing our marketing of BioMass, specifically pellet boilers, sized for homes as well as commercial facilities. BioMass is viewed as the next big heating cost saver with the added bonus of using local renewable resources while decreasing our reliance on fossil fuels and imports. We also offer Solar Hot Water and Wind Turbines to those customers who want to increase their energy savings while reducing their carbon footprint. **Specialties:** Photovoltaics, Biomass, Solar Hot Water

SolaBlock

Patrick Quinlan
Scibelli Enterprise Center
1 Federal Street
Springfield, MA 01105
339-230-4600 x101
pquinlan@SolaBlock.com
SolaBlock.com
SolaBlock LLC manufactures permanently PV-clad building materials, providing a cost-competitive solar solution to meet most of the electric load in a energy-efficient building. **Specialties:** Wind, Photovoltaics, Building Design/Construction

Solaire Generation

Logan Winston
150 West 28th St., Ste 1801
New York, NY 10001
646-738-6955
eaccounts@solairegeneration.com
solairegeneration.com
Specialties: Photovoltaics, Pavement

Solar Design Associates

Steven Strong
P.O. Box 242
Harvard, MA 01451
978-456-6855
sda@solardesign.com
solardesign.com
Specialties: Photovoltaics, Engineering Services, Alternative Technologies

Solar Hot

Dan Gretsch
1105 Transport Dr
Raleigh, NC 27603
919-439-2387
sales@solarhotusa.com
solarhotusa.com
We are a solar heating systems manufacturer. We specialize in systems design for residential, commercial, and industrial customers. We have the most efficient system on the market. **Specialties:** Solar Hot Water, Manufacturing, Solar Thermal

Solar Store of Greenfield

Claire Chang and John Ward
2 Fiske Ave
Greenfield, MA 01301
413-772-3122
claire@solarstoreofgreenfield.com; john@solarstoreofgreenfield.com
solarstoreofgreenfield.com
Local Western MA renewable energy consultants in a brick and mortar storefront. We provide Advice, Design, and Installation of Solar PV and Hot Water systems for residential and commercial settings. All projects are turnkey from beginning to end, covering all permits, incentives, utility interconnection and SREC aggregation. We also offer battery backup systems for grid and off grid PV systems. Additionally, composting toilets, biodiesel,

solar clothes drying racks, books and Eat More Kale tshirts are available. **Specialties:** Photovoltaics, Solar Hot Water, Energy Conservation

Solar Wave Energy, Inc.

Henry Vandermark
2 Tyler Ct
Cambridge, MA 02140
617-242-2150
hkv@solarwave.com
solarwave.com
Providing solar energy products and services since 1978. Today we provide controller integrated Web-based monitoring for solar thermal (heating & hot water) systems. **Specialties:** Energy Monitoring, Solar Hot Water, Other

SolarReviews

Jesse Truax
550 S Wadsworth Blvd #540
Lakewood, CO 80226
303-800-4083
jesse@solarreviews.com
solarreviews.com
SolarReviews is the largest consumer reviews website in the solar industry, with 10,000+ solar installer reviews and access to over 700,000 unique visitors each year who are interested in learning more about going solar. **Specialties:** Photovoltaics, Solar Hot Water, Marketing

Solect, Inc.

Ken Driscoll
89 Hayden Rowe
Hopkinton, MA 01748
508-589-4630
kdriscoll@solectenergydev.com
solectenergydev.com
Solect, Inc. is a solar renewable energy development company focused on the deployment of solar photovoltaic (PV) systems. Solect works with the appropriate financial partners to fund the deployment of solar renewable energy systems. **Specialties:** Other Renewable Energy Generation

Solectria Renewables

Anita Worden
360 Merrimack Street
Building 9
Lawrence, MA 01843
978-683-9700
inverters@solren.com
solren.com

Solectria Renewables designs and manufactures grid-tied photovoltaic inverters and related equipment (string combiners and data monitoring) for residential and commercial applications. Specialties: Photovoltaics

