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The Northeast Sustainable Energy Association (NESEA) is the region’s leading community of professionals working in sustainable energy, whole systems thinking and clean technology. We advance the adoption of sustainable energy practices in the built environment by cultivating a community where practitioners share, collaborate and learn. The content in this magazine is selected by an Editorial Committee of NESEA members, and most articles are peer reviewed. To learn more about NESEA member benefits, contact Membership Manager Katie Schendel at kschedel@nesea.org. To learn more about writing for the magazine, serving as a peer reviewer or on the Editorial Committee contact Florence MacGregor at fmacgregor@nesea.org.

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For as long as I have been on board as NESEA’s Executive Director, we’ve been talking about diversifying our membership by inviting the next generation into the fold. (In fact, we’ve been talking about it for so long that the next generation might now actually be a different generation than the “next generation” of eight years ago!) We’ve made steady progress over the years. We’ve recruited emerging professionals to serve on our conference planning teams, mentored by longstanding NESEA members. We have offered conference scholarships to emerging professionals and students (more than 60 over the past year), and have engaged NESEA members in that process as donors and scholarship sponsors. Two emerging professionals have participated in career-changing trips to Scandinavia to learn about building science and resiliency efforts and to build their own professional networks. We have hosted career forums at our conferences. But our efforts have always been limited to what we could do within existing budgets and staffing. We never had the bandwidth to make emerging professionals a real priority.

All that changed when the board adopted our new strategic plan. Goal 3 of the plan provides, “With an initial focus on Emerging Professionals, broaden the demographic diversity of NESEA membership to better reflect the constituency NESEA serves.” This goal invites us to think about how emerging professionals and students fit into all of our programs, and a mandate to find ways to engage them.

All change when the board adopted our new strategic plan. Goal 3 of the plan provides, “With an initial focus on Emerging Professionals, broaden the demographic diversity of NESEA membership to better reflect the constituency NESEA serves.” This goal invites us to think about how emerging professionals and students fit into all of our programs, and a mandate to find ways to engage them.

The NESEA staff has embraced the clarity of this new goal. We have charged Florence MacGregor with managing our Emerging Professionals program, securing financial resources and establishing and tracking metrics for how we engage students and those who are newly entering their sustainable energy careers. Here are a few of the things NESEA has in the works:

• A new membership level for Emerging Professionals. This new level allows us to more readily track when and how EPs are engaging with NESEA, and allows them to enjoy the benefits of membership at a slightly reduced rate.

• Focus groups to learn more from EPs about the challenges they face in their careers, and how NESEA might help.

• An EP component in our BuildingEnergy NYC Conference. For the first time this year, we will offer a Career Forum for Emerging Professionals in NYC to complement what we’ve done in Boston for many years.

• A revitalized jobs board, http://nesea.org/jobs-board, on which any NESEA business member can post job vacancies. This jobs board, one of the most heavily trafficked pages on nesea.org, also contains links to the job boards of all of our business members – a one-stop shop for all NESEA job seekers, not just EPs.

All these efforts take resources. Fortunately, a few NESEA members have stepped up to support our new Emerging Professionals program. Michael Gimbrere, who administers the Pat Cooke Fund, has pledged $5,000 in seed money for this new program. Lifetime NESEA member Max Horn has matched that $5,000. And 55 members of our community helped us raise more than $13,000 on Valley Gives Day to support the Kate Goldstein Fund for Emerging Professionals. We thank them for paving the way to make this new program possible. We invite you to support our efforts too.

As always, I look forward to keeping you apprised of our progress.

ABOUT THE AUTHOR

Jennifer Marrapese takes care of the big picture: How do we make NESEA’s multidisciplinary network of practitioners bigger and better? She works with the board of directors and members to establish NESEA’s strategy and to ensure that the board and staff have the resources to execute it. Jennifer is known for her strategic sense and for her ability to forge strong partnerships among staff, NESEA members and other collaborators.

She earned her BA in Journalism from the University of Wisconsin, her JD from the University of California, Berkeley, and her MA in Organizational Management and Development from Fielding University. She lives as close to net zero as possible in her deep energy retrofitted ranch, despite having two teenage daughters and a swimming pool.

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FROM THE BOARD CHAIR

D ear NESEA Members,

OK, I’m not an old timer, but I’m no spring chicken either: I’ve been an active NESEA member and BuildingEnergy Conference goer for 11 years, and a Board Member for 5. I’ve seen the best of Rosenbaum and the worst of Lstiburek. I’ve seen amazing Board Members come and go. And I’ve seen a most excellent Executive Director over the last several years really find her groove. And this year feels different.

I’ve never seen a staff like this one: engaged, affable, skilled and invested.

I’ve never seen a Board like this one: enthusiastic, collaborative, creative, diverse and all in.

The new Strategic Plan is a testament to the current strength of the organization. And the next steps are its execution, and making sure all of this excitement touches NESEA members in a very palpable way. You ready?

To start, we are tightening up the BuildingEnergy Boston Conference + Trade Show and giving you more of what you’ve asked for: NESEA Night included in your ticket, sessions filmed, food for exhibitors. We’ve listened.

Also, bye-bye, Seaport...hello, Westin Hotel! This is a serious venue upgrade, and although it involved some creativity, lots of hard work by NESEA staff and a little luck, we get to be in our new digs in ’18. We’ll get a more concentrated, higher-quality trade show floor, fantastic session rooms and a great place to stay all without even needing to open the door and let all that sweet, sweet energy flow out.

We are less BuildingEnergy Boston-centric than ever before. Our current mix has made room for other relatively new programs to expand each year, including BuildingEnergy NYC, and our Bottom Lines, Pro Tours and Emerging Professionals programs. This means more people, in more regions, in wider swaths of each active profession are getting involved in furthering our mission of advancing the adoption of sustainable energy practices in the built environment.

And in order to make the significant impact we all dream about, we are aiming for the true financial stability that a mature organization deserves. This year, we will launch NESEA’s first Capacity Campaign. This ambitious, three year initiative will be led by Board Development Chair and cheerleader extraordinaire, South Mountain Company’s Rob Meyers and the Development Committee. The organization you know and love is taking flight into new territory at a time that’s never needed us more. Let’s do this!

ABOUT THE AUTHOR

Phil Kaplan’s firm Kaplan Thompson Architects has received numerous accolades in the world of design and high-performance building. The firm’s motto, “Beautiful Sustainable Attainable,” reinforces their commitment to creating vibrant, healthy and durable buildings for all. His other venture, BrightBuilt Home, aims to provide more affordable, modular net-zero homes throughout the Northeast and Mid-Atlantic. Phil’s ‘edutainment’ podcast, Green Architects’ Lounge, is a topical blog on the popular website, Green Building Advisor.
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is dedicated to providing comprehensive commissioning services. The firm provides commissioning services in all forms – new building commissioning, renovation commissioning, retrocommissioning, ongoing commissioning of existing buildings, and commissioning of system retrofits. Clients who trust us with their building projects include U.S.-based companies and institutions, such as Brown University, Massachusetts Institute of Technology, Gillette Stadium, Bristol Fire Department, the Rhode Island Department of Education, and the City of Cambridge, MA, as well as international companies, such as KEO International Consultants.

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Let’s go on a journey. For a moment, let’s jump into our Back to the Future-style DeLorean time machine to visit a future where energy generation is as clean as possible, deep efficiency and renewables are widely valued and communities across the country are harnessing their own power to reach (and maybe even surpass) their carbon reduction goals. In this future-looking view, we see a country where most, if not all, energy comes from non-fossil fuel generation.

This hi-tech world isn’t too far off in the future. Many jurisdictions in the country – including several states within the northeast – have adopted aggressive greenhouse gas (GHG) emission reduction goals. In this future-looking view, we see a country where most, if not all, energy comes from non-fossil fuel generation.

This hi-tech world isn’t too far off in the future. Many jurisdictions in the country – including several states within the northeast – have adopted aggressive greenhouse gas (GHG) emission reduction goals. Several are already making good progress in meeting those goals. In fact, in the six New England states, emissions from energy use in 2015 were 19 percent less than in 2001. These states are committed to mitigating the impacts of climate change.

However, in order to reach reductions to the tune of 80 percent below 2001 levels, deep decarbonization is necessary. The traditional methods of increased energy efficiency and decarbonized electric grid aren’t enough. We need to integrate a third strategy – powering key end uses with low-carbon electricity instead of fossil fuels (Figure 1).

This is an area of great opportunity. A small number of end uses in buildings, industry and transportation sectors account for 85 percent of direct fossil fuel use in New York and New England.1

If we identify and focus on those end uses, we can carefully plan and make informed decisions about how and when to move them to electricity. Enter strategic electrification.

WHAT DOES STRATEGIC ELECTRIFICATION MEAN?

Strategic electrification, or smart electrification as it is sometimes called, is defined by Northeast
Energy Efficiency Partnerships (NEEP) as powering end uses with electricity instead of fossil fuels in a way that increases energy efficiency and reduces pollution while lowering costs to customers and society as part of an integrated approach to deep decarbonization.

Put this way, strategic electrification sounds like a nebulous concept. It feels as if it is a few steps away from an action plan. Simply put, though, strategic electrification is an energy makeover. It’s a shift in the way we think about energy. How do we currently use energy and how can we be more efficient and effective in that use? How can we produce and use energy to create a healthier, more comfortable environment, a planet more resilient to climate change and a more stable grid?

THE PATHWAY TO DEEP DECARBONIZATION

Although strategic electrification is our best pathway to deep decarbonization, this pathway isn’t free and clear. In order to harness the full power of strategic electrification, we must first cultivate both electricity-based technologies, with the potential to meet diverse customer needs and demands, and the markets that support them. The barriers to this growth come in several forms: economic, technical or infrastructural, social or institutional and policy or regulatory. They are challenging but not insurmountable.

A LOOK AT ELECTRIFICATION OPPORTUNITIES

In the midst of these market barriers that challenge the widespread use of electrification technologies, there is great opportunity. Specifically, a small number of end uses – space and water heating – account for a large fraction of direct fossil fuel use, creating a situation ripe with opportunity. Let’s take a look at some of them some of them (Figure 2).

1. Buildings

Based on state assumptions, energy consumption in buildings for thermal energy and HVAC applications across the Northeast region account for roughly one third of all energy consumption.
and energy-related GHG emissions. This region is highly dependent on fossil fuels for space heating applications, both residential and commercial. A targeted strategic electrification focus in buildings is the displacement and replacement of fossil fuel equipment used for space heating/cooling and hot water with heat pump technologies that operate at significantly higher efficiencies. Reducing the space-heating load through efficiency, including deep energy retrofits in existing buildings and construction of zero energy homes is a complementary strategy to strategic electrification in buildings. Electrification challenges are minimized when loads are minimized.

Promising technologies that fit this bill come in a few forms. Air-source heat pumps, including mini-split, centrally-ducted and those that perform in cold climates, are the dominant technology in the residential space heating application. Ground-source systems also have a role to play, especially in new construction. For commercial buildings, air-source heat pumps, ground-source systems and variant refrigerant flow offer great opportunity. Lastly, heat pump water heaters are a great electrification option for water heating.

2. Industry

The industrial sector is diverse in its range of business models, technologies and direct uses of fossil fuels. Regardless of nuances in these diverse businesses, the two dominant forms of industrial fuel usage are process heating and steam generation. These end uses account for 86 percent of the industrial consumption of fossil fuels nationally. Conversion of just one-fifth of the fuel used for heat and steam to electricity would be equivalent to electrifying the entirety of every other industrial use of fossil fuel.

3. Transportation

The transportation sector is just as diverse as the industry sector. Over 90 percent of fuel used in transportation is petroleum-based, leading the sector to generate 27 percent of greenhouse gas emissions nationwide. Electrification of motor vehicle-based transportation is the most impactful opportunity for strategic electrification in transportation. Replacement of conventional internal combustion engines with electric engines and wide adoption of those electric vehicles is the primary method of electrification in the transportation sector.

There has been rapid EV deployment among states in our region, and we expect continued progress. In order to facilitate this, however, a build-out of charging infrastructure will be necessary. Similarly, switching to an electrified rail is a big opportunity for medium- and heavy-duty vehicles.

SUPPORTING OPPORTUNITY THOUGH POLICY

It’s no secret that regulators in a handful of states across the country are rethinking the business model that currently informs most electric utilities. Bringing the grid into the 21st century without dramatically impacting customer rates is on everyone’s mind. Strategic electrification can assist in this re-evaluation by giving us a way to address the opportunities listed above.

The Northeast region is a leader in policies and programs related to strategic electrification. Executive leadership is moving forward on the path toward smarter use of electricity. Here are some highlights:

- Vermont integrated strategic electrification into its state energy plan, added a category of savings for “energy transformation projects” and offered ways to finance air-source heat pumps, heat pump water heaters and electric vehicle charging stations.
- New York provided a policy framework for renewable heating and cooling, offered many rebate and incentive programs for high...
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TURNING OPPORTUNITY INTO ACTION

The opportunities listed above are not without many challenges and barriers. But if we look at the policy frameworks being discussed and implemented, we see that forward-thinking states are willing to upend the current energy efficiency paradigm, which has traditionally focused on reducing electricity use. Instead, by focusing on increasing efficiency, reducing pollution and minimizing impact to consumers, policymakers can allow current energy efficiency program paradigms to shift toward the inclusion of strategic electrification. This will produce greater benefits to grid stability, climate mitigation and creation of a healthier environment.

States in the Northeast are already taking actions for continued deployment of renewables, like offshore wind and solar, to address the supply side and encourage electrification. Diverse stakeholders are actively engaged in exploring different aspects of this transformation. NEEP is bringing those stakeholders together to create a more complete picture of the challenges, opportunities and market potential for widespread strategic electrification.

This process of market development, policy reform, data, testing and analysis will help push us to a fundamental change in how energy is used. The iterative process will lead us, one step at a time, to a clean energy future we can be proud of.

To learn more about Northeast Energy Efficiency Partnership’s Northeastern Regional Assessment of Strategic Electrification, visit http://neep.org/reports/strategic-electrification-assessment.

ENDNOTES

1 Source: U.S. Energy Information Administration.
3 Estimates vary depending on the state as well as on the scope of building-related energy consumption included in estimates: for example, Rhode Island estimates approximately 35 percent of energy-related GHG emissions are related to thermal energy (RI Division of Planning, 2015. Energy 2035: Rhode Island State Energy Plan). New York estimates that 32 percent of energy-related GHG emissions are related to building HVAC systems (which include thermal energy) (NYSERDA, 2017. RHEC Policy Framework), and Massachusetts estimates 36 percent of energy-related GHG emissions are related to non-electricity building energy consumption (MA DEP 2016, 2014 GHG inventory).
4 Source: U.S. Energy Information Administration.

ABOUT THE AUTHORS

Dave Lis is NEEP’s Director of Technology & Market Solutions and has been a part of NEEP for 11 years, having served in several capacities, including intern, Residential Program Associate, Manager of the Appliance Standards Project and Senior Manager of Market Strategies. He currently leads regional market transformation initiatives for Home Energy Management Systems (HEMS), Air-Source Heat Pumps (ASHP), Strategic Energy Management for the Industrial sector and Strategic Electrification. He has also developed similar regional guidance on how to best accelerate market adoption of specified products throughout the region for several other categories of products.

Lisa Cascio joined NEEP in October 2013 as Public Relations Manager. She is responsible for designing and implementing a public relations plan that promotes NEEP’s mission and work across multiple channels, including traditional media, social media, digital avenues and in-person events. As part of the Strategic Marketing & Communications Team, Lisa brings visibility to NEEP’s work to accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system. Lisa has been in the PR industry since 1996, working in college athletics, higher education and non-profit.

ABOUT THE PEER REVIEWER

Chris Powicki (chrisp@weeinfo.com) is President of Water Energy Ecology Information & Design Services in Brewster, MA, providing research, planning, analysis, design and communications services to clients ranging from international organizations to individual consumers. He is an adjunct professor at Cape Cod Community College, teaching classes on renewable energy options and solar energy technologies. He also is active in community-based planning, outreach and advocacy focused on promoting electrification and other sustainable energy choices, at all levels.
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Winter in New York City comes with many familiar sights and sounds: the tree lighting at Rockefeller Center, sizzling chestnuts on snowy evenings — and radiators banging and hissing all day and night. Seventy percent of large buildings in New York City have steam heating distribution systems that boil water on-site to create steam, which is distributed through pipes to units to provide heat. Many of these systems were installed decades ago and have not been upgraded or properly maintained since then. The result is often overheated apartments, banging pipes and radiators and a significant waste of energy.

New York City has set out to tackle this problem through the NYC Retrofit Accelerator, a program launched by the NYC Mayor’s Office of Sustainability in 2015 that provides free, personalized advisory services to streamline the process of making energy efficiency improvements. The Retrofit Accelerator does not provide direct incentives, but rather one-on-one assistance to help building decision makers understand their options in the market and to connect them with available resources.

In December 2016, the NYC Retrofit Accelerator launched a “Better Steam Heat” campaign to educate, motivate and guide building decision makers to complete steam heating system upgrades that will make residents more comfortable, save on utility costs and reduce greenhouse gas (GHG) emissions.

WHY STEAM HEATING?

New York City has committed to reduce greenhouse gas emissions by 80 percent by 2050 (80 x 50) as part of OneNYC, the City’s long-term plan to address sustainability, resiliency, equity and growth. In order to meet the 80 x 50 commitment, the City completed a comprehensive study of NYC’s building stock, which accounts for nearly 70 percent of the city’s greenhouse gas emissions. This analysis found that the energy used to provide space heating and domestic hot water is responsible for over half of the emissions from large buildings, and that a majority of these buildings have steam heating distribution systems that use more energy on average than other types of heating systems.

The study found that comprehensively upgrading all steam heating systems in the city would lead to a five percent reduction in building-based emissions. Of the nearly 100 potential energy efficiency measures analyzed, these emissions were identified as the single largest potential reduction opportunity.
Steam heating systems in New York City are often characterized by oversized boilers, improperly-vented pipes, too-high boiler pressure and little ongoing maintenance. This contributes to imbalanced heating across a building, in turn resulting in many overheated apartments in an effort to ensure that no apartments are too cold. Residents in the overheated apartments open windows in the middle of winter to cool off — both a conspicuous waste of heat and major driver of emissions. Outdated or poorly-maintained systems also suffer from “water hammer” — steam being distributed throughout pipes and returning condensate compete for space, causing the banging that keeps residents up at night.

Although implementation is not always easy, there are relatively straightforward solutions to fix these problems. However, until now, few service providers in New York City offered them at scale in the market or as the comprehensive package necessary to get the best results. At the same time, customers were not aware that solutions existed and therefore did not ask for them.

**BETTER STEAM HEAT**

The NYC Retrofit Accelerator launched the Better Steam Heat campaign to develop a self-sustaining local market for steam heating system upgrades. The campaign includes:

1) defining the necessary upgrades to bring steam heating systems into working order,
2) developing the local contractor market to be able to provide these solutions,
3) generating demand for the upgrades among building owners, operators, and other decision-makers, and
4) providing ongoing technical guidance to both contractors and customers to ensure the work is done properly.

**Defining the Upgrades.** With assistance from technical experts, the NYC Mayor’s Office of Sustainability defined a scope of work to comprehensively upgrade steam heating systems. The scope includes cleaning and tuning the boiler and burner; installing boiler controls; adding master vents to steam piping; installing thermostatic radiator valves (TRVs) in apartment units; and in two-pipe buildings, installing orifice places on radiator valves with TRVs. Completing all measures together is key to ensure even distribution of heat throughout the building and efficient use of heating fuel.

**Developing the Market.** To build the local market, the Mayor’s Office and the Retrofit Accelerator staff engaged with firms that had staff with relevant skills and developed training, resources and support to help build capacity. After interviewing various types of contractors and potential customers, the City released a request for qualifications (RFQ) for heating service firms and heating controls companies. Customers already rely on heating service firms to ensure their buildings have adequate heat throughout the winter. These firms have staff with the skills necessary to perform work in both the boiler room and the distribution system, but were not trained or asked to do so. To become qualified to provide upgrades, the heating service firms were required to send lead technicians to a half-day training and complete on-site assistance with two projects brought in through the program to ensure quality installations. In addition, the Retrofit Accelerator team worked with the city’s utilities to ensure that incentives could cover some or all of the scope of work. In coordination with the campaign, Con Edison launched a program that provides rebates for the majority of the recommended measures for affordable housing with one-pipe steam systems. Over 100 buildings have participated in this program and Con Edison is planning to make a similar offering available to all customers with steam heating.