South Mountain Company

PO Box 1620
15 Red Arrow Rd.
West Tisbury, MA 02575
508-693-4850
info@southmountain.com
southmountain.com

An employee-owned design/build firm specializing in green development, houses and housing, furniture and interiors, and renewables. Our work is limited to Martha's Vineyard except education and consulting. Specialties: Building Design/Construction, Energy Conservation, Photovoltaics

Southern Light Solar, LLC

Christopher Sheldon
1128 Acushnet Ave.
New Bedford, MA 02746
774-473-9339
chris@southernlightsolar.com
SouthernLightSolar.com
Southern Light Solar is a full service engineering, procurement and construction contractor specializing in concept design, planning and installation of residential and commercial photovoltaic systems. Specialties: Green Electricity, Photovoltaics, Roofing

SouthPoint, LLC

Michael Lastella
77 Arlington Street
Leominster, MA 01453
978-840-4300
info@southpoint-llc.com
southpoint-llc.com
Provide design/installation services; specializing in solar

electric systems in the New England area. Our systems are for new and existing residential and commercial applications. Specialties: Consultant, Photovoltaics, Building Design/Construction

Sparhawk Group

Matthew Holden
81 Bridge St.
Ste. 107
Yarmouth, ME 04096
207-846-7726
mholden@
sparhawkgroup.com

From offices in New York City and Portland, Maine, we have driven energy efficiency into over 25,000 units of multifamily buildings, commissioned \$900+ million in new construction and provided leadership in energy efficiency since 1990. Specialties: Consultant, Energy Audit Services, Engineering Services

Speed Wire, Inc.

393 Jericho Turnpike
Mineola, NY 11501
877-977-7333
speedwireinc.com

Spirit Solar

Mike Kocsmiersky
PO Box 80007
Springfield, MA 01138
413-883-3144
info@SpiritSolar.net
SpiritSolar.net

Spirit Solar provides installation and service for all types of solar hot water systems, solar educational services, and third party PV system verification. Specialties: Consultant, Educator, Solar Hot Water

SPL Development Group

PO Box 239
Amherst, NH 03031
splllc.com
Specialties: Building Design/Construction

Stephen Turner, Inc.

Stephen Turner
P.O. Box 2523
Providence, RI 02906
401-273-1935
stephen@sturnerinc.com
GreenBuildingCommissioning.com
Specialties: Alternative Technologies, Energy Conservation, Indoor Air Quality

Steven Winter Associates, Inc.

61 Washington Street
Norwalk, CT 06854
203-857-0200
clients@swinter.com
swinter.com
Since 1972, SWA has provided services to improve commercial, multifamily, and residential buildings. We specialize in energy, sustainability, and accessibility consulting as well as certification, research, and compliance services. Specialties: Energy Audit Services, Engineering Services, Consultant

SunWind, LLC

300 Cranberry Highway
Orleans, MA
888-997-8694
sunwindllc.com
Specialties: Photovoltaics, Green Electricity

Taggart Construction, Inc.

Peter W. Taggart
P.O. Box 255
10 South Street
Freeport, ME 04032
207-865-2281
peter@tagcon.com
tagcon.com
Residential and commercial design/build construction company, emphasizing energy efficient, environment friendly and occupant healthy building solutions. Architectural services, construction management, value engineering, and historic restoration. Specialties: Building Design/Construction

The Blake Group

E. Windsor, CT 06088
800-353-1100
blakeequip.com
Specialties: Thermal Energy

The Community Preservation Corporation

Andrew Padian
28 E. 28th St., 9th Flr.
New York, NY 10016
212-869-5300 x544
apadian@communityp.com
communityp.com
CPC is a nationally recognized leader in helping developers finance and build affordable multi-family housing. To CPC, no loan is simply a financial transaction. Each project reflects CPC's commitment to help developers succeed at strengthening communities. Specialties: Finance/CPA, Energy Conservation, Building Design/Construction

The Green Cocoon

Candace Lord
141 Bridge Rd.
Salisbury, MA 01952
978-462-0082
info@thegreencocoon.com
thegreencocoon.com
The Green Cocoon is an insulation company that installs eco-friendly and sustainable spray foam and other insulation types in residential and commercial buildings throughout New England. Specialties: Insulation

The Green Engineer, Inc.