**Generating Demand.** To build demand among building decision-makers, the NYC Retrofit Accelerator developed a marketing campaign that tapped into issues of comfort and energy waste. To capture the attention of the target audience, the team developed an engaging concept that builds on New Yorkers’ love-hate relationships with their heating systems (figure 1). In addition, the Building Energy Exchange (BE-Ex), a nonprofit partner that provides resources and a physical center for the Retrofit Accelerator, developed a playbook for the upgrades and three case studies. These were paired with two panel events featuring stakeholders from the case study buildings, including co-op board members, engineers, contractors and executive staff from a large real estate developer.

**Technical Guidance.** As with all projects assisted through the NYC Retrofit Accelerator, the program’s team of Efficiency Advisors provide ongoing assistance from start to finish to help ensure
SMART STEAM HEATING UPGRADES

Most steam heating systems are decades old and haven’t been updated. Outdated systems waste heat, cause apartments to be too hot or too cold, and lead to banging or hissing pipes.

There are cost-effective solutions to fix steam heating systems that can save between $10,000 and $30,000* a year on energy costs. The best approach is to address the system as a whole.

1. **BOILER TUNE-UP**
   - Enable burner modulation. Most boilers can vary their steam output to match the building’s needs, but this ability is often bypassed.
   - You can also:
     - Clean and tune the boiler
     - Regulate and reduce pressure for steam production
     - Make sure steam is dry

2. **MASTER VENTING**
   - Add master vents to pipes. Without master vents, air blockages in pipes prevent steam from being distributed evenly. This causes some apartments to get too hot, while others don’t get enough heat. Adding vents to the tops of risers and at the ends of mains allows air out of the pipes so that steam can fill the pipes and be distributed evenly.

3. **CONTROLS AND SENSORS**
   - Install smart boiler controls and sensors. Most boilers operate based on the outside air temperature, which can lead to overheating. Installing wireless temperature sensors—and boiler controls that communicate with them—allows the boiler to read temperatures inside the building instead. This means units get the right amount of heat at the right time.

4. **ORIFICE PLATES (FOR TWO-PIPE STEAM BUILDINGS ONLY)**
   - End steam trap problems. Most radiators are too big and produce too much heat. Steam traps on radiators also break, which contributes to banging pipes. Adding orifice plates regulates steam flow and eliminates the need to repair steam traps.

5. **TRVs**
   - Add thermostatic radiator valves (TRVs) in apartments. Without TRVs, there’s no way for residents to turn down the heat when an apartment is getting too much steam. Adding TRVs enables residents to control the heat in their units.

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*Based on building size and heating fuel.

FIGURE 3:
projects continue to move forward. The guidance includes assistance choosing a contractor, applying for appropriate incentives, training building staff on how to operate steam systems and even tips and resources for engaging with tenants and residents to complete upgrades in units.

RESULTS AND NEXT STEPS
To date, the NYC Retrofit Accelerator has trained over 70 contractors and is assisting with the implementation of steam heating distribution upgrades in over 160 buildings. As the NYC Retrofit Accelerator continues its push to upgrade steam heating distribution systems, more and more New Yorkers will learn to love their heating systems again — all while the City continues its mission to reduce greenhouse emissions and fight climate change.

ABOUT THE AUTHOR
Ali Levine is a Policy Advisor in the NYC Mayor’s Office of Sustainability and is responsible for the management of the NYC Retrofit Accelerator Program. Ali joined the Mayor’s Office after working at the NYU Furman Center for Real Estate and Policy while completing her Master’s of Urban Planning at NYU Wagner. Previously, Ali worked in energy efficiency consulting in Philadelphia and policy and research in Washington, D.C. Ali obtained her bachelor’s degree from Lehigh University.

ABOUT THE PEER REVIEWER
Mina Agarabi has more than 12 years of experience troubleshooting, optimizing and designing both steam and hydronic heating systems in large multifamily buildings. She has extensive experience developing portfolio-wide changes to O&M plans and procedures, identifying health and safety issues, LL87 and energy auditing, project management and staff training. Mina serves on American Society of Heating Refrigeration and Air Conditioning Engineer’s technical committees: 7.3 Operation and Maintenance, 7.9 Commissioning and SPC 202-Commissioning Process for Buildings and Systems and is a licensed New York State Professional Mechanical Engineer, Certified Passive House Designer, AEE Certified Energy Manager, ASHRAE Commissioning Process Management Professional and a AEE Certified Measurement & Verification Professional. Don’t miss her session, “Better Steam Heat: Generating Steam System Upgrades in NYC,” at the BuildingEnergy NYC Conference + Trade Show, October 12, 2017 at the TKP Center.

ENDNOTES
1 Buildings over 50,000 square feet, which make up two percent of all buildings in NYC, but nearly half of the built square footage.
Is your home making you sick?

Houses are being more tightly constructed than ever before, making them more energy efficient but also allowing concentrations of indoor pollutants to reach alarming levels. Believe it or not, indoor air is commonly two to five times more polluted than outdoor air!
3 Common Indoor Air Quality Issues

Lack of Fresh Air Degrades Home Health
To save energy, homes are more tightly constructed to stop air leaks. Often, the air that does seep into the home enters through the basement or garage, bringing dust, mold, moisture, radon, and fumes. Your home may lack fresh air for diluting toxins. It is important to create a ventilation strategy to promote indoor air quality.

Insufficient Ventilation Traps Contaminants
Ventilation is essential for removing pollutants. Many homes rely on exhaust fans to remove moisture and contaminants. Exhaust fans work by venting polluted air out and require an equal quantity of makeup air to operate properly but tighter homes may not have enough makeup air for exhaust fans to operate well.

Moisture Issues Cause Mold Growth
Excess humidity can cause mold growth and allows bacteria and dust mite populations to flourish. Moisture from breathing, showering, cooking, and washing must be removed for healthy indoor air. Excess moisture in the basement can degrade home air quality on the first floor.

Healthy Air Solutions for your Home

Install a Zehnder HRV or ERV
Zehnder ComfoAir heat recovery ventilators (HRV) and energy recovery ventilators (ERV) provide a constant supply of fresh, filtered air while exhausting an equal amount of stale, contaminated air. Zehnder ventilators transfer heat from the exhaust air to the intake air in winter. In the summer, the warmth of the incoming air is transferred to the exhaust air, saving energy.

Create a Sanctuary Room with Exception Indoor Air Quality
Some homeowners prioritize the indoor air quality of one room. In many houses, this room is the bedroom as most people spend at least 7 hours a day there. To improve indoor air quality in a sanctuary room, stop any water leaks, remove sources of pollution, and ensure proper ventilation.

The Zehnder CA70 is specially designed to improve air quality in a small apartment or one room of the home. These units are simple to install and specifically designed for retrofitting existing homes.

Control Moisture Levels for Improved Health
It is essential to stop water from penetrating into the home, to fix plumbing leaks, and to vent moisture out of the home. Zehnder HRVs and ERVs remove excess humidity from bathrooms, kitchen, and mechanical rooms, for cleaner, healthier air.

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GOING ALL THE WAY:
WHAT IT WILL REALLY TAKE TO ACHIEVE NET ZERO ENERGY IN BURLINGTON, VT

BY MIKE CROWLEY

The City of Burlington, VT, is the first U.S. city to establish an energy efficiency utility (EEU), and the first to source 100 percent of its electricity from renewables. It’s now renewed its efforts with the recent announcement of a net zero energy goal through its existing Climate Action Plan platform, first proposed by its municipal electric utility, Burlington Electric Department (BED). An impressive list of players have stepped up to this challenge, including a coalition of designers, builders, renewable and energy efficiency experts and financiers. But there are some key challenges that they must overcome. Burlington is a college town, and most of its residents are college students who rent apartments in an aging building stock. The city is growing quickly, with many major developments in the works. This article will chronicle Burlington’s net zero strategy and distill transferable lessons learned. What does it really take to radically change an industry to achieve net zero, especially in a place with older buildings and increasing weather extremes?

ACHIEVING A FLAT ENERGY PROFILE

In 1987 the Burlington Electric Department (BED) was at a crossroads. Many of their energy generation contracts were up for renewal, and they were faced with a hard choice: invest in their own generation sources or renew expensive contracts with electric generators. The Electric Commission looked to recommendations from the Rocky Mountain Institute: instead of building more generation, why not invest in energy efficiency programs that bring down demand? That idea set BED on a long journey, resulting in a 2016 energy demand that was 4 percent lower than in 1989, despite significant growth.

It started in earnest in 1990, when voters passed an $11M municipal bond that established BED as the nation’s first energy efficiency utility (EEU). Instead of using bond money to invest in new generation, the funds were directed to efficiency programs designed to generate extra capacity by reducing the city’s overall electricity demand. Chris Burns, BED’s Director of Energy Services said that investment not only yielded a 2.1 savings ratio relative to contracting for power, it also ensured that money stayed local, resulting in a “multiplier effect.” The investment enabled BED to build in-house energy efficiency expertise that now resides in Burns’ Energy Services Team.

The bond inspired the state legislature to enact a statewide energy efficiency charge: a small charge on all electricity bills that is reinvested in energy efficiency. This charge, combined with the initial bond, enabled BED to invest $29M and leverage an additional $32M in energy efficiency investments from its customers over the last 27 years. These investments have effectively flattened Burlington’s electricity load, saving an average of $10M per year.

BED’s success gave Burlington the confidence to make a major greenhouse gas reduction commitment through its first Climate Action Plan in 2000. The plan, updated in 2016, commits the city to radically transforming its energy use away from fossil fuels in buildings and transportation.

A key pillar of the city’s carbon reduction strategy is what Burns calls “strategic electrification:” efficiently using electricity not just to power buildings, but also cars, busses and even bicycles. From a carbon reduction viewpoint, this strategy makes sense; in 2015, Burlington became the first city in the country to source 100 percent of its electricity from renewable sources.

A CHALLENGING RESIDENTIAL MARKET

Burlington is a college town. That means that of the ten thousand apartments in Burlington,
60 percent of residents live in rental homes, and up to 70 percent of renters are students. In 95 percent of Burlington’s apartments the tenant pays directly for utilities, which greatly reduces incentives for upgrades. “That tells you that to do anything really meaningful beyond changing a lightbulb, you have to come up with something that engages both the tenant and the property owner,” said Burns. “That’s not easy.”

Burlington is a landlord’s market. According to Burns, for the past 10 years the vacancy rate has been somewhere between 0.5 and 1 percent. As a result, rents have stayed high. In addition, BED turns over 35 percent of its rental customers every year. That’s typical for a college town, and it makes it even more challenging to reach a fairly transient population.

Burns points out that despite these challenges, Burlington’s average residential usage is among the lowest in the country, at a little under 400 kWh/month. While Burns says the city’s energy efficiency programs contributed to the lower overall energy use seen in the residential market, he acknowledges that many of the city’s apartments are in fact relatively small to begin with, with few outlets, and no in-unit laundry. “In many cases the cell phone bill is larger than the electric bill,” said Burns.

But lower energy usage is not yet net zero. And Burlington’s route to net zero is further complicated by the fact that many residential buildings are older (late 1800s), with poor thermal performance. “Taking all that into account, it’s a tough market to engage,” acknowledges Burns.

CREATING NET ZERO RESIDENTIAL INCENTIVES

Burlington is actively engaging its residents in its net zero strategies in a number of ways. First, in the 1990s the city passed an energy code that applies to renovation projects: energy-affecting components such as windows and boilers need to meet energy code, even if they are one-off replacements. According to Burns, this approach resulted in many small steps, which add up to big savings.

Second, acknowledging that its residential market is dominated by rentals with split incentives to upgrade for energy efficiency, the city passed an ordinance in 1997 that mandates energy upgrades if a building is below a BTU per square foot threshold at the time of sale. This ordinance incentivized new property owners to switch from oil to natural gas. The result was huge: roughly half of all rental weatherization dollars through Vermont Gas have been spent in Burlington.

In addition to codes and ordinances, the city created a series of friendly energy programs. Each year, landlords are required to engage a city building inspector to ensure basic health and safety standards. BED educates the inspectors about energy efficiency upgrades, and in turn, the inspectors promote the program among landlords. BED also created program aimed at residents called the Energy Champ Challenge (named after the mythical seamonster in Lake Champlain called Champ). It’s joint program between BED and Vermont Gas intended to unify and simplify how residents can engage the two utilities. The program
branding is targeted for each type of residential customer, from single families to multi-families and condos.

THE COMMERCIAL MARKET
BED only has 3,500 commercial customers (compared to 16,500 residential customers), yet this sector consumes 75 percent of all electricity and natural gas. And the top 20 commercial customers consume 50 percent of all residential and commercial electricity combined.

Burns said that when it comes to new construction, BED used to just rely on the energy code. “We gave them a prescriptive cookbook,” he said. BED simply verified that the right equipment was installed without monitoring actual performance. “It was a very prescriptive way of doing things and that’s how a lot of new construction programs work across the country.”

When the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) standard became popular, BED started exploring how they could promote energy modeling. Burns and his team became LEED Accredited Professionals, but they were frustrated that many LEED Certified projects were not improving energy performance beyond code. So they started a new, voluntary program for new construction projects. BED pays 50 percent of the energy model cost up front, then pays 50 percent of energy rebate incentives based on the model upon occupancy. To ensure that the building actually performs as designed, they recalibrate the energy model 9 months to a year later based on occupancy data, and the remaining 50 percent of rebate incentives are paid based on actual performance. If the building is not performing well, BED offers technical assistance to get the building where it needs to be. According to Burns, this assistance is designed to occur within the warranty window provided by general contractors, so many of the corrections are covered.

Almost every new development has participated in the program. Burns said that “it’s one of the smartest and best things we’ve ever done. It completely changes our role, it changes the attitude of everybody on the team. The owners are a little bit reluctant, but once they do it, they want to do it again. We really feel that at the end of the day we end up with a stronger, more efficient energy savings project where everyone’s better informed, rather than just filling out a prescriptive form and getting a check.”

DEVELOPING A DEEP RETROFIT STANDARD
In 2015, a local energy efficiency financing firm called Better Building Energy Efficiency (Better BEE) sent Ravi Parikh, an Energy Services Specialist with BED, to the Passive House International conference in Germany. The exchange was organized by Better BEE’s CEO Rob Conboy, who was impressed by Europe’s rapid adoption of the Passive House standard, and who saw the potential for the same transformation in Burlington. The timing of the conference was ideal – the Mayor had just adopted BED’s proposed net zero goal and BED was developing a strategy to engage its aging residential housing stock.

At the conference PHI introduced a new excel-based tool called the Passive House Planning Package (PHPP) designed to provide a step-by-step approach to deep energy retrofits. When Parikh returned to Burlington, he gave a detailed presentation to BED senior staff and the Mayor and recommended that Burlington develop a residential deep energy retrofit program. According to Burns, the presentation was “intriguing and mind-opening” and inspired BED to pursue a new deep energy retrofit standard.

In late 2016, BED awarded Better BEE a contract to develop the standard. Led by Conboy, they began outlining a strategy inspired by similar programs through NYSERDA, NSTAR and SMUD. But for Conboy, success in Burlington requires a three-pronged platform of financing, training and a program for residents to take a stepped approach to deep energy retrofits.

The key to achieving a net zero Burlington, says Conboy, is to bend the cost curve so that net zero buildings are competitive with code compliant buildings. “We’re at the point where cost parity is achievable. And some might go as far as saying that you could build an energy efficient commercial scale project at or below conventional costs,” said Conboy. He points to places that have adopted energy standards akin to Passive House performance. “Whether it’s Brussels or Germany, or Australia, there was a period of time where the learning curve was subsidized so that either through pilot projects or other means, the knowledge base was grown.” That’s what Conboy wants to mirror with BED through targeted professional training. The goal is to get contractors to stop “baking their numbers with a 5, 10 or 15 percent adder because they’re going to, for example, install windows to a degree that they hadn’t before.” He points to a training on thermal bridging offered in 2016 that resulted in a project manager bringing the class wall mockup directly to a jobsite. That simple act was a game changer for his company, which now confidently markets high performance buildings at market rates. BED and Conboy believe that every firm in Burlington can do the same.

From an industry perspective, the timing is right for a net zero standard in Burlington. This spring, the entire city was awarded 2030 District Designation. Led by Vermont Green Building Network’s Executive Director, Jenna DiMare, the 2030 District is charged by BED to create a roadmap for businesses in Burlington to reach net zero by 2030, starting with benchmarking the energy use of major properties in the city.

Indeed, this knowledge base is already growing in Burlington. A new company called Vermod is designing and building modular homes meant as an alternative to conventional mobile homes. Through efficient pre-fab design and a mix of subsidies from housing trusts and EEUs such as BED, their homes are cost competitive. And, unlike conventional modular homes that depreciate in value, Vermod’s homes appreciate in value, much like any other house with a permanent foundation.

Burns acknowledges that he’s championing an “audacious plan.” Yet the activity in the last year alone has taken the work to new heights, and with it, there is a growing sense of excitement in the building community. That’s certainly true for Conboy, who is focused on dispelling myths that this work can’t be done. “There’s a Yankee, pragmatic way of approaching [net zero] that Burlington is well suited for,” he said.

ABOUT THE AUTHOR
Mike Crowley believes that a sustainable design/build revolution can heal our relationship to each other and the natural world. He is the President of the Yestermorrow Design/Build School. There, he’s focused on empowering sustainability and climate leaders - from professionals to Do-it-Yourselfers to change-makers - with design/build skills that make sustainability tangible. Mike holds a Masters of Science from Schumacher College, and has held leadership positions at the Harvard Office of Sustainability and the Institute for Sustainable Communities.
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The Resilient Design Institute defines resilience as “the capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance.” In other words, it is the capacity to bounce back after a disturbance or interruption – events like Hurricane Katrina (2005), Tropical Storm Irene (2011), Superstorm Sandy (2012) and the New England drought (2016). Now that extreme weather events are becoming more common, we need to determine how to adapt to these changes.

Leadership to create new adaptation (or resilience) standards is coming from many angles: government, insurance companies and zoning and building rating systems, among others. As everyone tries to grapple with resilient design and what it means to the building process, the LEED green building rating system has introduced three Pilot Credits on Resilient Design in the Integrative Process category (Figure 1). The credits are: IPpc98 Assessment and Planning for Resilience, IPpc99 Design for Enhanced Resilience and IPpc100 Design for Passive Survivability. The new suite of credits takes a broad approach, providing a holistic framework for design teams to begin tackling this important issue.

We wanted to consider how the new credits could transform the way project teams plan and build their projects. We used three sample projects that we are familiar with, all designed before the credits came out, as case studies to benchmark how the current Standard of Care measures up to the LEED Pilot Credits on Resilient Design. We found the Resilient Design Pilot Credits require a rearrangement of the design process, the same way that pursuing the Living Building Challenge changes how design teams approach materials selection. Resilient design requires that local conditions and history be incorporated at the earliest stages of design and that livability of projects without power inputs be a primary design driver. This article looks at how each Pilot Credit works within current design methodologies and where our design process needs to change.

CREDIT IPpc98: PLANNING
IPpc98 Assessment and Planning for Resilience involves identifying the hazards common to the project region and site. This credit encourages assessment and then planning for a wide range of natural disasters or disturbances as well as consideration of longer-term trends affecting building performance, such as changing climate conditions. The goal is to make sure that project teams are aware of the specific natural and man-made hazards that are most common to the project’s location, such as flooding, hurricanes, tornados/high winds, earthquakes, tsunami, wildfires, drought or landslides/unstable soils. For each hazard the credit...
directs teams to look for local data but provides resources for national data and identifies thresholds to determine if you are low, medium or high risk.

At Wilson Architects, we developed a matrix (Figure 2) to track and compare data for the case studies. We used the matrix to track different projects, and it could also be used to track site or design options. We found that, driven by building codes, natural hazards with regional impacts like high wind and earthquakes seem to be well known and generally addressed in projects. However, hazards that could impact smaller areas, such as drought and urban flooding, are not well represented. We found a similar situation with climate change hazards. Regional hazards were well known but the hazards applicable at a finer grain are less well-understood.

The three projects we evaluated in our case studies (shown in the Figure 2 matrix) are institutional projects located in New England where we led the design team. They all happen to be built on urban landfill (land “reclaimed” from tidal waters), so the effects of climate change hazards such as sea level rise and more frequent and intense storms rose to the top of our list of concerns. From our assessment, the top hazards for our two waterfront projects were high winds associated with hurricanes and winter storms, and the accompanying storm surge flooding, sometimes with wave action (Figures 3 & 4). We also learned that the densely developed urban sites, built on land reclaimed from a tidal river, came with their own surprise hazards not always found on a FEMA FIRM flood map – urban flooding. These urban flooding risks are related to the hardscaping our cities and campuses, aging storm-water infrastructure and the effects of climate change. This discovery came from deeper analysis and understanding of the development and infrastructure history of a site. Local studies, in our case Climate Ready Boston and the City of Cambridge’s Climate Change Vulnerability Assessment, provided an invaluable starting point for assessing the vulnerabilities of our project sites.