Christopher Schaffner, PE
54 Junction Square Drive
Concord, MA 01742
978-369-8978
chris@greenengineer.com
greenengineer.com
Sustainable design firm offering Energy Modeling and LEED Certification for commercial buildings. Technical staff of 10 LEED APs with 150+ LEED projects. Also work with local utilities' energy efficiency programs. Certified B Corp. Specialties: Building Design/Construction, Energy Conservation, Engineering Services

The Jordan Institute/ Resilient Buildings Group

Laura Richardson
6 Dixon Avenue
Suite 201
Concord, NH 03301
603-226-1009
lrichardson@
jordaninstitute.org
jordaninstitute.org

As a non-profit, we address climate change by reducing energy use in buildings. We consult on High Performance and Deep Energy Retrofits, LEED buildings, manage projects, M+V, commission, and advocate for strong public policy. Specialties: Consultant, Deep Energy Retrofits, Public Policy

The United Illuminating Company

157 Church Street MS 1-6B
P.O. Box 1564
New Haven, CT 06505
203-499-3504
patrick.burns@uinet.com
uinet.com

The United Illuminating Company (UI) is an administrator of the Residential and Commercial & Industrial Energy Efficiency Programs through the Connecticut Energy Efficiency Fund (CEEF). The CEEF promotes efficient energy use, helps residents and businesses save on their electric bills, advances economic development, reduces electric demand and helps reduce air pollution. UI and CL&P administer the CEEF through conservation programs that serve residential customers, including fixed-income customers, as well as business and municipal customers. Connecticut's energy efficiency programs are funded by a charge on customer bills. Additional information on Connecticut's energy-efficiency programs can be found at www.ctenergyinfo.com. Specialties: Building Design/Construction, Energy Audit Services, Energy Conservation

The Valle Group, Inc.

Christian Valle
70 East Falmouth Highway, #3
East Falmouth, MA 02536
508-548-1450
info@vallegroup.com
vallegroup.com

The Valle Group sets the standard for thoughtfully-planned communities in southern New England. The company's special expertise is planning and creating communities of quality, energy-efficient homes, and building and remodeling for homeowners. Specialties: Building Design/Construction, Remodeling

Thomas Buckborough & Associates

Thomas Buckborough
358 Great Road
Acton, MA 01720
978-263-3850
thomasb@tbadesigns.com
tbadesigns.com
Specialties: Building Design/
Construction, Remodeling

Thompson Johnson Woodworks

Heather Thompson
115 Island Ave
Peaks Island, ME 04108
207-766-5919
heather@tjwhome.com
tjwhome.com
Residential building and renovations in the Greater Portland, Maine area. We employ best building practices in all aspects of each of our projects. We strive to incorporate highly efficient/green building standards and materials to the maximum extent possible on each of our projects. Specialties: Remodeling, Deep Energy Retrofits, Building Design/Construction

Thornton Tomasetti Fore Solutions

Gunnar Hubbard
386 Fore Street
Suite 401
Portland, ME 04101
207-347-5066
ghubbard@
thorntontomasetti.com
fore-solutions.com
Specialties: Building Design/
Construction, Consultant, Engi-
neering Services

Thoughtforms Corporation

Mark Doughty
543 Mass Avenue
Acton, MA 01720
978-263-6019
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com
thoughtforms-corp.com
Thoughtforms Corporation specializes in building high-end custom homes and unique institutional buildings in eastern Massachusetts. Now in our fourth decade, we have built our reputation and business by working together with architects and clients. Specialties: Building Design/Construction

Thoughtful Balance

Laura Nettleton
456 S Graham ST
Pittsburgh, PA 15232
412-661-6010
laura@thoughtfulbalance.
com
thoughtfulbalance.com
Specialties: Architecture

Timberhomes, LLC

Josh Jackson
PO Box 106
6335 VT Rt. 113
Vershire, VT 05079
802-685-7974
info@timberhomesllc.com
timberhomesllc.com
*Design/build of natural, soulful, resilient & energy efficient homes. Timber Frames. Tree forms. Scribe work. Vermont materials. Net zero homes. Timber framed solar pavilions. Barns & outdoor structures. Spiral stairs & compound roofs. Specialties: Building Design/
Construction*

Timeless Architecture

Henry P. MacLean
147 School Street
Milton, MA 02186
617-696-6448
hmaclean@timearch.com
timearch.com
Timeless Architecture is an architectural office specializing in residential & light commercial work, focused on the integration of historic preservation and green design. Specialties: Building Design/Construction, Energy Conservation, Remodeling

Tiny Houses, Inc.

Annette Lindbergh
141 Wiccopee Rd.
Putnam Valley, NY 10579
845-526-4753
tinyhousesinc@gmail.com
tinyhousesinc.com
Committed to environmental awareness and greener living, Tiny Houses, Inc. designs small, energy efficient green homes and accessory buildings. By building small, fewer carbon emissions are released into the environment. Specialties: Building Design/Construction, Architecture, Green Electricity

Transformations, Inc.

Carter Scott
8 Coppersmith Way
Townsend, MA 01469
978-597-0542
carter@transformations-inc.
com
transformations-inc.com
*Transformations, Inc. is focused on creating Zero and Near Zero Energy homes including Sustainable Developments. Specialties: Building Design/
Construction, Photovoltaics*

Tremco Commercial Sealants & Waterproofing

3735 Green Rd.
Beachwood, OH 44122
800-321-7906
jbuckley@tremcoinc.com
tremcosealants.com
Specialties: Indoor Air Quality

Trillium Architects

Elizabeth DiSalvo
409 Main Street
#14
Ridgefield, CT 06877
203-438-4540
trilliumarchitects@gmail.com
trilliumarchitects.com
Trillium has been designing super efficient homes since 1998 and pride ourselves as being perhaps the most experienced green architects in CT. We have built or are working on many levels of sustainable home including LEED and Passive House. Specialties: Architecture, Building Design/Construction, Deep Energy Retrofits

Truth Box, Inc.

Peter Gill Case
460 Harris Ave. Unit 104
Providence, RI 02909
401-453-1300
pgc@truthbox.com
truthbox.com
This architectural firm is for clients who seek alternatives to wasteful building practices. We offer cost effective solutions that help the environment and enhance design and comfort. Specialties: Building Design/Construction, Energy Conservation, Real Estate

Tunstall Corporation

Scott Malo
18 Exchange Street
Chicopee, MA 01013
413-594-8695
smalo@tunstall-inc.com
Tunstall Corporation is a manufacturer of steam traps and a distributor of hydronic heating and cooling specialties and has been for over 55 years. Thermostatic radiator valves, conversion inserts and many energy saving products/services. Specialties: Manufacturing, Energy Conservation

Uncarved Block Inc.

Brad Morse
78 Carter Rd
Becket, MA 01223
413-464-2598
brad@uncarvedblockinc.com
uncarvedblockinc.com
Uncarved Block is a design/build organization that combines historic building techniques with modern technology and an eye towards the artistic. We specialize in energy efficient structures primarily built with local wood and stone. Specialties: Building Design/Construction, Deep Energy Retrofits, Remodeling

Verdeco Designs, LLC

Mark Yanowitz
1 Elm Square
Andover, MA 01810
978-409-2217
mark@verdecodesigns.com
verdecodesigns.com
Full service architectural design/build firm specializing in pragmatic energy efficient design, green building principles, passive solar, and active renewable

energy systems. Specialties: Building Design/Construction, Architecture, Remodeling

Viessmann Manufacturing

Lauren Fuller
45 Access Rd
Warwick, RI 02886
401-732-0667
full@viessmann.com
viessmann.us
Specialties: Biomass, Solar Hot Water, Space Heating/Cooling

Warren Construction Group

P.O. Box 362
South Freeport, ME 04078
207-865-3522
info@warrenconstructiongroup.com
warrenconstructiongroup.com
Specialties: Building Design/Construction

Warren Design Build

Carl Warren
268 West Street
Berlin, MA 01503
978-838-0022
carl@warrendesign.com
warrendesign.com
30 years experience using current building science techniques to design and build durable, low maintenance, healthy, low-impact homes. Check us out at warrendesign.com Specialties: Building Design/Construction

Water Energy Distributors, Inc.