CREDIT IPpc99: APPROACH

Once identified, hazards need to be addressed. IPpc99 Design for Enhanced Resilience provides direction for mitigating the identified risks and points to quantifiable goals for mitigation. For the projects that we evaluated, we found that the owners and design teams were aware of the highest risk hazards and were planning for the current case; the expected service lives of the projects we looked at are all 50 to 100+ years.

Climate change is a moving target – the further out you look, the greater the delta. As a result, the teams may have underestimated hazards for the entire 100-year life cycle of their buildings.

A benefit of the pilot credits is that they provide an educated starting point – because you have to start somewhere. The pilot credits guide project teams in making assumptions while

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CREDIT IPpc100: PEOPLE

The last credit is where we saw the greatest departure from current practices. The intent of IPpc100 Design for Passive Survivability is to ensure that buildings will maintain reasonable functionality in the event of an extended power outage or loss of heating fuel. Power outages are often one of the most important secondary impacts of natural disasters and there is growing concern about terrorist actions targeting energy infrastructure.

In our daily practice, we find that institutional and commercial owners are aware of and addressing their needs for back-up power. Tweaking some of the systems included and/or the duration of function would be enough to meet the requirements of the credit. However, as our case studies showed, the requirements for thermal habitability (see sidebar) are not typically incorporated into projects. It is the most groundbreaking of the Pilot Credit requirements. Detailed thermal modeling is required to demonstrate that the building will maintain “livable temperatures” during a power outage lasting seven days during both peak winter and peak summer conditions.

Resilience can mean the difference between years of rebuilding vs. days of recovery until we are back to business as usual. In a nutshell, the three Pilot Credits were created to ensure design teams are aware of the vulnerabilities and address the most significant risks in the project design, including functionality of the building in the event of long-term interruptions in power or heating fuel. The new LEED Pilot Credits on Resilient Design provide a holistic framework to create a new design strategy, pushing us to think at a building level and a community level early in the process. Geographic areas that have had a “wake-up call” event are much further ahead in preparedness (living with
it means reacting faster). What project teams had been doing as “above and beyond” is quickly becoming the minimum standard for resiliency.

**CALL TO ACTION**

Like it or not, climate change – with more intense storms, sea level rise, heat waves and greater variability in weather – is happening today, and terrorism is now an ever-present risk. These threats call for a new design paradigm: resilience. That is the goal of the LEED Resilient Design Pilot Credits, and that’s why forward-looking design firms are focusing on resilience.

There is a steep learning curve with resilient design, and some of the measures – like redundancy – conflict with the goals of sustainability. We hope that our experiences at Wilson Architects, as we have tested the Resilient Design Pilot Credits on real-life projects, will inform this unfolding discussion and contribute to creating more resilient and sustainable buildings and communities.

**ABOUT THE AUTHORS**

Alex Wilson is President of the Resilient Design Institute, a nonprofit organization working to advance the adoption of resilient design into buildings and communities throughout North America. He is also Founder, in 1985, of BuildingGreen, Inc., a highly respected consulting and information company. He is a widely published writer on green building, energy and the environment. Alex served on the national board of the U.S. Green Building Council from 2000–2005 and in 2008 received their Leadership Award for Education; in 2010 he received the second annual Hanley Award for Vision and Leadership in Sustainability.
There are lot of new ideas introduced in the LEED pilot credits on Resilient Design, but the most groundbreaking idea is that of "thermal habitability." As BuildingGreen and the Resilient Design Institute (RDI) have been arguing since Hurricane Katrina struck the Gulf Coast in 2005, we as designers and buildings should be thinking about whether a building will maintain livable temperatures should it lose power for an extended period of time.

Thermal habitability is one of the measures that falls under the Passive Survivability pilot credit (IPpc100), along with backup power. While there has long been an understanding that a better-insulated building envelope will keep occupants safer should there be an extended power outage, Pilot Credit 100 provides a methodology for measuring this aspect of resilience.

The revised version of Pilot Credit 100 (v.2) provides two methods for modeling the thermal habitability of a building. The first method defines a “habitability zone” of 54°F to 86°F, based on standard effective temperature (SET), rather than simply air temperature, and defines the number of degree-hours during summer and winter design weeks that can fall outside of that zone. (SET is a temperature metric that factors in relative humidity and mean radiant temperature, in addition to air temperature. (Figures 5 & 6, page 28).

The other metric uses methodology from ASHRAE Standard 55 to show that conditions will remain within a band on the psychrometric chart during summer and winter design weeks that can be reasonably considered to represent habitability conditions. Note that this band of temperature and humidity conditions is far different from the more commonly referenced comfort zone.

While the Resilience Working Group has sought to define thermal habitability through the LEED pilot credits on Resilient Design, a similar effort is underway at the Passive House Institute U.S. (PHIUS). The PHIUS+ 2015 Passive Building Standard does a good job of demonstrating that a building will maintain habitable temperatures in the event of a power outage. This certification will likely become a third compliance option for satisfying the thermal habitability requirement in LEED Pilot Credit 100.

Jim Newman is Founder and Principal at Linnean Solutions, which provides environmental analytics and benchmarking for corporate, institutional and municipal clients. Linnean’s work includes resilience analysis and planning, ecosystem services assessment, life cycle assessment and embodied carbon studies. This work is embodied in Living Building Challenge consulting, EcoDistrict planning and management, and stakeholder engagement processes to strengthen communities. Previous to Linnean, Jim worked with BuildingGreen as the Director of Strategy, where he led the development and introduction of most of BuildingGreen’s online products including LEEDuser.com, BuildingGreen Suite and the High Performance Buildings Database.

Katie Courtney of Wilson Architects draws on over 13 years of experience with complex projects for academic, commercial and life science clients. She brings an inclusive, hands-on approach to the design process, and is known for thoughtful, enduring and sustainable solutions that connect people and spaces. Katie has a long-standing interest in Resilient Design, attended the 2015 FEMA HURRPLAN training in Gloucester, MA, and presented at NESEA’s BuildingEnergy Boston 2017 Conference. Katie earned a Bachelor of Architecture degree from the University of Notre Dame and is licensed in Massachusetts.

Marcell Graeff of Wilson Architects draws on 20 years of experience with complex projects for K-12 and higher education clients. Marcell has a long-standing interest in sustainable design with a focus on high-performance building envelopes, healthy building materials and renewable energy. Marcell earned a Bachelor of Architecture from Syracuse University and presented at the BuildingEnergy Boston Conference in 2017.

ABOUT THE PEER REVIEWER
Matthew Broderick, AIA, NCARB, LEED AP BD+C, is an Architect and Principal at Ashley McGraw Architects (ashleymcgraw.com) where he leads the Higher Education studio. He has worked on many sustainable, aspirational projects, including multiple LEED Gold buildings. He is currently working on a Living Building Challenge project at Binghamton University which is also targeting Passive House certification. Matt’s firm recently joined the BuildingEnergy Bottom Lines program.
While indoor pollutants of concern include particulates, volatile organic compounds (VOCs), moisture, carbon monoxide and radon, carbon dioxide (CO₂) – which is relatively simple and inexpensive to test accurately – is often considered a proxy for other harder-to-measure pollutants. It has become a common indicator of indoor air quality and is reliably produced in all homes when humans and their pets breathe.

During the 2016-2017 heating season, we tested the indoor air quality in the bedrooms of 22 northern Vermont homes. The study took place from November 2016 through April 2017 and consisted of in-home assessments to measure each home’s airtightness, ventilation levels and master bedroom and whole-home volume, followed by four days/nights of measuring carbon dioxide (CO₂) levels. This testing occurred in the primary occupied bedroom with all of the home’s windows closed. Participants were asked to leave the bedroom door(s) open and closed on alternating days and keep a log of irregular events such as doors opening/closing and people entering/leaving the room.

The CO₂ concentration of 1000 parts per million (ppm) is a commonly used benchmark for “passable” indoor air quality and as a set point for commercial demand-controlled ventilation systems. The homes in the study spanned a wide range of size, age, airtightness, heating system type and occupancy, and represent a reasonable spectrum of existing homes in New England.

During testing, a CO₂ probe-data logger was placed in a draft free location approximately 3 feet above the floor (sleeping height), a minimum of 3 feet from the nearest sleeping being and at least 1 foot from walls.

HOW DID THESE HOMES DO?

All homes exceeded CO₂ concentrations of 1000 ppm on at least one of the four nights. Periods when bedroom doors remained open had significantly lower CO₂ levels for the majority of homes, yet only one of the 22 homes stayed below 1000 ppm on both door-open nights. Door-closed nights were much worse: 86 percent of homes (19 of 22) exceeded 2000 ppm – double the 1000 ppm threshold – on at least one of the nights with the bedroom door closed and 32 percent (seven of 22 homes) had CO₂ levels that rose above 3000 ppm. One home exceeded the measuring equipment maximum range of 5500 ppm. Full results are shown in Figure 1.

Some homes clearly performed worse than others. In an attempt to establish cause-and-effect, we investigated impacts of airtightness, heating system type, occupant density in the bedroom and ventilation system.
Surprisingly, there was little apparent correlation between airtightness of homes and CO2 concentrations (Figure 2). Comparing homes with heating systems that mechanically “move” air (e.g. furnaces and cold climate heat pumps) with those that do not (e.g. boilers with hydronic distribution) yielded similar results. Data did not show that one system type clearly resulted in “better” indoor air quality. As expected there was a tendency for peak CO2 level to be higher in homes with more people and smaller bedrooms. However, with doors open – i.e. reduced ability to “trap” air inside the bedroom as people exhale CO2 during the night – occupant density and bedroom volume had little effect.

Ventilation system was the one variable that clearly stood out as having an obvious impact on air quality. Two homes had balanced ventilation with heat recovery, considered a “best practice” in modern building construction. Seven homes had exhaust-only ventilation with automatic controls; that is, fan(s) operate throughout the day without a person switching them on. The rest – 13 homes – had either no ventilation or ventilation that operated only on manual switches.

Were they constructed today, none of the 22 homes would pass the Vermont energy code requirements for ventilation (which calls for adequate spot ventilation for bathrooms with baths or showers, plus whole-house system flow at sufficient rate with automatic controls). However, the difference between the three homes that came close – those with automatic controls and within 50 percent of the ASHRAE 62.2-2013 whole house flow rate – and the other 19 homes (including home 5, which had a balanced ventilation system, but without a supply or exhaust register in the bedroom) is dramatic (Figure 3).

**DISCUSSION**

While not usually considered immediately dangerous at 1000-5000 ppm, recent studies have linked CO2 exposure in this range to reduced cognitive function and sensitive individuals may experience headaches, fatigue and a sense of air “stuffiness,” to name a few symptoms. Worse, perhaps, is that as an indicator of inadequate ventilation, elevated CO2 may indicate that if there are sources of VOCs, particulates, moisture and other pollutants in the home – many of them potentially more serious than CO2 – these may also be present at elevated levels.

While this study involved only 22 homes, results defy the assertion that ventilation is not a concern in older, leakier homes – sometimes referred to as homes that “breathe.” While there may be greater movement of air in these homes, there is not necessarily control of where fresh air is delivered: a leaky home doesn’t give you fresh air where you want or need it. By contrast, homes that approach (even if they don’t meet) current ventilation standards displayed much lower CO2 levels, even if not below the optimal 1000 ppm threshold. This highlights the need for adequate ventilation in most, if not all, homes – not just new, “tight” homes.

To optimize both ventilation effectiveness and energy efficiency, the approach of balanced ventilation using a heat recovery or energy recovery ventilator – installing an HRV or ERV – is advocated as best practice for new construction and retrofits. This also has the benefit of including high efficiency.
filtration such as HEPA or MERV 13 or higher in homes occupied by individuals with allergies or other sensitivities. Simply installing an HRV or ERV “machine” is not enough; proper design and commissioning of such systems – including ventilation directly to bedrooms – is key to “getting what you paid for.”

In situations where installing an HRV or ERV is not feasible, data from this study suggests that retrofitting exhaust fans with automatic controls and ensuring flow rates in accordance with energy codes and ventilation standards is a backup strategy worth considering.

And if nothing is done? At least open that bedroom door at night.

ABOUT THE AUTHOR
Brian Just is RESNET, CPHC and LEED AP certified. While obtaining his MASc in mechanical engineering, his research focus was indoor air quality and biomass combustion, which deepened his interest in the health impacts of the built environment. Outside of his daytime role working with residential energy efficiency programs at Vermont Energy Investment Corporation (www.veic.org), Brian serves on the Board of Directors for the Vermont Green Building Network and volunteers with the International Living Future Institute as an Ambassador Presenter.

ABOUT THE PEER REVIEWER
Mike Duclos is a principal and founder of the DEAP Energy Group, LLC (www.deapgroup.com), a consultancy providing a variety of Deep Energy Retrofit, Zero Net Energy and Passive House consulting services. Mike is a Certified Passive House Consultant and PHIUS+ Rater who has designed and certified Passive House homes with PHIUS and PHI, and enjoys ‘measuring things.’ Mike has a BS in Electrical Engineering from UMass Lowell, and two patents.

ENDNOTES
1 Home size varied from 568 to 5739 square feet. Year constructed (or building envelope substantially renovated) was between 1890 and 2015. Air tightness ranged from 1.5 to 10.0 air changes per hour at 50 Pa depressurization. 10 homes had forced-air heating systems; 12 had non-forced air systems. 19 homes were single-family detached dwellings; one duplex (half) and two single-family attached (multifamily) dwellings were also included. Bedroom occupancy varied from one to three (with children under age four and dogs counting for 0.5), resulting in occupancy/volume ranging from 0.81 to 2.48 people/1000 ft3.
2 TSI VelociCalc 9565-P meter connected to a TSI 986 probe.
3 Other variables including stack effect, outdoor temperature, and wind/wind exposure were not investigated.
4 These systems, which include non-ducted cold climate heat pumps and furnace systems that may or may not have a return inside the tested bedroom, do not necessarily result in air exchange to/from the room.
5 Ten homes would fail the requirement for spot ventilation. 21 homes would fail the requirement for whole-house system flow; the one home that passed this requirement would fail due to inadequate spot ventilation in one bathroom.
6 The Occupational Safety and Health Administration (OSHA) exposure limit for CO2 over an 8-hr workday is 5000 ppm.
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Despite progress in the United States over the past decade toward implementation of sustainable development policies and practices, the average American remains mystified about how to participate in the greening of our economy. To be most effective, sustainability must be broadly practiced, but myths and mystery around sustainable practices and even the word “sustainability” remain an obstacle. In this essay, I argue that inclusive diversity is the key to demystifying sustainability, which will be necessary to efficiently address the challenges humanity faces, especially climate change.

I invite the reader to expand their definition of sustainability while considering how any organization can benefit from nourishing diverse leaders with both visible and invisible diversity traits.

We live in a time where most people understand that centuries of environmental illiteracy have contributed to a loss of ecosystem services and increasing threats to human health and the environment. Yet everyday people struggle with things like recycling. According to a 2015 study by Yale University published by the Nature Climate Change Journal, the average American household sends five pounds of waste, per person, per day to landfills. That means that the average American discards their body weight in trash each month. According to the Environmental Protection Agency (EPA), American households recycle and compost approximately 34 percent of the waste we generate. Though this figure seems low, the Yale study suggests it is inflated. According to the Yale study findings, Americans only recycle 21.4 percent of the waste we generate. That means 78.6 percent goes unrecycled, which is more than double EPA’s statistics associated with solid waste disposal.

I have observed the mystifying effects of sustainability first hand. We sustainability professionals tend to work on large scales and often in the abstract. As the Director of Sustainability for Yonkers, New York State’s fourth largest city, I had the privilege and opportunity to practice sustainability at the ground level. While my responsibilities went far beyond recycling, that is one aspect of sustainability that has managed to reach people broadly. I was surprised but motivated when I was confronted with how much people struggle with recycling. I found that recycling stations were consistently misused. I wondered whether the misuse was the result of apathy or something else. I discovered that people genuinely wanted to recycle but generally felt unsure about which items were recyclable and which were not, and where those items should be placed. So I spearheaded a project that entailed designing new visual aids to help residents recycle, which they were sincerely interested in doing.

Through my interactions with the community, I discovered that people genuinely wanted to recycle but generally felt unsure about which items were recyclable and which were not, and where those items should be placed. So I spearheaded a project that entailed designing new visual aids to help residents recycle, which they were sincerely interested in doing.

But the deeper issue I pondered was, why was it falling to me to be designing and re-designing something so basic? Shouldn’t the sustainability field have figured this out by now? The conclusion I have come to is that sustainability professionals are not communicating effectively about sustainable...
practices because there is a barrier: a lack of diversity.

Sustainability planning needs to embrace diversity in order to be successfully implemented. By diversity, I am referring to people with certain visible or invisible traits such as skin color, age, gender, physical abilities, sexual orientation, religion, culture, ethnicity, national origin, etc. To effectively integrate diversity in sustainability planning will require a conscious effort in promoting inclusive leadership. According to a 2013 study by the Center for Talent Innovation, diverse leadership directly correlates to the bottom-line performance of a company. Furthermore, the study suggests that homogeneity in a company’s leadership, along with the failure of management and top executives to appreciate ideas from people who are “unlike themselves” may hinder growth of the organization. It is no different in the field of sustainability.

A 2014 University of Michigan School of Natural Resources & Environment study of nearly 300 environmental organizations shows that over 70 percent of the presidents and chairs are male. The study also reveals that the percentage of minorities on the boards or general staff of environmental organizations does not exceed 16 percent, despite the fact that ethnic minorities and people of multi-racial backgrounds make up a growing 38 percent of the U.S. population. In fact, the study shows that once hired, ethnic minorities are concentrated in the lower ranks, making up less than 12 percent of the leadership positions in the environmental organizations.

At an organizational level, inclusive diversity in leadership increases the credibility and legitimacy of the work of sustainability planning in the eyes of the broad populace. Bringing professionals with various backgrounds – be it age, sexual orientation, culture, religion, nationality, physical abilities, etc. – into the workforce enables different perspectives. Encouraging perspectives to be voiced is a channel to fostering new ideas. This kind of fresh thinking will likely result in organizations that value new and unique opinions, as well as an inclusive culture. Hiring professionals from various backgrounds is just one aspect of inclusive diversity. Recruiting will be deemed successful when talent is retained and developed into leadership.

In sum, the solution to demystifying sustainability entails re-evaluating the definition of sustainability and how organizations implement strategic sustainability planning. By giving priority to inclusive diversity, you can ensure that the message that is created and communicated is credible and legitimate and reaches a broad audience. Greater diversity of leadership in environmental roles will provide new, more appropriate tools to the public to participate in the fight against climate change, green our economy and promote sustainable development, no matter where they are on the environmental spectrum.

Note: The opinions and ideas expressed in this article are solely those of the author.

ABOUT THE AUTHOR
Heliana Higbie has spearheaded the development and implementation of sustainability programs for nearly a decade. She has worked in New York, and throughout North and South America. She has experience working for the United Nations, City Government, the MTA and Fortune 500 companies. Most recently, she has also led the Mayor’s Office of Sustainability for Yonkers, the fourth largest city in New York State, with the goal of reducing the state’s overall carbon footprint. Heliana is multilingual.
For this issue of BuildingEnergy magazine, we’re interviewing Jonathan Orpin, founder of New Energy Works Timberframers and Pioneer Millworks, both headquartered in central New York. Started as a small timber frame company, New Energy Works works with Pioneer Millworks to design and build beautiful, energy efficient timber framed buildings. Together, the two companies employ nearly 100 designers, timberwrights, engineers, craftspersons and community members.

New Energy Works’ services include architectural design, timber framing, designing enclosure systems, construction and fine woodworking. Pioneer Millworks is the largest domestic source for reclaimed and sustainable wood products. The two companies were among the founding members of BuildingEnergy Bottom Lines, NESEA’s triple bottom lines peer network. To learn more about our BuildingEnergy Bottom Lines program, visit nesea.org/buildingenergy-bottom-lines.

Tell me a bit about New Energy Works and Pioneer Millworks. When and how were they founded? Can you describe your businesses to me?

JO: I started New Energy Works (NEW) in the mid-80s as a response to my dislike of plastic vapor barriers. I had read the Saskatchewan Report and discovered SIPs (Structural Insulated Panels) and heavy timber. Then I discovered heavy timber and craft. It was a romance at first sight.

I founded Pioneer Millworks in the late-80s to support my timber framing habit. I was looking for more stable timbers than what were available at the time in Western New York.

What are the biggest challenges you face in running these two companies?

JO: I am a cowboy at heart. When you grow companies like we have ours, through sheer force of will, and unswerving focus and hard work, rather than proper capitalization and thoughtful management techniques, it’s a challenge. We’ve only started to grow through the latter two (proper capitalization and thoughtful management techniques) recently, in part because I’ve been smart enough to hire and recruit people who are better than I am at their jobs.

What drove you to join Bottom Lines?

JO: I joined at the outset, in 2014. I did so for two reasons: one as a favor to John Abrams (a good friend and the facilitator of the Open Matters Bottom Lines group); and two because I trusted John. I didn’t expect much out of participating, possibly because I’d never participated in anything like this before.

What’s been the biggest surprise about Bottom Lines so far?

JO: I am pretty convinced that no one has gotten more out of the program than my co-workers and I. Seven of us participate, and more of our employees would love to be involved. This is a big investment on our part, both in terms of time and travel. But it’s been incredibly useful.

I have learned specific skills through participating: in the form of actual business tools and, even more so, in terms of big picture thinking. I would suggest that both of these are true for my co-workers as well. I’ve also made new friends. As an owner of a company, friends don’t come easily for many complicated reasons. It’s really nice to have some new friends.

You hosted your Bottom Lines group, Open Matters, in April 2016. What was it like to host a meeting?

JO: We have a great deal to share. Our companies are not only the largest in Bottom Lines but we’re also chaotic as heck and expanding on all fronts at the same time (see my cowboy comment above). So for us, the hardest challenge was to share our story and resources in as cogent a way as we could with limited time. Bottom Lines gatherings last a total of 48 hours. While that is the right amount of time, it’s never enough time.

In addition to having a great deal to share, we have a great number of needs. Part of our challenge was to pick just a few that the group could help us with most. On the NEW side, for instance, we had just experienced a catastrophic building failure (or, as I like to call it, a bucket of opportunity) of a WWII-era building that housed our fine woodworking division, NEWwoodworks. Seeing this as an opportunity to bring new building technologies to the region and relocate the fine woodworking team to our main campus, we started the journey to a CLT (Cross Laminated Timber) building wrapped with Wood Fiber Insulation. (Editor’s note: This project, dubbed “Tomorrowland,” was featured in NESEA’s BuildingEnergy Pro Tour series in June 2017. It is intended to showcase CLT construction as the wave of the future, offering possibilities for both businesses and housing with dramatic environmental benefits.) There was much more here than just the mechanics of rebuilding, including financing, design and personnel issues. Our group’s feedback was extraordinarily helpful.
On the Pioneer Millworks side, we shared our struggle to create a living wage for our staff, given the differences between the production economy represented by that business and the service economy represented by NEW. They are very different companies, Pioneer Millworks being a linear goods and materials business, NEW being a service provider. Thanks to our Bottom Lines experience, our compensation structure for both companies now reflects that difference.

Any last thoughts?

JO: I’ve been a longtime industry leader in timber framing and supporter of developing greater business skills and ethics among timber framers. Bottom Lines has inspired me to work with other timber framing owners and managers, including Christian Goodman of Hardwick Post and Beam (another group member) to bring peer-to-peer network advantages to the timber framing industry. I am also involved in the Northwest Ecobuilders Guild which looks to NESEA’s model and leadership. Bottom Lines and some of NESEA’s other programs are serving as relevant models for other Triple Bottom Line associations throughout the country.
As the design of high performance building envelopes continues to evolve, so must the process of evaluation. Throughout the past few decades and with the growth of the Passive House standard in the United States, designers are increasingly being forced to create finely tuned shells for their projects that somehow balance cost, ease of construction and increased thermal performance. Not long ago, the wall assembly for a project would have been relatively standard, but a “high performance” wall worthy of a Passive House plaque demands attention from several disciplines often before design development. What has changed in the fundamental thinking about wall construction that has created such an obsession? The answer has to do with a shift in the perception of what makes a building assembly “efficient.”

The definition of efficient is “functioning in the best possible manner with the least waste of time and effort.” With regard to typical construction in the U.S., a wall assembly has historically been considered efficient if it fulfills the structural requirements of the building and creates a sufficient barrier from the elements while being as cheap and easy to construct as possible. Additional requirements are inevitably introduced to disrupt this basic equation, but regardless of the project the original criteria always remain. Luckily, stricter building codes have served as the catalyst to push construction toward a new definition of efficiency where thermal energy is as important as time and material cost.

The primary function of a wall has always been structural. Therefore the majority of a wall’s thickness has historically been filled by – you guessed it – structure. Instead of building solid structural walls, lightweight but strong materials act as framing members to cover a greater area at reduced cost while leaving void spaces for which we have found many functions. For instance, filling these convenient spaces with lower density material has become the obvious solution to an otherwise unobstructed flow of sound and heat. As the benefits of such an acoustical and thermal barrier were realized, building codes began to require a certain amount of insulation efficiency. When the concept of super-insulation became popular in the ’70s, it eventually became clear that this formula of using the structural cavity as the insulation layer was no longer sufficient. Increasing the wall depth to accommodate more insulation also meant beefing up the structure unnecessarily – negatively affecting the cost efficiency of the assembly. Today, in the world of high performance construction in colder climates, it is basically required that some amount of the insulation layer be separated from the structural layer, increasing the efficiency of both components.

Moving insulation out of the structural cavity to the exterior poses a new design hurdle: what will attach the façade to the structure while spanning the gap required for insulation? Many systems exist today to do that and more, varying based on the façade type and backup structure. In addition to supporting the façade, such systems often must hold the insulation in place and leave an air space for ventilation.

So what systems are we talking about? Panelized and lightweight façade materials have the widest array of high performance attachment systems available. For instance, a clip and rail system reduces insulation penetrations while forming a grid to hold insulation, supports a façade and creates an air gap. In addition, a simpler approach is to use continuous girts, almost like a lightweight stud cavity, to hold insulation and support the façade. Not surprisingly,
brick veneer has a very different set of attachment options from the lighter façade materials. The combination of brick ties and shelf angles can be designed to accommodate insulation and an air gap for a high-performance system.

Although simple in concept, the high-performance building world has produced many solutions to serve the same structural purpose with higher thermal efficiency. So what can a designer do to evaluate these different systems?

First, understand the factors that typically affect the decision of what system to use. Qualitative factors include the product’s availability, testing and constructability. Newer products may have long lead times, leading to less flexibility during construction. Similarly, reducing thermal transfer often results...
FIGURE 5: The weight of brick requires a shelf angle and brick ties to connect to a building’s structure. Each of these elements contributes to a loss of exterior insulation efficiency. Photo credit: Steven Winter Associates.

FIGURE 6: Lightweight façade materials have a wide range of attachment options with varying degrees of thermal efficiency. Photo credit: Steven Winter Associates.

FIGURE 7: Brick façade assemblies require both brick ties and shelf angles. Photo credit: Steven Winter Associates.

FIGURE 8: Two attachment systems for panel façades were considered for this study. Girts can be attached directly to the structure, or they can be offset from the building with clips. Photo credit: Steven Winter Associates.
in higher complexity, which can decrease constructability. Finally, depending on the project requirements, NFPA 285 testing may be unavailable for products that are still new or made from less conductive and often more flammable materials.

Quantitative factors include cost, structural efficiency and thermal efficiency: how do the material costs compare, and will they be entirely outweighed by the increase in labor/detailing later on? How deep is the offset required for the insulation and ventilation gap and what is the weight of the façade? Finally, to what degree will the exterior insulation R-value be degraded as a result of the thermal bridging from the attachment system?

While this article does not answer all of these questions, many resources exist to provide guidance. For instance, the Masonry Systems Guide produced by the Masonry Institute and many publications by RDH such as their Technical Bulletin No.11 provide road maps to most of these systems with regard to detailing, constructability and thermal performance.

The research presented in this article evaluates the thermal performance of several systems assuming a uniform layout by quantifying the exterior insulation efficiency. This metric is commonly used in similar studies to evaluate exterior cladding attachment systems and is defined as:

\[
\text{Insulation Efficiency} = \frac{\text{Modeled R-Value}}{\text{Nominal R-Value}}
\]

The base cases for this study were meant to represent typical mid- to high-rise new construction projects in the northeast U.S. The goal was to achieve around an R-30 wall and to evaluate the effect of each system using two different backup systems – a 6-inch steel stud cavity filled with mineral wool and 2 inches of exterior XPS and an 8-inch CMU wall with a 6-inch interior cavity and 2 inches of exterior XPS. All clips were spaced 16 inches horizontally and 24 inches vertically, which is typical if not the worst-case scenario. The modeling was done in a three-dimensional thermal modeling program called Heat3.

This research revealed a few very interesting observations. First, a continuous girt made of a low conductivity material such as fiberglass results in the lowest reduction in efficiency. It is counterintuitive that a continuous fiberglass girt would perform better than intermittent fiberglass clips – the material is the same, but there is less insulation being interrupted. The difference is that each clip typically requires two screws (in this case galvanized) that penetrate the entire insulation layer, while girt screws only penetrate the sheathing and structure, not the exterior insulation. The cumulative heat flow through these points outweighs the flow through the continuous thin web in the girts. Additionally, the effect of a clip system on the exterior insulation is reduced when attached to CMU as opposed to a steel stud backup structure.

Understanding differences between products early in the design process can save time and money. Structural efficiency and cost are closely tied to the thermal efficiency of a system and achieving a balance between all three will be determined by the design of the entire assembly, from backup system to façade material. This is not as easy a task as it was even a decade ago. In the world of low consumption, the recipe for achieving efficiency calls for an entirely new set of ingredients.

ABOUT THE AUTHOR
Chris Hamm is a Building Systems Engineer focused on Passive House design and energy modeling research at Steven Winter Associates. Before working for SWA, he completed his Master’s in Product Architecture and Engineering at Stevens Institute of Technology where he oversaw the energy modeling team for the SURE House, a storm resistant Passive House and winner of the 2015 Department of Energy Solar Decathlon. His current work includes several multi-family apartment buildings and college dorms in NYC and around the Northeast U.S. and Canada.

ABOUT THE PEER REVIEWER
Jordan Goldman is a specialist in energy modeling and mechanical engineering, and manages the HVAC design practice for ZeroEnergy Design. He is fluent in building envelope strategies and energy efficient construction systems, building science design principles, as well as mechanical system design, specification, and sizing for enhanced energy performance. He is a Certified Passive House Consultant, LEED Accredited Professional, and HERS Rater. Jordan studied Environmental Engineering at Cornell University, where he received both a Bachelor of Science and Master of Engineering.
INTRODUCTION
Since the 60s, many innovative building strategies have been developed that deviate from traditional building practices by incorporating ambient energy sources, especially solar, into the building (skin) for passive heating or cooling, producing warm water or natural daylighting. Examples are the trombe wall or the transparent insulation materials (TIMs), some of which are still in use today in one form or another. However, few concepts have really been able to take hold in conventional building practices. Reasons for that are numerous, and might include cost, energy prices, problems of overheating, durability, life expectancy, maintenance or simply architectural appeal. Most often such systems are add-ons, meaning that they do not entirely replace an existing technology or standard building component (i.e., the cladding, the window or the wall). Breaking from traditional building methods seems to be extremely difficult not only physically, but also psychologically.

Giuseppe Fent, a Swiss architect has extensively studied these systems, especially the concept of transparent insulation materials (TIMs). TIMs absorb solar energy and convert it into heat, which is then transmitted through conduction and radiation, while the typical heat loss through convection is greatly suppressed. However, because these systems have too many drawbacks and can be architecturally challenging to implement, Fent decided to develop his own system that would be highly energy efficient and low-tech, using only eco-friendly materials.

Furthermore, the system was not allowed to be perceived as an add-on, but needed to be an integral part of the building envelope construction and design.

By 1999 he built his first three single family houses with his own invention, a high performance cladding system called Lucido® (in Europe only). In subsequent years the system has evolved and found its way into numerous multi-residential, commercial and institutional buildings, both in new construction and deep energy retrofits. A separate, independent company is now marketing and selling this system in North America under the name SAF®.

SAF®
Conventional insulation systems decouple the building’s interior and exterior climate conditions to the impossible end of creating an airtight, energy-tight barrier between the two. As an antidote to this, SAF® incorporates the outdoor energy sources into the exterior skin, creating a thermal sun-warmed buffer that heats up over the course of the daylight hours (Figure 1). After sunset, the wood absorber cools over the next 5 to 9 hours (Figure 2). This cooling period gives the building a thermal buffer against the cold exterior temperatures to which it is exposed. This cycle dramatically reduces the building’s heat loss. In summer, when the solar incident angle is higher than in winter, a reverse process takes place: the uniquely angled wood slats of the solid wood heat-absorber shade the façade from direct solar impact while the...
back-vented glass draws excessive heat out of the system much faster, causing the absorber to warm up less than in winter months (Figure 3).

To accomplish this, SAF’s core technology comprises: (1) the solid wood heat buffer/absorber, which sits against a conventionally insulated wall; (2) a back-vented solar glass façade applied over the wood absorber to protect the wood from the elements while amplifying the thermal buffering effect, which primarily takes place on the western, southern and eastern facing façades but also, in a lesser fashion, on the northern façade. It is a system that can be applied on the entire building façade making it an equal substitute to any other cladding system, with the major added value of energy performance.

Furthermore, SAF® achieves greater passive solar radiation results with fewer resources than the standard Passive House method, in which insulation of a wall to an R-value of R-60 requires about 40 cm of insulation (fiberglass or mineral wool). This thickens the wall, which deepens the window reveals, decreases the living space, expends more resources and increases insulation costs. SAF, however, can reduce a Passive House wall thickness of 40-50 cm by about half. Finally, SAF® is aesthetically pleasing and provides a new tool for architects seeking to give their buildings uniquely warm, modern appearances.

CASE STUDIES

The Hofberg development consists of single and multi-family residences with SAF® technology in Wil, Switzerland (Figure 4). It was designed and built by G. Fent, the system inventor. The first (Hofberg 1) in a series of eight buildings was built in 2004, while the most recent (Hofberg 8) was finished in 2016 and features the latest evolution of the system, including integrated PV cells and a mechanically controlled ventilation of the air gap. Each building has a compact building volume; high performance airtight building envelope (triple glazing windows and SAF®); a geothermal heat pump; a mechanical ventilation system with heat recuperation; and a rooftop- or façade-integrated PV system.

In Switzerland, new construction must meet strict energy codes, thus each building has to be modelled for its overall energy consumption. SAF® can help reduce the heating energy demand by up to 80% compared to a standard building. The added cost for SAF® and other energy efficiency measures are about 10%, an investment that pays off in many ways, such as higher comfort, long-term value, better mortgage interest rates, increased living space and, of course, all the energy savings.

All of the buildings are at least Minergie® (Swiss energy label similar to the better known German Passive House standard) certified or better, several have received the Swiss Solar Award.

<table>
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<th>BUILDING</th>
<th>YEAR</th>
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<tr>
<td>HOFBERG 8</td>
<td>2016</td>
<td>~80%*</td>
<td>128%***</td>
<td>~8–10%</td>
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</tbody>
</table>

FIGURE 3: SEASONAL PERFORMANCE. WINTER HEATING: MAXIMUM SOLAR ABSORPTION THROUGH INCREASED SURFACE. SUMMER COOLING: INCREASED REFLECTION, MINIMAL ABSORPTION THROUGH SELF-SHADING EFFECT AND VENTING. GRAPHIC BY NELSON ARCHITECH GMBH.

FIGURE 4: HOFBERG DEVELOPMENT IN WIL, ST. GALLEN, SWITZERLAND. ARCHITECTURE BY FENT SOLARE ARCHITEKTUR. PHOTO CREDIT: LUCIDO SOLAR AG.

FIGURE 5: NET POSITIVE ENERGY PROJECT, “HOFBERG 6/7” IN WIL, CANTON OF ST. GALLEN, SWITZERLAND. RECIPIENT OF THE 2012 LORD NORMAN FOSTER SOLAR AWARD. BUILDING IS MINERGIE-P® CERTIFIED (SG-074-P) AND PRODUCES ROUGHLY 180 PERCENT OF ITS TOTAL ENERGY DEMAND. ARCHITECTURE BY FENT SOLARE ARCHITEKTUR. PHOTO CREDIT: LUCIDO SOLAR AG.

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CONTINUED ON PAGE 45
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for Excellence and one (Hofberg 6/7) even received the European Norman Foster Solar Award in 2012 (Figures 5, 6 and 7).

Since the very first SAF® project in 1999 the system has been successfully adapted by many green architects in over a hundred commercial, institutional and residential buildings in Switzerland and surrounding countries.

SWISS CHALET

SAF® can be produced by locally contracted manufacturers using locally harvested wood. The value of SAF® lies not just in its performance abilities but also in the fact that it can be produced with local renewable resources, keeping the value chain local. It is eco-friendly and carbon neutral. This chalet in Nax (Figure 8), is a perfect example of the vision that drives this invention. It is a net-positive energy and carbon building that can cover its own energy demands as well as the fuel for an electric vehicle to drive 15,000 to 18,000 miles a year.

FUTURE OF SAF®

SAF®’s passive solar thermal system can be enhanced by integrating photovoltaic technology in a semi-transparent fashion into the outer glass cover. The wood core absorbs both direct sunlight and indirect heat radiating off the back of the PV cells. While the thermal performance may be slightly reduced, the added benefit of producing renewable electricity increases the overall ratio of solar energy used. It is therefore possible to cover the entire energy demand of a building with a single system, especially on taller buildings with a much bigger façade-to-roof surface ratio.

Finally SAF® e³ marks the next generation in the system’s technology by adding a third layer of solar energy usage and an active measure of controlling its distribution. This triple absorption of solar energy provides a thermal buffer (mass) around the building, waste heat that is extracted from the air gap through a connecting duct system and led into the heat exchanger of a heat pump and renewable electricity to power the heat pump and the rest of the house/facility and/or car (Figure 9). Furthermore, by funneling the sun-warmed air from the air gap into a closed duct system one can mechanically increase or decrease the airflow rate in the air gap, actively cooling down or heating up the thermal buffer and the PV cells. This shifts the energy efficiency more toward the PV power production or the thermal mass all depending on the seasonal and diurnal needs of the building occupants.

LIMITATIONS

While the material and architectural qualities of glass and wood are undeniable, there are also some limitations. The smoothness and hardness of the glass makes it very durable. The glass in this system is typically a single-pane tempered safety glass, and is very impact resistant. Nevertheless, the chance of breakage through impact cannot be completely eliminated. Tall buildings may require laminated safety glass for human safety instead. Dust and dirt may accumulate on the surface over time but there is no need for active cleaning because the rain washes excessive dirt away and minimizes any impact on its performance.

The drawback of the wood is that it is combustible and therefore subject to fire code restrictions, especially in the commercial building applications. However, in Switzerland, where similar restrictions exist, solutions have been devised to make SAF fire code compliant. The tallest building to date is a seven-story
low-income multi-residential housing project in Geneva. A twelve-story building is currently in the design phase.

The glass and wood together compose a rear-vented system that is about 2.5 inches deep. While some condensation may occur, it evaporates shortly after daybreak. The system is designed to keep water from driving rain out. Due to its depth and the component glass, the system is less malleable than other cladding systems, which poses some restrictions on designing buildings with lots of angles and architectural protrusions. The system clearly favors a more modern architectural design with simple geometric volumes and larger surfaces.

CONCLUSION

There are many innovative concepts and solutions out there that respond to certain needs or climate zone of a building, such as building ecology, energy and material efficiency, energy self-sufficiency, carbon footprint and design. But few manage to address so many aspects in a single system, making SAF® a truly remarkable and sustainable system. Above all, however, is the long lasting beauty of the natural wood protected behind the glass.

ABOUT THE AUTHOR

Eric Nelson, a former marine scientist and now architect and building energy consultant, was born and raised in Switzerland. He studied Marine Science in the United States, but after graduating and working for the US Geological Survey he realized that he wanted have a greater impact on his immediate environment. He became an architect so he could help shape the world. Finding little awareness of sustainable building practices in the States, he returned to Switzerland to join some pioneers in solar architecture and learn about new solutions and methods to lower the energy demand of buildings, increase energy efficiency and minimize the carbon footprint. He now runs an architecture and energy consulting firm (www.nelsonarchitech.com) and is building a business to transfer that knowledge and technology from Switzerland to North America. His firm owns the exclusive rights to market and distribute the SAF system in the U.S.