Martin J. Orio
2 Starwood Drive
Hampstead, NH 03841
603-329-8122
martin@northeastgeo.com
northeastgeo.com
Geothermal design & geothermal heat pump distribution for the northeastern United States since 1978. Specialties: Energy Conservation, Geothermal, Space Heating/Cooling

Weedon Design Build

Charles Weedon
24 Tull Lane
Pomfret, CT 06259
860-974-2362
cweedon24@gmail.com
Specialties: Building Design/Construction

Wesson Energy, Inc.

William Wesson
165 Railroad Hill ST
P.O. Box 2127
Waterbury, CT 06722
203-419-5046
wwesson@wessonenergy.com
wessonenergy.com
Specialties: Domestic Water Heating

Wolfworks, Inc.

Jamie Wolf
195 West Main Street
Avon, CT 06001
860-676-9238
jamie@homesthatfit.com
homesthatfit.com
We are guides. We guide a process for clients who are prepared to design and build collaboratively and responsibly. Together we create spaces that look great, work well and feel good to be in. Specialties: Building Design/Construction, Remodeling, Deep Energy Retrofits

Wright Builders, Inc.

Melissa Caldwell
48 Bates Street
Northampton, MA 01060
413-586-8287 x104
mcaldwell@wright-builders.com
wright-builders.com
Wright Builders, Inc. is one of the leading construction firms in the Pioneer Valley area, known for our creativity and ingenuity, we strive for the highest quality and enduring value on every project. We are committed to sustainable construction, utilizing the guidelines for Energy Star and LEED Certified building to protect and promote the health and wellness of its occupants, while reducing the overall impact of the construction on the environment. Specialties: Remodeling, Building Design/Construction, Deep Energy Retrofits

Yaro-DSI

84 Sherman St.
Cambridge, MA 02140
617-671-8905
tk@yaro-dsi.com
yaro-dsi.com
Yaro Windows and Doors is a full service, high performance window and door supplier. We specialize in Passive House Certified windows, large span glass, and custom fenestration assemblies. Specialties: Windows

Zehnder America, Inc.

540 Portsmouth Ave.
Greenland, NH 03840
603-422-6700
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Advertisers Index

- ABX 2014 / Boston Society of Architects 6
Air Barrier Solutions, LLC 22
American Solar Energy Society (ASES) 16
Architectural Openings 49
A & B Cooling & Heating 4
Bales Energy Associates 49
Bensonwood 4
Boston Magazine 22
Bryan G. Hobbs Remodeling Contractor 29
Burrington's Solar Edge 48
Cellu-Spray 34
Coldham & Hartman Architects 42
Con Edison Back Cover
Conservation Services Group (CSG) 6
Cotuit Solar 48
deap energy group 34
Dietz & Co. Architects 36
eco_logic STUDIO 49
EFI 26
European Architectural Supply / Windows & Doors 2
The Falcon Group 48
HMFH Architects, Inc. 40
Ideal Concrete Blocks 22
Integrity 36
Loewen Window Center of VT & NH 49
Maclay Architects 47
Maple Hill Architects 48
Mitsubishi Electric / Heating & Cooling 15
Noble Home 22
NYSERDA Inside Front Cover
Performance Building Supply / Maine Green 12
Pinnacle Windows 68
Powerhouse 36
Preformed Line Products / DPW Solar 33
Prosoco Inc. 38
Quigley Builders Inc. 49
R.H. Irving Homebuilders 29
Schletter 29
Stiebel Eltron Inside Back Cover
S & H Solar 28
Timeless Architecture 48
Transformations, Inc. 24
US Solar Works 48
Valley Home Improvement 49
Viessmann 1
Warren Design Build 46
Westcott G. Clarke 49
Wright Builders 14
Zehender America Inc. 13



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Why the Accelera® 300 is a heat pump water heater.

This is not a “hybrid.”



Reason #1: The condenser

The roll-bond condenser wraps around the outside bottom of the tank. No energy is wasted pumping water. Refrigerant cannot contaminate the water and, coupled with a glass-enamelled tank interior, hard water problems are mitigated. The condenser location plus its large size ensures a high heat transfer rate to the coldest water in the tank for optimal performance and high efficiency.



Reason #2: The evaporator

The evaporator’s coating is tested to ASTM anti-corrosion standards, but we also engineered to allow quick water drainage during defrost. This increases air flow through the evaporator, and combined with optimal cooling fin spacing, cleans the evaporator to maintain maximum efficiency without a filter. The flow of refrigerant through our evaporator has also been engineered to provide cold climate performance in addition to the easy-to-engineer warm climate performance.



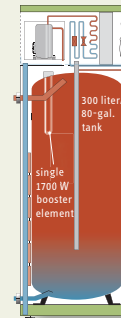
Reason #3: The cold water inlet

Our inlet baffle prevents incoming cold water from mixing with the hot water in the tank and cooling the hot water during a draw. With 50 gallons of fully hot water capable of being drawn without the backup element being needed, most household draws are satisfied through the heat pump alone for maximum efficiency at the lowest electrical cost.



Reason #4: 80-gal. tank + a single heating element

The balance between tank size and heat pump size affects efficiency and customer comfort. With average household hot water usage at 45–60 gal/day, the 50-gal. draw without the back-up element from our 80-gal. tank maximises household comfort through the heat pump. The single back-up element at the top of the tank near the tank’s outlet ensures comfort if more hot water is needed, and heat pump efficiency is enhanced without a bottom element. Hot water is available, at maximum efficiency and the lowest energy cost.



BONUS REASON: Is it “stealing” heat from conditioned space if you convert the energy to another use? Plus read this on the need for cooling in tight houses: passivehouse.us/blog/?p=125

More than thirty years ago we realized the world needed heat pump water heaters, not “hybrids,” so we engineered a water heater that relied on the heat pump to make hot water, not on the back-up element. We don’t call it a “hybrid.” It’s not. The Accelera® 300 is a heat pump water heater.

- › Designed for low operating cost, optimal storage capacity, high first-hour rating, and reliability
- › 2.73 Energy Star EF and at 1391 kWh/year DOE estimate, the most efficient water heater in the U.S.
- › Engineered for efficiency in a wide operating temperature range and a wide range of climates, with a COP typically between 3–6
- › 240 V, 15 A circuit breaker
- › The largest seller in Europe for over 30 years



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Con Edison's Green Team has **big incentives** for **multifamily** and **large commercial** properties

For Multifamily Buildings (5-75 units):

The Green Team offers multifamily customers:

- **Financial incentives** for approved equipment upgrades
- **Energy surveys** to show where your building could save energy and money through this program
- **Free "smart" power strips**, CFLs, and low-flow devices in apartment units

We'll Recommend:

- **Heating system upgrades** to high-efficiency boilers
- **Heating-control installation**, including energy-management systems, boiler reset controls, and programmable thermostats
- **Roof and heating-pipe insulation**
- **High-efficiency fluorescent lighting**, occupancy sensors, bi-level-operation light fixtures for stairways and corridors, and **new LED lighting**
- **Thermostatic radiator valves** for apartment radiators

Commercial & Industrial Properties:

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\$220 Million Available to Improve Energy Performance

Con Edison customers who own or run large buildings can receive lucrative incentives for energy-efficiency and demand management projects, reducing peak demand for electricity by 50 kW or more. Individual accounts in a portfolio can be combined to qualify for the 50 kW reduction.

Restrictions apply. Refer to program eligibility requirements and other terms and conditions.

A Powerful Partnership



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