ABOUT THE PEER REVIEWER

Jenna Ide (LEED AP, AICP, BOC) is currently the Director of Capital Improvements & Municipal Operations for Salem, MA. She was previously the Director of Energy & Sustainability for Massachusetts (DCAMM), where for 15 years she managed more than 700 energy and sustainability projects worth more than $450M. She has worked regulating large power projects and in outreach for environmental non-profits. Jenna, an avid outdoor recreationalist, also enjoys art, reading and food. Jenna lives in Salem with her family where she volunteers locally. She also serves on the NESEA Board of Directors.
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On the leading edge of sustainability and design, award-winning firm Kaplan Thompson Architects founded BrightBuilt Home with the goal of providing more beautiful, healthy and low-energy homes for the American homebuyer. To optimize affordability, we rely heavily on supreme geekery married with years of custom design experience and construction knowledge. Sketches and cost spreadsheetes are used hand-in-hand with energy models in order to optimize each home and reduce its carbon footprint. As a partnership between design professionals, modular builders, and site contractors, we can keep our fingers on the pulse of the industry at large. As a team, we stay current on all aspects of home-building, from design innovations to pricing projections to best construction practices to more!  

Specialties: Building Design & Construction, Multifamily, Net Zero Energy, Social Services

BrightBuilt Electric, Inc.
P.O. Box 4910
Vineyard Haven, Massachusetts 02568
508-693-0764
jaret@briselectric.com
www.briselectric.com

Brissette Electric, Inc. is a Martha’s Vineyard based electrical contractor committed to customer service and quality. Our electricians take a team approach on every job and are dedicated to providing quality and performance that will exceed expectations. We enjoy working with people, and will do everything possible to complete your project in a professional and timely manner.  

Specialties: Construction Process

Brooks Post & Beam, Inc.
208 Pettingill Hill Rd.
Lyndeborough, New Hampshire 03082
603-654-3210
paul@sbbrooks.com
http://www.brookspostandbeam.com

Brooks Post & Beam has been building energy efficient, sustainable homes throughout New England for over 40 years. We have been building homes, barns, and commercial buildings sustainably for decades. We are a small company focused on improving our quality  

Specialties: Building Design & Construction, Single Family

Brown Lindquist Fenuccio & Raber Architects, Inc.
203 Willow St., Ste. A
Yarmouthport, Massachusetts 02675
508-362-8382
kate@capearchitects.com
www.capearchitects.com

Brown Lindquist Fenuccio & Raber Architects, Inc. is a diversified architectural firm located in historic Yarmouthport, Massachusetts. We provide comprehensive architectural and consulting services to a wide range of Commercial, Civic and Residential clients.  

Specialties: Architecture

Bruss Project Management, LLC
17 Springfield St.
Concord, New Hampshire 03301
603-856-8218
mdbruess17@gmail.com

Bruss Project Management provides Project Management Service from project start to completion. We work with Owners to tailor a scope of services uniquely suited to their project needs.  

Specialties: Commercial & Institutional, Construction Process, Consultancy, Design Process, Single Family

Building Shelter, Inc.
P.O. Box 2297
Vineyard Haven, Massachusetts 02568
508-693-7734
info@buildingshelter.com
www.buildingshelter.com

We build homes from nature. Our construction practices are based on building science and the tradition of our trade. Our team is trained to understand how buildings work well and why they can cause harm. We are RESNET trained, a Certified Passive House Builder, Certified Passive House Consultant, EPACertified Firm, and Certified Building Performance Institute Home Analyst Professional. Our carpenters are trained to understand that a house is more than parts assembly. A building incorrectly conceived and executed can be expensive to maintain and harmful to live in and harmful to nature on which we depend. We value honesty and good relationships with our clients, helping our community and respect for nature.  

Specialties: Building Design & Construction, Consultancy

BuildingGreen, Inc.
122 Birge St., Ste. 30
Brattleboro, Vermont 05301
802-257-7300
jerelyn@buildinggreen.com
www.buildinggreen.com

BuildingGreen provides building industry professionals with well-researched information on environmentally sound building practices and green products. Online resources include BuildingGreen and LEEDuser.  


BuildingLogic, Inc.
P.O. Box 210
Gardiner, New York 12525
845-443-0657
lillianmaurer210@gmail.com
www.buildinglogicinc.com

We design and build beautiful high performance homes. Our full service company integrates traditional craft, science, and modern design, to create durable efficient homes that people love to live in. Certified Passive House Consultant and Tradesperson, Net-Zero Energy design.  


Built To Last Design & Build, LLC
30 Greenwood Rd.
New Milford, Connecticut 06776
203-947-1196
benjamincbogie@gmail.com

Offering general contractor services.  

Specialties: Building Design & Construction, Single Family

Byggiemeister, Inc.
667A Sawmill Brook Pkwy.
Newtown, Massachusetts 02459
617-527-7871
info@byggiemeister.com
www.byggiemeister.com

Byggiemeister 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: Building Design & Construction, Remodeling/DER
Celebration Green Design & Build
20 Hamilton Dr.
Madison, Connecticut 06443
203-533-4689
alicia@celebrationgreen.com
www.celebrationgreen.com
We combine our passion with our extensive knowledge & experience utilizing many types of energy efficient construction practices to design and build high performance homes, including passive house and zero net energy. We are also committed to spread the word and teach other stakeholder groups “why, what & how” building this way matters for our future. As part of this effort, we are proud to be founding members of CTPH – Connecticut Passive House.


Celtic Energy, Inc.
437 Naubuc Ave., Ste. 106
Glastonbury, Connecticut 06033
860-882-1515
wdonizla@celticenergy.com
www.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.

Specialties: Alternative Energy, Beyond Energy

Center For EcoTechnology (CET)
320 Riverside Dr., Ste. 1-A
Florence, Massachusetts 01062
413-586-7350
cet@conetonline.com
www.conetonline.com
We help people and businesses save energy and reduce waste. For more than 40 years, we’ve offered proven advice and resources to save you money, make you more comfortable at home, and help your business perform better. Working with partners throughout the region, we’re helping make our community a better place to live and work. We make green make sense.


Center For Sustainable Energy
50 Milk St., 16th Fl.
Boston, Massachusetts 02109
617-243-2021
elizabeth.glynn@energycenter.org
www.energycenter.org
A nonprofit social enterprise, CSE has facilitated 44,000 energy projects for consumers, businesses and governments. Through our market outreach and technical and policy expertise over 130,000 people have been directly served by our programs and CSE has a well-established reputation as a point of statewide and regional coordination among utilities, end-users, industry, regulators and local governments. Today, our reach is expanding nationally. Our areas of expertise include clean transportation, distributed generation, building performance, energy efficiency, energy storage and renewable energy. We work with energy policy makers, regulators, federal, state and local governments, utilities, public agencies and business.


Celtic Energy 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. CGH: Design for the Next Hundred Years

Specialties: Architecture, Energy Conservation, Remodeling/DER

Caliper Studio
75 Scott Ave.
Brooklyn, New York 11237
718-302-2427
info@caliperstudio.com
www.caliperstudio.com
Caliper Studio is a full-service, integrated design office and metal fabrication shop located in Brooklyn, NY. Founded in 2003, Caliper offers both architectural services and custom metal fabrication to other architects, general contractors, and end users.

Specialties: Architecture, Building Design & Construction, Design Process

Casaceli Construction, LLC
55 West St.
Northborough, Massachusetts 01532
508-351-9400
michaelcasaceli@gmail.com
Casaceli Construction, with over 30 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. Casaceli Construction has made a commitment to be a sustainable builder and remodeler and to pass the benefits on to our clients. With this commitment, we are offering deep energy retrofits and zero energy ready homes.

Specialties: Building Design & Construction, Remodeling/DER

CED Greentech East
1559 King St.
Enfield, Connecticut 06082
860-289-7711
solarateam@cedgreentecheast.com
www.cedgreentecheast.com
CED Greentech East serves East of the Mississippi in the ever-expanding solar industry. We work closely with installers and have both excellent service and extensive experience in the electrical and photovoltaic fields. Our goal is to meet your project requirements at a competitive price, and to manage and deliver your system in a timely and professional manner. Our stock of material and accessories will help complete your jobs without any holdups! Greentech personally handles daily deliveries throughout the region, ensuring that your complete system arrives on time and at no additional cost to you! We get low freight rates through our corporate account and your order will be shipped out same day!


Centerbrook Architects and Planners, LLP
67 Main St.
Centerbrook, Connecticut 06409
860-767-0175
can@centerbrook.com
www.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.


Chris Green, LLC
36 Sawyer Hill Rd.
New Milford, Connecticut 06776
203-628-0549
greennch@sbcglobal.net
www.patternsinwood.com
A craftsman searching for good designs and artful solutions in residential construction.

Specialties: Building Design & Construction, Single Family

Clark & Green Architects
113 Bridge St.
Great Barrington, Massachusetts 01230
413-528-5180
info@clarkandgreen.com
www.clarkandgreen.com
Clark & Green, Inc. is committed to meaningful architectural design. Since 1988, it has applied its design principles to a variety of building types. In addition to residential work, the firm has executed major commercial, institutional and municipal projects. These include the adaptive reuse of an historic building into a mixed-use, six-screen cinema and the conversion of an athletic field house into a multi-use theater complex. The firm relies on strong relationships with consultants supporting the special needs of each project. Collaboration enables Clark & Green to integrate quality design with complex engineering requirements.

Specialties: Architecture

CLEAResult
50 Washington St., Ste. 3000
Westborough, Massachusetts 01581
508-836-9500
cara.russell@clearesult.com
www.clearesult.com
CLEAResult is the leading provider of energy efficiency programs and services. Our Building Performance Consulting and certification teams provide consultation and project management to advance high-performance buildings. We help owners and developers maximize performance and energy savings for commercial and residential buildings.

Specialties: Consultancy, Consumer Information, Energy Conservation

Coastal Windows & Exteriors, Inc.
100 Cummings Ctr., Ste. 236H
Beverly, Massachusetts 01915
978-304-0495
service@mycoastalwindows.com
Doing Things the Right Way Turns Out to be a Great Way to Grow Your Business. David and Stephanie knew that a home improvement company run with a customer-first attitude could do well. They just didn’t realize how well until they launched. When they started out, they only sold and installed windows, but customers love businesses that show them respect. As word got around people kept asking about other products and services and within several months they added doors, roofing and siding to meet the demand. Stephanie and David are more committed than ever to maintaining Coastal Windows & Exteriors as a truly exceptional company.

Specialties: Remodeling/DER, Roofing, Windows
Community Preservation Corporation (CPC)
28 East 28th St., 9th Fl.
New York, New York 10016
212-869-5300
edeny@communitytp.com
www.communitytp.com

As a leading nonprofit affordable housing and community revitalization finance company, we utilize our deep, strategic relationships to create customized loan opportunities for our customers. As a trusted partner in your success, we work hand-in-hand with you to help maximize the potential of your multifamily project and its impact on the community.

One of the biggest barriers to pursuing energy efficiency can be restricted access to sufficient capital. In an attempt to cut both costs and carbon footprints, CPC has developed a financing methodology to catalyze integration of energy efficiency and water conservation measures into construction loans. This allows for a quality retrofit that locks in energy and water savings, helping to ensure long term economic stability of the property.

**Specialties:** Finance/CPA, Money & Business, Multifamily, Real Estate, The Big Picture

Connecticut Green Bank
845 Brook St.
Rocky Hill, Connecticut 06067
303-459-7840

The Connecticut Green Bank is the nation’s first green bank. We’re creating a thriving marketplace for homeowners, businesses and community projects. Our clients include both public and private sector organizations, as well as educational, administrative, healthcare, and community projects. Our clients do not have to be a homeowner to benefit from a CTgreen loan. Our CTgreen loan enables them to make improvements to their property, such as energy efficiency, climate adaptation and resiliency.

**Specialties:** Commercial & Institutional, Consultancy, Energy Conservation

Consolidated Edison Company of New York, Inc. (Con Ed)
100 Summit Lake Dr., Ste. 410
Valhalla, New York 10595
212-460-4771

Con Edison provides energy to 3.4 million customers in New York and Westchester County. New York. Newsweek recently named the company the ‘Greenest’ utility in the United States. To learn more about our energy-saving programs, visit conEd.com/greenteam.

**Specialties:** Alternative Energy

Cornerstone Architecture
700 Richmond St., Ste. 110
London, Ontario N6A 5C7
519-432-6644

cornerstone@cornerstonearchitecture.ca

Cornerstone Architecture is a leading firm in our region, including the Crown Heights community, including the Weatherization Assistance Program. The Weatherization Assistance Program (WAP) is a Federally-funded program for improving energy efficiency and lowering costs for owners of multi-family buildings or private homes. The program can upgrade heating systems, replace windows, insulate roofs and walls, and eliminate air infiltration – think of all the money you’re spending that are literally going out the windows or the doors.

**Specialties:** Social Services, The Big Picture

Cosella-Dörken Products, Inc.
4655 Delta Way
Beamsville, Ontario LOR 1B4
888-433-5624
tkimmel@cosella-dorken.com
www.cosella-dorken.com

Cosella-Dörken delivers innovative, high-performance air and moisture barriers for commercial and residential construction sold under the DELTA® brand name. Building green involves the business of manufacturing. Therefore we do not manufacture products or by-products which can negatively impact our world. We are very sensitive to protecting our environment and the people who are in our employ, while producing high quality, sustainable products that will create healthier living environments.

**Specialties:** Indoor Air Quality, Manufacturing

Cotuit Solar, LLC
3800 Falmouth Rd.
Marstons Mills, Massachusetts 02648
508-428-8442
info@cotuitsolar.com
www.cotuitsolar.com


**Specialties:** Multifamily, Single Family, Mechanical Systems & Lighting, HVAC, Photovoltaics, Wind

Crosby Real Estate
100 Salem St., O35
Smithfield, Rhode Island 02917
617-563-8595

Crosby Real Estate, Inc. will assist you and take the hassle out of buying or selling your home or piece of property. Crosby Real Estate specializes in homes and property in Henryetta and the surrounding area.

**Specialties:** Real Estate, Single Family

Crown Heights Jewish Community Council, Inc.
387 Kingston Ave.
Brooklyn, New York 11225
718-771-9000
mail@chjcc.org
www.chjcc.org

The CHJCC offers a wide range of programs to the Crown Heights community, including the Weatherization Assistance Program. The Weatherization Assistance Program (WAP) is a Federally-funded program for improving energy efficiency and lowering costs for owners of multi-family buildings or private homes. The program can upgrade heating systems, replace windows, insulate roofs and walls, and eliminate air infiltration – think of all the money you’re spending that are literally going out the windows or the doors.

**Specialties:** Social Services, The Big Picture

Danish Cleantech Hub
15 Metro Tech Center, Fl. 19
Brooklyn, New York 11201
453-377-3377
jash@dci.dk

Danish Cleantech Hub is concerned with energy efficiency, climate adaptation and resiliency. We focus on areas where we see clear links between the specific needs of New York and the Danish strongholds.

**Specialties:** Alternative Energy, Cities & Communities, Commercial & Institutional, The Big Picture
David Matero Architecture
100 Front St., Ste. 40
Bath, Maine 04530
207-389-4278
david@davidmatero.com
www.davidmatero.com
David Matero Architecture is a full service LEED AP architect specializing in residential, commercial, historic, green and restaurant architecture.

Specialties: Architecture, Commercial & Institutional, Multifamily, Single Family

David Murray Architect
61 Church Hill Rd.
New Paltz, New York 12561
845-255-2222
davidmurrayarchitect@gmail.com
www.hudsonvalleyarchitect.com
David Murray is a NYS licensed Architect based in New Paltz, New York. His practice consists of both Residential and Commercial projects in both Traditional and Contemporary Styles. The designs utilize Green strategies and products with super insulated, energy efficient design a priority. This is a small firm with great ideas and excellent client service.


DEAP Energy Group, LLC
667 Saw Mill Brook Pkwy.
Newton, Massachusetts 02459
617-775-4716
mduclos@deapgroup.com
www.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. We work on single-family homes, multi-family up to three stories, and small-scale commercial and institutional projects.

Specialties: Building Design & Construction, Energy Conservation, Remodeling/DER

Decumanus Green Design/Build, Inc.
29 Edgewood Dr., Ste. 2
Lenox, Massachusetts 01240
413-281-0046
joseph@decumanusgreen.com
www.decumanusgreen.com
Decumanus Green provides both design and construction services. Whether you are looking to build new or remodel, we can help you to visualize and realize a new home that fits within your budget. At Decumanus Green we strive to make all of our building practices as environmentally responsible as possible and our homes and additions as energy efficient as possible. We keep ourselves abreast of the constantly developing world of sustainable design and building.


Demand Management Institute, Inc. (DMI)
300 Chestnut St., Ste. 150
Needham, Massachusetts 02492
781-449-5700
info@DMIinc.com
www.DMIinc.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 Auditing, Energy Conservation

DeMetrick Housewrights
21P Gravelly Hill Rd.
Wakerfield, Rhode Island 02879
401-789-4712
sdmetrick@gmail.com
www.demetrickhousewrights.com
DeMetrick Housewrights is a residential building company in Rhode Island that specializes in high-performance building, millwork, and high-end remodeling.


Dietz & Company Architects, Inc.
55 Frank B. Murray St., Ste. 201
Springfield, Massachusetts 01103
413-733-6798
office@dietzarch.com
www.dietzarch.com
For over 30 years, Dietz & Company Architects has been serving the architectural needs of private and public institutions including the housing, education, healthcare, commercial, and historic preservation sectors. We are dedicated to interpreting our clients’ ideas while building healthy, sustainable communities. We routinely design high performance buildings and implement a “best practice” approach for energy conservation and sustainable materials whenever it can be determined to be cost-effective for our clients. Our sustainable design achievements include two recently built affordable housing developments that are designed to be zero net energy.

Specialties: Architecture, Commercial & Institutional, Multifamily, Single Family

Dominic Paul Mercadante Architecture
70 Waldo Ave.
Belfast, Maine 04915
207-522-2051
info@dpmercadante.com
www.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, Consultancy

Donnell Carpenter
46 Hop Brook Rd.
Amherst, Massachusetts 01002
413-522-2051
ddonnell@crocker.com

Specialties: Building Design & Construction, Construction Process

Dryvit Systems, Inc.
1 Energy Way
West Warwick, Rhode Island 02893
401-822-4100
dean.balicirak@dryvit.com
www.dryvit.com
As a global leader contributing to sustainable buildings, Dryvit Systems is committed to providing quality products and services while considering people, planet, and prosperity in all business decisions. We are recognized for developing the world’s most energy efficient, architecturally diverse, insulated cladding systems and decorative finishes for vertical wall surfaces. Utilizing responsible chemistry and exceptional manufacturing processes, we conserve resources and minimize our environmental impact to support and enhance healthy, vibrant communities. With an engaged and empowered workforce, Dryvit embraces a sustainable culture and creates lasting value for our stakeholders.

Specialties: Insulation, Manufacturing

Duncan • Wisniewski Architecture
255 South Champlain St.
Burlington, Vermont 05401
802-864-6883
michaelw@duncanwisniewski.com
www.duncanwisniewski.com
Passive means PRO-actively designing structures that use less energy, last beyond a lifetime, and offer a sanctuary for the inhabitants. Duncan Wisniewski Architecture is committed to learning, teaching, and sharing passive design. Passive is a mindset placing value on the ecosystems and communities we inhabit at home and at work. Passive House is a performance building standard that sets a pretty high bar for low energy consumption. Simply put- we believe in designing good places that prosper, and we have adopted a design strategy focusing on a robust building envelope (passive) to minimize mechanical systems (active).

Specialties: Architecture, Commercial & Institutional, Multifamily, Passive Housing, Single Family

E

E2 Solar, Inc.
831 Main St., Rte. 6A
Dennis, Massachusetts 02638
508-237-3892
jason@e2solarcapecod.com
www.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 and numerous solar thermal systems on residences and businesses across southeastern Massachusetts. Jason Stoots and the entire staff at E2 Solar, Inc. is committed to designing and installing exceptionally efficient, low maintenance, long lasting solar energy systems. E2 offers SunPower PV modules with the highest efficiency now available (cell efficiencies over 20%). Talk with one of E2 Solar’s qualified solar site analysts today.

Specialties: Photovoltaics, Solar Thermal

E4TheFuture
10 Speen St.
Framingham, Massachusetts 01701
774-777-9121
info@e4thefuture.org
www.e4thefuture.org
Bringing clean, efficient energy home for every American. E4 = energy, economy, equity, environment. E4TheFuture promotes residential clean energy and sustainable resource solutions to advance climate protection and economic fairness by influencing federal, state and local policies, and by helping to build a resilient and vibrant energy efficiency and clean energy sector. Follow us on Twitter @e4thefuture

Specialties: Education, Energy Conservation, Public Policy
Eco-Logical Building Solutions
27 Frost Hill Rd.
Marlborough, New Hampshire 03455
603-876-4040
ted@ecologicalbuildingsolutions.com
www.ecologicalbuildingsolutions.com
Eco-Logical Building Solutions is a Green Building Design, Consulting and Project Management Company. We specialize in implementing sustainable, energy efficient, environmentally friendly building and lifestyle practices that minimize waste of all resources. We strive to provide each customer with a wholly cooperative and personal experience. Whether you are building new, expanding, or remodeling an existing building we want to work with you to come up with eco-logical and cost effective solutions to your building needs.

Specialties: Consultancy, Design Process, Remodeling/DER, Single Family

Element Marcom
31 St., James Ave., 6th Fl.
Boston, Massachusetts 02116
212-920-4878
adixon@element.link
Our mission is to tell the stories of small, medium and large companies focused on energy efficiency and sustainability. By telling our clients’ stories, we seek to raise their visibility among target audiences and drive new business. We work to position our clients as thought leaders in their industry, ultimately increasing brand awareness and interest from potential customers. By identifying core differentiating elements, we create compelling narratives that cut through the noise and capture people’s attention. Starting with strategy and focusing on the business impact, our services consist of strategic messaging, content marketing, media relations, executive visibility, event marketing, award submissions, internal communications, global implementation and digital outreach.

Specialties: Commercial & Institutional, Marketing

Embue
745 Atlantic Ave.
Boston, Massachusetts 02110
617-314-6260
info@embue.com
www.embue.com
Our Mission: To make apartment building operations more efficient, comfortable, and cost-effective. Our goal is the intelligent building that automates management tasks, optimizes resource use, and protects against loss, while providing a healthy comfortable environment tailored to residents’ individual needs. With thoughtful application of technology we aim to transform multifamily portfolio, property management and resident experience in all segments of market. Embue was created by a group of engineers and entrepreneurs that are obsessive about making apartments work better so that you can worry less and enjoy more. Our team is highly engaged in creating what it means to live in, manage or own a smart apartment.

Specialties: Commercial & Institutional, Energy Conservation, Multifamily, Information Technology

Emerald Builders
PO Box 259
Bowdoinham, Maine 04008
207-841-2775
reggie@emeraldbuild.com
www.emeraldbuild.com
Emerald Builders is a residential building company serving mid-coast Maine. We focus primarily on building sustainable and energy efficient homes and buildings. We work closely with our clients, designers, and subcontractors to bring their dreams to reality. We rely heavily on open communication between all parties from conception through project completion to make sure we’ve put out the best possible product for our clients. We pride ourselves on an unwavering commitment to the highest quality craftsmanship and to the environment.


Energy Balance, Inc.
160 White Rock Dr., #1
Montpelier, Vermont 05602
802-229-5676
andy@energybalance.us

Energy Co-op of Vermont
PO Box 111
Colchester, Vermont 05446
802-860-4090
info@ecvt.net
www.ecvt.net
The Energy Co-op of Vermont was launched in September 2000 and began accepting members for the first time in July 2001. This historic event was the culmination of two years work in which we completed our business plan, established low-income energy bill management programs, researched co-op operations, acquired the Miller Oil Company, and completed other start-up tasks. Today, we deliver heating oil, kerosene and wood pellets and provide heating system maintenance, repairs and replacement for 2,000 members. We install super-efficient, cold-climate heat pumps, offer energy audits and energy upgrades for our members’ homes.

Specialties: Cities & Communities, Energy Auditing, Single Family

Energy Emporium
78 Main St.
NH, Connecticut 03748
603-632-1263
info@energyemp.com
www.energyemp.com
The Emporium is a showroom, information center and full service sales, installation and support for solar electric systems, solar hot water, wind and water turbines.

Specialties: Photovoltaics, Solar Thermal, Wind

Energy Engineering and Design, Inc.
65 Main St.
Framingham, Massachusetts 01702
781-775-2658
info@energymengineeringinc.com
www.energymengineeringinc.com
EED has the ability to develop a customized facility improvement program that fits your individual needs in the most cost effective way.

Specialties: Certifications & Standards, Commercial & Institutional, Energy Auditing

Energy Federation, Inc. (EFI)
40 Washington St., Ste. 2000
Westborough, Massachusetts 01581
508-870-2277
joconnell@efi.org
www.efi.org
For over 30 years, EFI has assisted people in their efforts to use less energy and water by providing energy efficient products and delivering successful utility program services. Our mission is to encourage people to use our planet’s limited energy and water resources wisely. We assist people in these efforts by offering high quality conservation products and services at affordable prices while communicating practical, objective information. By following this mission, our work will lead to an improved quality of life and economic condition. EFI a leading promoter of residential energy efficiency-related products, distributing products directly through our Consumer and Wholesale Divisions, and administrating utility-sponsored rebate programs through our Incentive Processing Division.

Specialties: Building Design & Construction

Energy Futures Group
PO Box 587
Hinesburg, Vermont 05461
802-482-5001
info@energyfuturesgroup.com
www.energyfuturesgroup.com
EFG is a consulting firm that provides clients specialized expertise on energy efficiency markets, programs and policies, with an emphasis on cutting-edge approaches. It was founded in April 2010 by Chris Neme, Richard Faesy, and Glenn Reed, each of whom has more than 20 years of experience in the energy efficiency industry. EFG has worked with a range of clients – government agencies, consumer advocates, environmental advocates and utilities – in 24 states, 3 Canadian provinces, and several countries in Europe.

Specialties: Consultancy, Public Policy
Energy Investment Systems
125 Maiden Ln., Rm. 505
New York, New York 10038
212-966-6641
eis@eisincorp.com
www.eisincorp.com

When building owners contemplate a major improvement program, it is the time to consider all of the energy performance opportunities available. EIS works with each client building to consider the highest performing and most appropriate energy equipment available, to review the configuration of the building’s supply and generation of energy, and to integrate energy systems with user information technology. EIS works closely with its clients to develop custom improvement packages that maximize operating cost reductions and program incentives to offset capital costs. We produce long-term improvement packages with lifetime savings that can be several times the cost of the improvements. We assist clients to structure low-cost financing that keeps the project in the black from day one.

Specialties: Money & Business, Multifamily

Energy Management Professionals, LLC
PO Box 2127
Waterbury, Connecticut 06722
203-756-7041
www.wessonenergy.com
www.wessonenergy.com

Energy Management Professionals, LLC (previously Wesson Energy) is a progressive energy partner specializing in modern, high-efficiency solutions. Founded in 1993, EO is also a Green Architects for 2005 by Natural Home and Garden magazine.


EvB Design
1310 Broadway, Ste. 200
Somer ville, Massachusetts 02144
617-623-2222
edrick@evbdesign.com
www.evbdesign.com
EvB Design provides architectural services for custom designed energy efficient housing, from single family to multi-family housing.

Specialties: Architecture

Fine Homebuilding
63 S Main St.
Newtown, Connecticut 06470
800-926-8776
fh@taunton.com
www.finehomebuilding.com

Fine Home Building provides expert home construction tips, tool reviews, remodeling design and layout ideas, house project plans, and advice for homeowner.


European Architectural Supply (EAS)
144 North Rd., Ste. 2500
Sudbury, Massachusetts 01776
617-647-4432
pmuzila@eas-usa.com
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Supplier of high-quality Passive House certified windows, doors and curtain wall from Schuco and Makrowin. Products include entry doors, tilt-turn windows, lift-slide doors and are available in PVC, wood, aluminum, and commercial curtain wall.


EvB Design provides architectural services for custom designed energy efficient housing, from single family to multi-family housing.

Specialties: Architecture

Fitch Architecture & Community Design
110 Pulpit Hill Rd.
Amherst, Massachusetts 01002
413-543-5799
info@facdarchitects.com
www.facdarchitects.com

Fitch Architecture & Community Design 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.

Specialties: Architecture, Commercial & Institutional, Multifamily, Net Zero Energy, Remodeling/DER

Foard Panel, Inc.
PO Box 185
West Chesterfield, New Hampshire 03466
800-644-8885
pete@foardpanel.com
www.foardpanel.com

Foard Panel manufactures and installs structural insulated panels for residential and commercial construction.

Specialties: Building Design & Construction, Insulation, Manufacturing

Garland Mill Timberframes
273 Garland Road Lancaster, NH 03584
tele/fax 603.788.2619  www.garlandmill.com

High-Performance Homes

Environment Systems, Inc.
273 Garland Road Lancaster, NH 03584
603.788.2619
info@enviropowertec.com
www.enviropowertec.com

Enviro Power Technologies creating combined heat and power solutions utilizing Smartwatt technology achieving over 90% efficiencies.

Specialties: Alternative Energy, Manufacturing
Fred Davis Corporation
120 North Meadows Rd., Ste. 3
Medfield, Massachusetts 02052
800-497-2970
info@freddaviscorp.com
www.freddaviscorp.com

Fred Davis Corporation is a leading independent nationwide wholesale distributor dealing exclusively with energy efficient lighting products since 1983. Our company was founded by Fred Davis, who made his start in the energy conservation field during the “Energy Crisis” of the mid-1970’s. He enjoys sharing his knowledge as a speaker at conferences, as well as writing The Lightening Volt, our occasional newsletter on the latest in energy efficient lighting. Whether you are looking for LED screw-ins at the best possible price or far advice on what type of lighting fixture is best for an application, Fred Davis Corporation is your one-stop supplier.

Specialties: Lighting Supply

Futuro Construction
371A Islington St.
Portsmouth, New Hampshire 03801
603-294-4222
matt@futuroconstruction.com
www.futuroconstruction.com

Futuro: Seacoast NH and Southern Maine’s go-to source for Zero Energy Homes and Green Construction.


Garland Mill Timberframes
273 Garland Rd.
Lancaster, New Hampshire 03584
603-788-2619
mail@garlandmill.com
www.garlandmill.com

Garland Mill is a small family-owned business, specializing in the design and construction of heavy timber framed structures and high performance homes. Garland Mill has designed and built a variety of super-insulated buildings over the last 14 years. Net Zero has become a particular sweet spot, but we are excited to pursue any building project that integrates exceptional energy performance with beautiful and durable craftsmanship. While the heart of our business is the design and construction of high performing buildings, the soul of our business resides in our old water powered sawmill that has been in continuous operation since 1856. We use the mill to saw the timber and lumber we use in our homes. When not sawing, the mill’s micro hydro-electric generator produces clean energy.


Geoffrey H. Richon Company, Inc.
19 Duncan St.
Gloucester, Massachusetts 01930
978-283-6063
info@ghrichon.com
www.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 and commercial 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.


George Penniman Architects, LLC
35 Pratt St., Unit 202
Essex, Connecticut 06426
980-767-2822
greg@pennimanarchitects.com
www.pennimanarchitects.com

George Penniman Architects LLC is a full-service, client oriented firm working on large and small scale residential projects, as well as small commercial and institutional projects throughout New England. Our work is characterized by its contextual nature, high performance building practices and environmental stewardship. George Penniman is a Certified Passive House Designer/Consultant and LEED for Homes professional.


GO Logic, LLC
137 High St., 3rd Fl.
Belfast, Maine 04915
207-338-1566
matt@gologic.us
www.gologic.us

We create carefully designed, highly energy-efficient, Passive-House-standard buildings. GO Logic is pleased to announce the launch of the GO Home—a breakthrough product line of high-performance, high-design prefab houses—and thegohome.us, a new website that makes the full line easily available to homeowners anywhere in New England.

Specialties: Passive Housing, Single Family

Godfrey Design-Build
14 Roundy St., #2
Beverly, Massachusetts 01915
978-473-0987
pat@godfreydesign-build.com
www.godfreydesign-build.com

Godfrey Design-Build is a full-service remodeling company serving the North Shore of Massachusetts. Our process allows clients to hire one company for all their design, scope development and construction services.

Specialties: Building Design & Construction, Design Process, Remodeling/DER

Good Energy Construction
197B E Central St.
Natick, Massachusetts 01760
508-653-0510
john@goodenergyconstruction.com
www.goodenergyconstruction.com

Good Energy Construction brings together Boston’s top design and construction talent to create beautiful, healthy, comfortable spaces. We build thoughtful and resilient spaces.


Gotham 360
48 Wall St., 5th Fl.
New York, New York 10005
917-338-1023
jkeaney@gotham360.com
www.gotham360.com

Our energy management and consulting solutions transcend conventional service providers. We are trusted advisors and facilitators with the resources to execute proven energy management strategies. Gotham 360 provides the relevant energy consulting expertise you need with an individualized approach that works with your energy sustainability and procurement goals. Our team provides a number of services including: Energy Procurement, Demand Response Enablement, Data Management and Reporting, Auditing and Rate Analysis, Energy Efficiency, Distributed Energy Solutions – CHP, Solar, Storage, Fuel Cell, Sustainability Management

Specialties: Consultancy, Energy Auditing, Energy Conservation, Engineering, Finance/CPA, Lighting Design, Multifamily, Photovoltaics, Real Estate, Solar Thermal

Green Mountain College / Griswold Library
1 Brennan Ctr.
Poultney, Vermont 05764
802-287-8303
millette@greenmtn.edu
www.greenmtn.edu

Green Mountain College prepares students for fulfilling lives by taking the goal of creating just and sustainable societies as the unifying theme for its interdisciplinary graduate and undergraduate liberal arts education. The College fosters the ideals of environmental and personal responsibility, civic engagement, entrepreneurial spirit, and global understanding.

Specialties: Education

Green River Architecture
11 Hickory Hill Rd.
Great Barrington, Massachusetts 01230
413-528-1108
grarchitecture@me.com

The art of building always is an act of renovation; even the unbuilt landscape provides a context which requires understanding, acknowledgment and respect. Meaning in modern architecture resides in the successful synthesis of ideas about place and tradition.


H2O Degree-Global Water & Energy Solutions
3580 Progress Dr., Ste. L
Bensalem, Pennsylvania 19020
215-785-8485
info@h2odegree.com
www.h2odegree.com

H2O Degree uses a wireless based technology to monitor, control, and quantify utility consumption in multifamily buildings. We provide sub-metering solutions for electric and hydronic heating and cooling, as well as toilet leak detection.

Specialties: Energy Conservation, Energy Auditing, Education

Green Mountain College / Griswold Library
1 Brennan Ctr.
Poultney, Vermont 05764
802-287-8303
millette@greenmtn.edu
www.greenmtn.edu

Green Mountain College prepares students for fulfilling lives by taking the goal of creating just and sustainable societies as the unifying theme for its interdisciplinary graduate and undergraduate liberal arts education. The College fosters the ideals of environmental and personal responsibility, civic engagement, entrepreneurial spirit, and global understanding.

Specialties: Education
Hardwick Post & Beam
272 Fleming Rd.
Hardwick, Massachusetts 01037
413-426-6315
contact@hardwickpostandbeam.com
www.hardwickpostandbeam.com

We are a company of craftspeople. For 33 years we have designed and built beautiful, custom, timber frame structures for clients in Massachusetts, New England, and across the United States. A family company in its second generation of leadership, we have been employing a group of timber framers year-round for more than three decades, and are committed to our people. We are very eager to work with architects and builders who are in the front line of cutting edge energy sustainability and who want to pair their product with the beauty and tradition of a timber frame. Our bottom line is designing and fabricating one frame at a time, bringing all of our resources, passion and experience to delivering the perfect timber frame for each specific client, site, and budget - every time.

Specialties: Building Design & Construction, Construction Process, Design Process

Healthy Home Energy & Consulting, Inc.
230 Tomahawk St.
Yorktown Heights, New York 10598
914-242-9733
info@gethealthyyhome.com
www.gethealthyyhome.com

A leading provider of Home Performance Services in the Tri-State Area, Healthy Home Energy and Consulting is on a mission. For too long, homeowners have been putting up with cold, damp, and inefficient homes. As a sister company to Brenner Builders, our 25 years of experience in residential construction makes us well suited to diagnose, recommend, and implement whole house energy savings solutions. Our own employees use top of the line products and cutting edge equipment, providing you with the highest quality standards possible. We arrive on time, when we say we will, and leave your home neat and tidy when we leave.

Specialties: Consultancy, Indoor Air Quality

Heartwood Group, Inc.
185 Evergreen St.
Providence, Rhode Island 02906
401-861-1650
info@heartwoodsolutions.com
www.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.


Heat-Timer Corporation
20 New Dutch Ln.
Fairfield, New Jersey 07004
973-575-4104
apetruzziello@heat-timer.com
www.heat-timer.com

Heat-Timer is one of the leading manufacturers of automated heating controls for the HVAC/R and Plumbing Industry. At Heat-Timer, our goal is to provide innovative, cost effective control solutions that enhance the comfort and efficiency of new and existing buildings. In doing so, we reduce the environmental impact of building heating systems worldwide, oftentimes within the imperfect framework of existing mechanical systems. For over 75 years, Heat-Timer products have been manufactured in the United States. The diversity of Heat-Timer controls, as well as their extraordinary fine-tuning capability, means improved performance of virtually any building’s heating system - old or new, large or small, steam or hydronic.

Specialties: Commercial & Institutional, Energy Conservation, HVAC, Manufacturing

HELM Construction Solutions
61 Upper Forest St.
Brattleboro, Vermont 05301
802-225-8933
kate@buildhelm.com
www.buildhelm.com

At HELM, we work with owners, designers and builders to create high performance and sustainable building structures and businesses. HELM provides a range of innovative services to help your business and your projects run smoothly and efficiently. We’re here to help support your business in whatever way you need, by offering expertise in business planning, accounting, estimating, job costing, project management, hiring, technology, software, and marketing that is specific to the high performance design and construction industry and the small business world.

Specialties: Building Design & Construction, Construction Process, Consultancy

Heritage Natural Finishes, LLC
P.O. Box 307
Escalante, Utah 84726
541-844-8748
info@heritagenaturalfinishes.com
www.herokuappirstifacts.com

We are Heritage Natural Finishes, our business name was formerly Land Ark Northwest and we called our products Land Ark. We have all the same great finishes and excellent customer service you are used to, just under a new name! We pride ourselves in making and selling the wonderful products famous for it. We are committed to keeping our products safe for those who work with them and especially for those who live with them in their home. We use all super high quality, non-toxic ingredients and try to run an environmentally sustainable office and shop. We recycle nearly everything and try to choose packaging that is recycled, fully recyclable or at least re-usable. We are nearly paperless and are always working to find a better and softer footprint for our business.

Specialties: Manufacturing

Home Energy Technologies
PO Box 364
Chester, Connecticut 06412
877-809-6440
info@homeenergytechnologies.com
www.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 analytical services. Our clients include architects, builders, and owners of single-family and multi-family homes in Connecticut and adjoining areas.

Specialties: Consultancy, Energy Auditing, Energy Conservation

Home Matters Company
15 Indian Field Dr.
South Dennis, Massachusetts 02660
508-237-4675
barr@hommatterscapemod.com
www.hommatterscapemod.com

Home Matters is all about client advocacy and attention to detail because your home does matter! We know that detail done well takes time, effort, and expertise. Our focus is to thoughtfully manage each property as though it were our own.

Specialties: Building Design & Construction, Single Family

Huber Engineered Woods
19325 David Taylor Dr., Ste. 300
Charlotte, North Carolina 28262
704-548-5443
beth.blount@huber.com
www.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.

Specialties: Insulation, Manufacturing, Roofing

Hudson River Design
120 Lighthouse Dr.
Saugerties, New York 12477
845-246-0725
chuck@chucksilver.com
www.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 Building in NY.

Specialties: Building Design & Construction
In Posse
1500 Walnut St., Ste. 1414
Philadelphia, Pennsylvania 19102
215-282-6600
info@in-posse.com
www.in-posse.com
In Posse provides consulting and engineering design services for high performance, deep green projects with a special expertise in net-zero energy. At In Posse, we focus exclusively on the energy and sustainable design sectors of the built environment for clients in a broad range of market sectors. Our services address all aspects of building performance including modeling and analysis of building systems, engineering high performance building systems, commissioning and occupant education and engagement. In Posse is a subsidiary of AKF Group and is headquartered in Philadelphia, PA with an office in New York, NY.

Specialties: Consultancy, Energy Conservation, Engineering

Infrared Diagnostic, LLC
9 Elaine Rd.
Sudbury, Massachusetts 01776
978-440-9900
info@infrareddiagnostic.com
www.infrareddiagnostic.com
Infrared energy audit, Duct Blaster and Blower Door testing. Certified Infrared Thermographer, HERS Rater. Provide consulting to builders, home owners on how to reduce energy consumption. Stretch Code and 2012 ICCI testing.

Specialties: Consumer Information, Energy Auditing, Energy Conservation, HVAC, Insulation, Roofing, Single Family, Electrical

InSoFast, LLC
PO Box 1225
Mitchell, South Dakota 57301
484-668-1414
info@inosfast.com
www.insofast.com
InSoFast, LLC, since 2006, manufactures single component continuous insulation panel. This panel combines do-it-yourself simplicity with cutting edge performance. InSoFast is an engineered alternative to the complex, multi-part conventional field assembled systems. InSoFast’s R-10 continuous panel performs like a continuous insulated membrane that incorporates dual rainscreen layers and 16” o.c. framing. The non-conductive studs are covered with a ½” of foam to eliminate the thermal short circuits that plagues traditionally installed sidings. With millions of square feet in place and thousands of happy customers, why work so hard just to do it right when you don’t have to?


Integral Building & Design, Inc.
231 Main St., Ste. 103
New Paltz, New York 12561
845-255-0418
pasquale@integralbuilding.com
www.integralbuilding.com
Integral Building & Design, Inc. is an independent and locally-based team of building performance professionals committed to energy efficiency and sustainability. Specializing in high performance building and deep-energy retrofits, we provide building professionals and homeowners with resources and experience to achieve maximum home performance. We believe that buildings should be safe, affordable, and made to last generations.


Integrita Architecture + Construction
419 Palmer Ave., Ste. 200
Falmouth, Massachusetts 02540
508-495-6575
info@integrita-ac.com
www.integrita-ac.com
Integrita 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.


Integrated Eco Strategy
85 Main St., Ste. 212
North Adams, Massachusetts 01247
413-884-2571
charley@integratedecostrategy.com
www.integratedecostrategy.com
Integrated Eco Strategy supports project teams as they pursue the most challenging green building design standards. IES provides: integrative design consulting to plan high-performing and healthy buildings, building material research via our proprietary healthy materials database Red2Green, green building certification consulting, Living Building Challenge & LEED. Goals our clients have include creating a healthier indoor environment to promote well-being and increased productivity; smaller energy bills and their associated carbon footprint; Net-Zero Energy; LEED certification – full living or petal certification. We work with clients ranging from billion-dollar thought leaders to grassroots advocates for Justice. Give us a call; we’d like to hear about your green building goals.

Specialties: Building Design & Construction, Commercial & Institutional, Consultancy

Integrated Solar Applications Corporation
121 Spring Tree Rd.
Brattleboro, Vermont 05301
802-257-7493
info@isasolar.com
www.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: Multifamily, Single Family, Mechanical Systems & Lighting, HVAC
Jack Miller Contractors, Inc.  
158 Sand Springs Rd.  
Williamstown, Massachusetts 01267  
413-884-6124  
info@jamillercontractors.com  
www.jmillercontractors.com  
Residential Contractors specializing in high-performance homes and remodeling. We’re a full-service general contractor experienced in a variety of construction and energy retrofit strategies, including ICF, double-stud wall and exterior insulation, air, thermal and water management strategies and mechanical systems. Our goal is to combine traditional craftsmanship with high performance materials and techniques to achieve the holy grail of beauty, durability and performance for our clients.

Specialties: Building Design & Construction, Remodeling/DER

Jim Muku, Window Sales  
193 Silvio O Conte Dr.  
Greenfield, Massachusetts 01301  
413-774-6975  
jimmuk212@gmail.com  
Independent window and door sales representative. Over 36 years of experience in the residential and commercial window and door industry. Providing direct sales of both high performance fiberglass and specialty clad/wood and all wood windows and doors. Alpen Fiberglass Window and Door Direct Sales Representative. Builder and Architect direct price quotes, budget pricing, product service. Homeowner direct sales/service.

Specialties: Windows

John Fulop Associates, Architects and Planners  
103 East Alford Rd.  
West Stockbridge, Massachusetts 01266  
413-232-7122  
john@fulopassociates.com  
www.fulopassociates.com  
John Fulop 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/DER

Johnson Braund, Inc.  
1520 S 2nd Ave. South, Ste. 200  
Seattle, Washington 98188  
206-765-8300  
info@gethealthyhome.com  
www.johnsonbraund.com  
Since 1977, Johnson Braund, Inc. has designed thousands of top quality projects from coast to coast. We provide architecture and interior design services throughout the United States. What began as a handful of architects designing multifamily housing has grown into a company offering much more. From class leading hotels, comfortable homes, to attractive businesses, and lush green parks, we forge ahead, breaking new ground every day. We aim to bring to our designs some of the most sustainable designs and techniques in the industry. From programming and feasibility studies, to schematic design, through construction management, we are the firm for award winning design solutions that are on time and on budget.

Specialties: Architecture

Jones Whitsett Architects, Inc.  
308 Main St., Ste. 3A  
Greenfield, Massachusetts 01301  
413-733-5551  
office@joneswhitsett.com  
www.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

K

Kaplan Thompson Architects  
102 Exchange St. 2nd Fl.  
Portland, Maine 04101  
207-842-2888  
info@kaplanthompson.com  
www.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.


Kent Hicks Construction Company  
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West Chesterfield, Massachusetts 01084  
413-246-0123  
janet@kenthicksconstruction.com  
www.kenthicksconstruction.com  
Our clients often want both high quality and low environmental impact as they build, renovate, or restore their home. They want to reduce energy costs, achieve greater energy independence, and protect their health from toxic chemicals. Whether you want to make your own energy, invest for long-term energy security, live in a ‘healthy’ home, or protect the environment, we have the experience to help you choose the best design and materials for your high-performance green home. We know the full range of products, construction materials, and building processes at all levels. Our team has experience with contractors who can provide a full range of systems for efficient heating, cooling and ventilation, and for generating your own energy.

Specialties: Building Design & Construction, Remodeling/DER

Klepper, Hahn & Hyatt  
5710 Commons Park Dr.  
East Syracuse, New York 13057  
315-446-9201  
jad@khhp.com  
www.khhp.com  
Klepper, Hahn & Hyatt is a multi-disciplinary design firm specializing in structural engineering, landscape architecture, and building envelope systems. We serve the northeastern United States from our office in Central New York. Our firm works in both the public and private sectors to develop projects which are cost-effective, sustainable, and responsive to the needs of our clients.


Kolbert Building  
90 Gray St.  
Portland, Maine 04102  
207-799-8793  
dan@kolbertbuilding.com  
www.kolbertbuilding.com  
We focus on bringing energy efficiency and healthy home techniques to all of our work, from small renovations to complete new houses. We are active members of NESEA, and run a local building science discussion group.

Specialties: Building Design & Construction, Consultancy, Remodeling/DER

KOW Building Consultants  
1034 West Jericho Tpke.  
Smithtown, New York 11787  
631-757-5000  
kevinw@kowbc.com  
www.kowbc.com  
KOW Building Consultants has been a trusted provider of construction consulting services since 1978. We add value to traditional banks, private lenders, mortgage lending institutions, state housing agencies, city housing agencies, mezzanine lenders, and other financial institutions by providing construction loan monitoring, property condition assessment, and technical plan & cost reviews.

Specialties: Consultancy, Finance/CPA

L

LAM Development  
139 W. 82nd St., 6C  
New York, New York 10024  
212-321-0965  
support@lamdevelopment.com  
www.lamdevelopment.com  
LAM Development is New York State’s premier solar developer. Our primary focus is to bring cost-saving renewable power to local municipalities and businesses, enabling communities of all sizes to attain energy security and reduce their energy expenditures. We accomplish this by leveraging our vast network of partnerships with utilities, construction firms, and real estate companies to quickly and efficiently meet the needs of our clients.

Specialties: Alternative Energy

Landmark Services, Inc.  
316 Washington St. Anx.  
Wellesley Hills, Massachusetts 02481  
508-533-8393  
info@landmarkservices.com  
www.landmarkservices.com  
Landmark Services, Inc. specializes in renovating and restoring period homes. We also build new, energy efficient homes inspired by traditional architecture. We believe that saving old homes can and should be a key part of any sustainable housing strategy in New England and beyond. Building Zero Net Energy/Renewable new homes aligns with the principals’ lifelong passion for fostering and supporting sustainable innovation. We believe that it is our highest calling as builders and citizens to be conscious, compassionate stewards of the natural world. Whenever we can we support people and businesses that share this mission.

Lassel Architects PA
370 Main St.
South Berwick, Maine 03908
207-364-2049
info@lasselarchitects.com
www.lasselarchitects.com

Lassel Architects PA is an architectural and planning firm founded in 1989. We have been designing sustainable and energy efficient structures for over 20 years. The firm provides a broad range of services with experience in a variety of project types. All members of our design team are LEED Accredited Professionals and one is also a Building Performance Institute (BPI) Certified Building Analyst. Our portfolio of work includes renovation and new construction projects, in commercial, institutional, health care, retail, multi-family housing and unique single family residences of various sizes and budgets. We treat all of our projects, be they small or large, with the same care and thought to achieve our clients’ goals.

Specialties: Architecture, Commercial & Institutional, Multifamily, Single Family

Lewis Creek Builders
903 Long Point Rd.
North Ferrisburgh, Vermont 05473
802-999-6942
mark@lewiscreekbuilders.com
www.lewiscreekcompany.com

Our Company has four integrated divisions: Design, Build, Energy, and Education. We offer traditional design/build residential services which are coupled with expertise in renewable energy, high performance homes, and passive house construction. What makes us special is our whole systems approach which includes not just the built environment but the education of the public and homeowners in matters related to sustainability and generative living.


Luthin Associates, Inc.
535 Main St.
Allenhurst, New Jersey 07711
732-774-0005
info@luthin.com
www.luthin.com

At Luthin Associates we draw upon our robust industry experience to provide a unique perspective and innovative solutions for our clients. Luthin Associates provides a wide array of energy consulting services to all of the industry sectors predominately in the New York tristate area. We currently conduct business in New York, New Jersey, Connecticut, Pennsylvania, and Massachusetts. In addition, we are also licensed to conduct business in Maryland and Illinois.

Specialties: Alternative Energy, Commercial & Institutional, Consultancy

Maclay Architects
4509 Main St.
Waitsfield, Vermont 05673
802-496-4004
wmap@maclayarchitects.com
www.maclayarchitects.com

Maclay Architects specializes in ecological planning and architecture, healthy building design, micro-load and net zero building design and received the 2012 NESEA Zero Net Energy Building Award. The firm’s project portfolio includes ten LEED Gold or Platinum certified buildings, and ten net zero or net zero ready institutional and commercial projects. Bill Maclay and Maclay Architects authored a book titled: The New Net Zero: Leading-Edge Design and Construction of Homes and Buildings for a Renewable Energy Future, by Chelsea Green Publishing. Bill Maclay, AIA, LEED-AP, and founding principal of Maclay Architects, has been recognized as a leader in innovative, healthy, and ecological planning and architectural design since 1971.

Russia, we are increasingly engaging in participatory design workshops, through which future residents work together to define their visions and design their communities. These same approaches to connecting people and nature.

Specialties: Consumer Information, Education, Public Policy

Mighty Roots is a residential design-build company focusing on healthy, durable, and energy efficient new homes and renovation/addition projects.


Maryann Thompson Architects
741 Mt. Auburn St.
Watertown, Massachusetts 02472
617-964-5107
maryann@maryannthompson.com
www.maryannthompson.com
Maryann Thompson Architects is a Cambridge-based architecture firm that offers a wide range of services to public and private clients. We specialize in architecture that is sustainable, regionally driven and that attempts to heighten the phenomenological qualities of the site in which we work. Our architectural investigations revolve around such concerns as the creation of a rich and thoughtful edge between inside and outside, utilizing light as a medium, and employing warm, natural materials in order to accentuate a sense of place. The firm’s staff of 15 comes from diverse backgrounds, including architecture, landscape architecture, green architecture, planning, interior design and the visual arts.

Specialties: Architecture, Landscape Design

Massachusetts Audubon Society
208 South Great Rd.
Lincoln, Massachusetts 01773
bpoor@massaudubon.org
www.massaudubon.org
Mass Audubon works to protect the nature of Massachusetts for people and wildlife. Together with more than 100,000 members, we care for 35,000 acres of conservation land, provide school, camp, and other educational programs for 225,000 children and adults annually, and advocate for sound environmental policies at local, state, and federal levels. Founded in 1896 by two inspirational women who were committed to the protection of birds, Mass Audubon is now one of the largest and most prominent conservation organizations in New England. Today we are respected for our sound science, successful advocacy, and innovative approaches to connecting people and nature.

Specialties: Consumer Information, Education, Public Policy

Massachusetts Clean Energy Center (MassCEC)
63 Franklin St., 3rd Fl.
Boston, Massachusetts 02110
617-335-9335
info@masscec.com
www.masscec.com
The Massachusetts Clean Energy Center (MassCEC) is dedicated to accelerating the success of clean energy technologies, companies, and projects in Massachusetts—while creating high-quality jobs and long-term economic growth for the people of Massachusetts.

Specialties: Consumer Information, Education, Energy Conservation, Public Policy

McCauley Lyman, LLC
10 Speen St.
Framingham, Massachusetts 01701
508-665-5801
inquiries@mccauleylyman.com
www.mccauleylyman.com
McCauley Lyman is a corporate and commercial law firm with a heavy emphasis on clean energy technology. Its lawyers are highly experienced and excel in all aspects of renewables development, finance, construction, operation, acquisition, and sales.

Specialties: Commercial & Institutional, Construction Process, Consultancy, Finance/ CPA, Public Policy, Real Estate

Mindel and Morse Builders, LLC
PO Box 643
Brattleboro, Vermont 05302
802-254-6662
info@mindelandmorse.com
www.mindelandmorse.com
Mindel and Morse Builders provides clients in the Brattleboro, VT, area with beautiful, comfortable, and efficient homes – be it a new construction or renovation project. Ever since Steve Mindel and Jonathan Morse teamed up over thirty years ago, our focus has been to reach high energy efficiency. We continuously adopt new discoveries from building science and work with our clients to find the best solutions for their individual projects.


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Bryan G. Hobbs
346 Conway St.
Greenfield, MA 01301
Mitsubishi Electric Heating & Cooling
150 Cordaville Rd., Ste. 110
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978-988-5771
rwillet@hvac.mea.com
www.mitsubishelectric-usa.com
For more than 90 years, Mitsubishi Electric has made changes for the better through its energy-efficient products and technologies. These include factory automation equipment, automotive equipment, escalators, elevators, heating and cooling products, commercial hand dryers, large-scale video displays for stadiums and arenas, uninterruptible power supplies, solar panels, semiconductors, display walls, photographic and thermal printers, and electric utility products.
Specialties: HVAC, Mechanical Systems & Lighting, Energy Conservation

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254 Columbus Ave.
Toronto, Ontario K1K 1P6
613-745-6627
moneca@mkdb.ca
www.mkdb.ca
From your initial vision right through to the finishing touches, we will see you all the way home. MKDB is a full-service & build team located in the city of Ottawa. We provide a single point of responsibility and seamlessly integrated in-house design, renovation and building services to see you all the way home.
Specialties: Building Design & Construction

Mulberry Tree Builders, LLC
24 Old Amherst Rd.
Mont Vernon, New Hampshire 03057
603-801-6938
mulberrytreebuilders@gmail.com
www.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. 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 accommodations. 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, Consultancy, Remodeling/DER

N

N Sabella Inc.
393 Central St.
Framingham, Massachusetts 01701
617 462 0179
nick@nsabellawma.com
www.nsabellawma.com
Uncommon dedication to service and craftsmanship. We are a full service, design-build firm specializing in residential remodeling. From renovations to additions, historical homes to contemporary, our experienced, licensed employees are dedicated to superior quality. N Sabella proudly serves MetroWest Boston. Our streamlined process keeps your project plans on budget, reduces design errors while completing your project on time.
Specialties: Remodeling/DER, Single Family

National Grid
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Waltham, Massachusetts 02451
315-481-4295
jackie.vando@nationalgrid.com
www.nationalgridus.com
We are one of the largest investor-owned energy companies in the world - covering Massachusetts, New York, Rhode Island and the UK. We are at the heart of one of the greatest challenges facing our society—delivering clean energy to support our world long into the future. Every day we work with stakeholders to promote the development and implementation of sustainable, innovative and affordable energy solutions. We are proud of the contributions our work and our people make to the prosperity and wellbeing of our customers, communities and investors.

Neighborhood Housing Services of New Haven, Inc.
333 Sherman Ave.
New Haven, Connecticut 06511
203-562-0598
kfay@nhsfonworthaven.org
www.nhsfonworthaven.org
Neighborhood Housing Services of New Haven was incorporated in 1979 with a mission to revitalize selected neighborhoods in New Haven. Over time, our mission has evolved to focus on positioning New Haven’s neighborhoods to succeed by increasing homeownership; making homes beautiful, energy-efficient, and affordable; and helping residents take charge of their neighborhoods. We believe that increased owner-occupancy rates, educated homebuyers, and rehabilitated houses will produce stable, revitalized neighborhoods that our clients will be proud to call home. During the course of our 35-year history, NHS has fully renovated and sold nearly 450 units to low- and moderate-income families.
Specialties: Social Services, Remodeling/DER

Nelson Architech GmbH
Rigistrasse 33
Cham/Switzerland 06330
info@nelsonarchitech.ch
www.nelsonarchitech.com/en
Our services exceed the simple design of buildings. At Nelson Architech we view architecture holistically and in relations to the living habits of its occupants. This way we create sustainable solutions that not just influence the design but also the surrounding environment.
Specialties: Architecture, Design Process

Net Zero Builders
36 Wildberry Ln.
Turner, Maine 04282
207-713-9080
admin@netzero.builders
www.netzero.builders
There are many builders, developers and designers who sell similar concepts and brands. Our company has a long history and background in the modular industry. We have taken what we have learned over the last 25+ years about the modular home manufacturing industry to the next level. As a group we have spent a long time strongly focusing on what drives the building cost/cost per square foot and have learned how to control it. We then developed a system that stream lines the very labor intensive building process while still providing a high level of custom finishes and options. Our system applies to stick built, post frame and modular construction projects.

New Ecology, Inc.
15 Court Sq. Ste. 420
Boston, Massachusetts 02108
617-537-1700
info@newecology.org
www.newecology.org
The mission of New Ecology, Inc. is to catalyze sustainable development and bring its benefits to under-served populations, and to maintain a focus on acting locally to address global environmental issues. We work in many areas of community-based sustainable development, but we devote most of our efforts to green affordable housing. Our focus is on the practical and cost-effective: making new and existing buildings efficient, durable, and healthy.

New Energy Works Timberframers
1180 Commercial Dr.
Farmington, New York 14425
800-486-0661
joinery@newenergyworks.com
www.newenergyworks.com
Thirty years ago we started New Energy Works Timberframing, a small timber frame company. Today, along with our sister company, Pioneer Millworks, we employ over 120 designers, timberwrights, engineers, craftspeople, and community members. Together, we design and build some of the most lyrical and efficient timber frames in the industry, using reclaimed timbers, energy efficient envelope systems, environmentally responsible practices, and state-of-the-art technology and software.
New Frameworks
1 Mill St., Ste. 163
Burlington, Vermont 05401
802-917-4059
info@newframeworks.com
www.newframeworks.com

New Frameworks is a full-service contracting, consultation, and education company specializing in the integration of natural materials and technologies and high-performance building systems. We are passionate about working in healthy environments and creating positive relationships to build structures that are truly sustainable. We enjoy working directly alongside clients in both design and construction, and firmly believe in the importance of social justice and skills access to enable people of all creeds and economic backgrounds access to safe, beautiful, and affordable shelter.


New York State Energy Research and Development Authority (NYSERDA)
17 Columbia Cir.
Albany, New York 12203
518-862-1090
info@nysersa.ny.gov
www.nysersa.ny.gov

NYSERDA offers objective information and analysis, innovative programs, technical expertise, and funding to help New York businesses and residents increase energy efficiency, save money, use renewable energy, and reduce their reliance on fossil fuels.

Specialties: Consultancy

Next Phase Studios, Inc.
344 Boylston St.
Boston, Massachusetts 02116
617-375-9300
info@nps-architects.com
www.nps-architects.com

Next Phase Studios Architects is a collaborative design firm providing full design services for architecture and interiors. We work as an experienced, integrated team and use a dynamic, problem solving approach. As both individuals, and studio members, we strive for a very high level of expertise and effectiveness. This method leads to creative, sustainable, innovative design, building technology, and well managed Project Delivery.

Specialties: Architecture

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stephanie@nriverarchitecture.com
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Stephanie Bassler and Peter Reynolds, co-founders of North River Architecture & Planning have worked together since 2006. During their collaboration, their many and diverse completed design projects in the Hudson Valley and beyond are distinguished by their energy efficiency, and their sensitivity to local context and to the community and client’s highest achievable goals. As Principal of NRAP, Stephanie pursues projects with a strong best-practices approach to sustainability, efficiency, and integration of whole systems design. As Senior Designer, Peter draws on over 25 years of experience with architectural, interior design, master planning, and space planning services that integrate North River’s design values with clients’ diverse needs over a broad range of project scales.

Specialties: Architecture, Building Design & Construction, Multi-family, Single Family

Northeast Sustainable Energy Association (NESEA)
50 Miles St.
Greenfield, Massachusetts 01301
413-774-6051
nesea@nesea.org
www.nesea.org

Founded in 1974, the Northeast Sustainable Energy Association (NESEA) is the region’s leading membership organization helping high-performance building and energy efficiency professionals improve their practices by learning from and networking with each other. We, as professionals in the fields of renewable energy and building, embrace whole systems thinking as the path to sustainability.

Specialties: The Big Picture

Northern Manhattan Improvement Corporation (NMIC)
45 Wadsworth Ave., 8th Fl.
New York, New York 10033
212-822-8300
danieber@nmic.org
www.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 buildings save as much as 35%. NMIC is BPI certified with cumulative staff experience of over 100 years in the energy conservation and retrofit industry.

Specialties: Energy Auditing, Energy Conservation, HVAC, Mechanical Systems & Lighting, Multifamily, Single Family

Noveda Technologies
Bridgewater, New Jersey 08807
908-685-6448
info@noveda.com
www.noveda.com

Noveda Technologies is the award-winning global leader in real-time, Web-based monitoring for conventional and renewable energy systems. Our products and services enable you to lower energy costs, reduce carbon footprint and enhance occupant comfort in you.

Specialties: Alternative Energy, Consumer Information, Conservation, Information Technology

NS Builders
8 Tuckerman St., Unit B
Boston, Massachusetts 02127
617-799-7521
nick@nsbuildersma.com
www.designbuildrepeat.com

Design should follow function and be smart and strong. We believe it should also be innovative and forward thinking, and NS Builders prides itself on being just that. Hand-crafted. One of a kind. We build with our hands, our hearts, and our minds. Precision and attention to detail is what we here at NS Builders are all about. The only way to be the best at something is to work hard at it. With 15 years in the business, NS Builders has the skills and expertise to turn your dreams into a reality.

Specialties: Building Design & Construction, Single Family

October Engineering, LLC
16 October Rd.
Sudbury, Massachusetts 01776
508-561-7553
rm@octoberengineering.com
www.octoberengineering.com

October Engineering offers project development services for energy service performance contracts (ESPC), energy management systems (EMS) design and specification, heating, ventilating and air conditioning (HVAC) energy analysis and design and residential HVAC design. See octoberengineering.com for details and work samples.


Partners For Architecture, Inc.
48 Union St., Bldg. 1
Stamford, Connecticut 06906
203-708-0047
studio@pfarch.net
www.pfarch.net

After a combined 75 years of working for many successful organizations, Partners For Architecture Inc. was inaugurated in 1999 with the dedication to establish an architectural firm that provides comprehensive and environmentally sensitive architectural services.


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Specialties: Landscape Design, Pavement
Petersen Engineering provides green consulting for sustainable, energy-efficient buildings. Charles Polas, LEED AP, can be reached at Charles.Polas@philips.com.

info@petersenengineering.com

335 Maplewood Ave.

Portsmouth, New Hampshire 03802

603-436-4233

207-710-9478

info@petersenengineering.com

www.petersenengineering.com

Petersen Engineering provides green consulting services in the areas of HVAC, plumbing, fire protection, and building envelope for commercial, residential, and institutional buildings.

Specialties: Commercial & Institutional, Consulting, Engineering, Envelope & Enclosure, HVAC, Multifamily, Single Family

Petersen Engineering Group

25 Van Zant St., Ste. 7D

Norwalk, Connecticut 06855

203-810-4191

info@peg-eng.com

www.peg-eng.com

Petersen Engineering Group, LLC has been open since 2000. All employees have multiple years experience in consulting engineering for MEP & FP trades. The team has worked on projects from hotels to marinas & airports. PEG takes part in the energy efficiency incentive program. PEG pays special attention to energy efficiency savings as well as operational & maintenance issues. PEG deals with these issues early in the design stage rather than at the end of the project to ensure a successful lifetime of the building. The principal of PEG is Mr. Donald C. Peterson, PE. He has been in the consulting engineering trade for the past twenty years. Mr. Peterson is a LEED AP with a focus on improving the livability and effectiveness of indoor and outdoor environments, providing everything from functional general illumination to spectacular color-changing experiences that enhance your brand, encourage social interactions, and revitalize communities.

Specialties: Commercial & Institutional, Lighting Design, Lighting Supply, Manufacturing, Multifamily

Pill-Maharam Architects

53 Falls Rd.

Shelburne, Vermont 05482

802-735-1286

dpill@pillmaharam.com

www.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.


Pioneer Millworks

1180 Commercial Dr.

Farmington, New York 14425

800-951-9663

Jennifer@pioneermillworks.com

www.pioneermillworks.com

Pioneer Millworks provides reclaimed timbers to timber frame companies, including our sister company, New Energy Works Timberframers, design professionals, fine builders, and residential customers across the nation. This outdoor living space in Oregon showcases as-found industrial salvaged timbers, one of many available grades.

Specialties: Building Design & Construction

Pioneer Valley Habitat for Humanity

140 Pine St., Ste. 9

Florence, Massachusetts 01062

508-566-5430

admin@pvhabitat.org

www.pvhabitat.org

Since 1989, Pioneer Valley Habitat for Humanity has built decent, affordable homes with 37 low income families in Hampshire and Franklin Counties. We build our homes with volunteer labor and donations of material, supplies, land, and services.

Specialties: Building Design & Construction, Energy Conservation, Single Family, Social Services

PhME [passivhausMAINE]

139 South Freeport Rd.

Freeport, Maine 04032

207-710-9478

info@passivhausmaine.org

www.passivhausmaine.org

We build and design extremely energy efficient buildings. As a Certified Passive House Consultant, we do energy calculations using the PHPP software.

Specialties: Certifications & Standards, Multifamily, Passive Housing, Single Family

Preservation of Affordable Housing (POAH)

40 Court St., Ste. 700

Boston, Massachusetts 02108

617-443-1077

info@poah.org

www.poah.org

Preservation of Affordable Housing (POAH) is a nonprofit developer, owner and operator of nearly 9,000 affordable homes in 9 states and the District of Columbia. Our mission is to create, preserve and sustain affordable, healthy communities that provide economic security and access to opportunity for all people. At POAH we recognize that managing the environmental footprint of our properties is a critical piece of our preservation mission. POAH has committed to both The Big Reach and Better Buildings Challenge, national programs with a target of reducing portfolio wide energy and water consumption but 20% by 2020. Our green initiatives weave throughout POAH activities and impact development, operations, and property management practices.


PV Squared Solar

311 Wells St., Ste. B

Greenfield, Massachusetts 01301

413-772-8788

info@pvsquared.coop

www.pvsquared.coop

PV Squared is proud to be one of the longest standing renewable energy specialists in the Pioneer Valley and Western New England. Since our founding in 2002, we have worked to deliver projects that go above and beyond, both in terms of energy production and financial performance, and in terms of thoughtfulness and attention to detail. Our structure as a worker-owned cooperative means we’re able to offer the benefit of working with an owner of the business through every phase of your project, and that we’ve invested in the long term happiness of our clients, the livelihood of our workers, and the health of our community. Our customer-focused approach has built a reputation for quality and service that is second to none. If you’re interested in talking solar, we’d love to hear from you.


Qnergy

300 West 12th St.

Ogden, Utah 84404

610-390-9360

mia.ciasulli@qnergy.com

www.qnergy.com

Qnergy strives to be a world leader in thermal energy conversion by providing cutting-edge solutions that extract maximum value-of-energy for our customers while preserving the environment. Qnergy was established in 2009 by Ricor Cryogenic & Vacuum, a world leader in the field of miniature Stirling cryogenic coolers. The Company develops and manufactures highly efficient, reliable and cost-effective Stirling engines for various applications including: micro-combined heat and power (CHP), liquidized natural gas solar power generation and solar CHP. Qnergy’s technology will enable residential and business customers to generate power and hot water on-site with a total efficiency of over 90%.

Specialties: Manufacturing
Quebec Government Office in Boston
201 Washington St., Ste. 3850
Boston, Massachusetts 02108
617-482-1153
cq.boston@mi.gouv.qc.ca
www.international.gouv.qc.ca/en/boston
Quebec has maintained an office in New England since 1970, recognizing the region’s importance as a neighbor and a partner in a wide array of sectors. The Quebec Government Office in Boston’s mandate is to defend and promote Quebec’s interests throughout the region and to foster economic, political, artistic, academic and institutional exchanges with the six New England states.
Specialties: Cities & Communities

r3construction_inc.
96 Upham St.
Melrose, Massachusetts 02176
781-844-2621
andrew@r3-inc.com
www.r3-inc.com
r3construction_inc. is a residential builder serving the Greater Boston area. We are a certified Passive House Builder with an in-house PHPP. We are passionate about re-establishing craft into the building process in service of resilient and efficient buildings.


R. J. Aley Building Contractor
185 Wilton Rd.
Westport, Connecticut 06880
203-226-9933
jaley@rjaley.com
www.rjaley.com
We specialize in energy efficient home remodeling, green building & historic preservation. Our projects include additions, bathrooms, kitchens and whole house renovations that blend seamlessly with the architectural style & period details of your home while enhancing its energy efficiency, functionality and comfort. We pride ourselves on attention to detail, and re-enforce our commitment to high standards through ongoing education in energy efficiency and sustainable building materials and methods. We strive to establish a relationship with our clients based on trust and integrity. 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.


R. L. Benton - Builder
154 Schoolhouse Rd.
Center Sandwich, New Hampshire 03227
603-284-6860
rbentonbuilder@gmail.com
Full service builder/designer for energy-efficient residential construction in the NH lakes region. Timber-framing as well as advanced hybrid construction, with expertise in solar thermal system design and installation since 1978. Our Sandwich Cabinet Shop can furnish your project as well.
Specialties: Building Design & Construction, Energy Conservation, Renewables & The Grid

Ra Solar Company
PO Box 2222
Littleton, Massachusetts 01460
802-496-9496
info@rasolarpower.com
www.rasolarpower.com
Builders of energy efficient, solar, green homes, additions & renovations since 1978. We can provide complete design/build services to our clients. We also offer green project consulting, plans modification, and specifications writing.

Rachel Conly Design, LLC
26 Sterling St.
Peaks Island, Maine 04108
207-766-5625
rachel@rachalconlydesign.com
www.rachalconlydesign.com
We specialize in high performance residential design. Our team is dedicated to improving the health of our global home as we tend to the needs of individual homes. We believe in the interconnectivity of our planet and the sanctuary of a simple, safe and carefully crafted house. Since 2008, we have been practicing in the Northeast, sharing our passion for beauty born in the balance of artistry, efficiency and care.
Specialties: Architecture, Design Process, Envelope & Enclosure, Remodeling/DER, Single Family

RBI Solar, Inc.
5513 Vine St.
Cincinnati, Ohio 45217
513-618-7214
info@rbisolar.com
www.rbisolar.com
RBI Solar, Inc. is the leading turn-key supplier of solar mounting systems. As a specialist in ground mount, roof mount, landfill solar, and custom designed specialty solar structures, RBI Solar focuses on providing the most robust solar racking systems, installation services, and project management capabilities to serve owners and integrators. RBI Solar has engineers on staff licensed in all 50 states and offers complete design, high tech manufacturing, nationwide installation, and technical support to help solve the toughest challenges in the industry. Leveraging more than 80 years of experience in the commercial design-build specialty structures market, RBI Solar works with its clients to identify the most economical, durable and robust solution for solar installations.
Specialties: Photovoltaics

Rentricity
175 Varick St., 8th Fl.
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732-319-4501
info@rentricity.com
www.rentricity.com
Providing Clean, Renewable In-Pipe Hydropower Energy Recovery Solutions. Designed for drinking, irrigation, and industrial water operators to reduce energy costs, create resiliency, and establish smart & sustainable water grid infrastructure.
Specialties: Alternative Energy, Manufacturing

Resynergy
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Newton, Massachusetts 02458
781-801-6480
dfpauling@gmail.com
www.resynergysystems.com
We’re dedicated to improving residential energy efficiency through transparency. Most of us have trouble understanding how much energy we use in our homes—a lack of information makes it difficult for any of us to know. As homeowners and renters, we may understand how much our energy costs each year, but we don’t necessarily know how much energy we are actually using or if that energy use is better or worse than other similar homes. We can tell you how efficiently your home is operating by analyzing your home’s energy use and benchmarking it to models that take into consideration the age and size of the home, the climate, and the number of people living in the home.
Specialties: Energy Auditing, Single Family

Retro tec, Inc.
1060 East Pole Rd.
Eveson, Washington 98247
604-732-0142
support@retrotec.com
www.retrotec.com
Retro tec is the world’s leading manufacturer of building diagnostic tools. They make blower doors, duct testers, digital manometers, and air leakage testing software. Retro tec promotes green building through air tightness and enclosure integrity testing with equipment, software & training.

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Salisbury, New Hampshire 03268
603-344-6488
info@rhirvinghomebuilders.com
www.rhirvinghomebuilders.com

Richard Renner | Architects
35 Pleasant St.
Portland, Maine 04101
207-773-9639
info@rennerarchitects.com
www.rennerarchitects.com
Richard Renner | Architects, a full-service architectural firm with offices in Portland, Maine and Sherborn, Massachusetts, is a richly varied practice creating inspired places for living, working, and learning. Environmentally responsible design is a cornerstone of the practice, and for over a decade, the firm has expanded and refined the process of designing effective “green” buildings.
The home-building industry is more dynamic than ever before. As our environmental consciousness grows, the protection of land and natural resources is a mounting public concern. How we build homes, with regards to location, design and choice of materials, is one of the most significant ways we impact our future. At Ridgeview, we offer a holistic, green approach to home building, harmonizing the intricate systems within the home and property to minimize the environmental impact and improve the overall efficiency and healthiness of a home.

Best of all, we care about the bigger picture without compromising aesthetics or the needs of the present. Our award-winning custom design shows that our eye for detail extends through all aspects of the home-building process.

**Specialties:** Building Design & Construction, Remodeling/DER

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Specialties: Consultancy, Design Process, Energy Auditing, Engineering, Multifamily

Spartan Solar 10 Charles St. Greenfield, Massachusetts 01301 413-768-0095 gospartansolar@gmail.com gospartansolar.com Spartan Solar is a full service solar hot water provider based in Greenfield, Massachusetts. Solar hot water is the solar that comes with a battery. Call or see demo at www.solarwave.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.


Solar Store of Greenfield 2 Fiske Ave. Greenfield, Massachusetts 01301 413-772-3121 claire@solarstoreofgreenfield.com www.solarstoreofgreenfield.com Local Western MA renewable energy consultants in a brick and mortar storefront. We provide Advice, Design, installation of Solar PV and Hot Water systems for residential and commercial settings. All projects are turnkey 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 rags, books and Eat More Kale t-shirts are available. Tracking the SUN: Not Fracking Gas

Specialties: Energy Conservation, Photovoltaics, Solar Thermal

Solar Wave Energy, Inc. 31 Cambridge Ter. Cambridge, Massachusetts 02140 617-242-2150 info@solarwave.com www.solarwave.com Solar Wave Energy has been installing and servicing solar energy systems since 1978. Today we provide controller integrated web-based monitoring for solar thermal (heating & hot water) systems allowing installers and building owners to oversee and manage their systems remotely. We currently have integrated performance monitoring for solar controllers including Resol, Caleffi, Stiebel Eltron, Viessmann and more. Call or see demo at www.solarwave.com.

Specialties: Energy Auditing, Energy Conservation, Solar Thermal

Solect Energy Development 89 Hayden Rowe St., Ste. E Hopkinton, Massachusetts 01748 508-598-3511 info@solect.com www.solect.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: Alternative Energy, Photovoltaics

SOTA Construction Services, Inc. 80 Union Ave. Pittsburgh, Pennsylvania 15202 412-766-4630 esota@sotaconstruction.com www.sotaconstruction.com We are a leading regional provider of sophisticated, cost-effective Total Quality Construction Services*. We take pride in our commitment to client satisfaction, personal attention, open communication, continuous process improvement, dedication to sustainability and value engineering. We are proud of the solutions we’ve delivered for our clients. Our client list includes medical, institutional, light industrial and multi-family residential developers—both for-profit and not-for-profit owners.

Specialties: Commercial & Institutional, Construction Process, Multifamily

South Mountain Company 15 Red Arrow Rd. West Tisbury, Massachusetts 02575 508-693-4850 info@southmountain.com www.southmountain.com South Mountain Company, located on Martha’s Vineyard, is a multi-faceted firm offering architecture, engineering, building, interiors, woodworking, and energy services.

Specialties: Building Design & Construction, Energy Conservation, Photovoltaics

Sparhawk Group 81 Bridge St., Ste. 107 Yarmouth, Maine 04096 207-846-7726 admin@sparhawkgroup.com www.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. Early in the company’s history, Sparhawk Group began with pay-for-performance energy efficiency projects delivering 3.5 megawatts of electrical power.

Specialties: Consultancy, Design Process, Energy Auditing, Engineering, Multifamily

SPL Development Group 71 Deer Hill Cir. Pelham, New Hampshire 03076 603-582-0151 spaquette@spllc.com Steve has over 28 years experience in real estate development, construction and property management. After earning a bachelor’s degree in management in 1984, he began working in real estate development, acquiring development sites. He has been a registered Massachusetts Real Estate Broker since 1987. In 1988, Steve began developing multi-family apartment buildings for SK Properties. During that time, he developed over 600 units of elderly and family properties in three New England States. He also developed and managed the build out of several single-family subdivisions, the latter of which was a 42-unit development in the southern part of Manchester, NH, Heritage Common, completed in 1997.

Specialties: Building Design & Construction

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Specialties: Architecture, Design Process
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We are SunCommon, Rochester, Central and Western New York’s Largest Solar Provider. With residential, commercial, and the Rochester region’s first ever community solar option, we’re powering thousands with clean solar energy. SunCommon believes that everyone has the right to a healthy environment and brighter future – and renewable energy is where it starts. Energy from the sun can power our lives and build vibrant communities. Our mission is to tear down barriers to clean energy and use our business as a force for good.
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Worcester, Massachusetts 01608
508-713-6680
info@greenrater.com
www.greenrater.com
Sustainable Comfort, Inc. (SCI) is a green building and energy efficiency consulting firm with expertise in multifamily housing. SCI specializes in ENERGY Star Homes, LEED for Homes, Enterprise Green Communities, Passive House, HERS Rating, State Incentive Programs, and Code Compliance. We are also involved with the property management and development of multifamily buildings. SCI is proficient in the affordable multifamily development process and helps you secure funding and project certifications. We help make it easy to navigate the many options to meet your green building and energy efficiency needs. Our team has over 20 years combined experience in the energy efficiency and green building consulting industry. We have certified over 3,000 units for various programs and certifications.
Specialties: Certifications & Standards, Consultancy, Multifamily, Passive Housing

Sustainable Energy Analytics
4 Militta Dr., Ste. 6
Lexington, Massachusetts 02421
781-652-8282
energystar@sea.us.com
www.sea.us.com
Sustainable Energy Analytics, LLC is dedicated to helping owners of all types of residential buildings (from single family to large multi-family, new and existing) maximize the value of their property by: Reducing the energy consumption, improving the building’s durability and comfort, providing a safe and healthy environment for the occupants, and identifying the most economical path, unbiased by product or technology loyalties.

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info@tagcon.com
www.tagcon.com
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Specialties: Building Design & Construction

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The Green Engineer, Inc. is a sustainable design consulting firm specializing in solutions to design, build, and operate buildings with improved energy efficiency and reduced impact on the environment. Founded in 2005 by Chris Schaffner, PE, LEED Fellow, the firm has a technical staff of fifteen LEED-Accredited Professionals. The expert team brings to the table experience and perspective from a variety of backgrounds including engineering, architecture, construction, planning, development, and public policy.
Specialties: Design Process

The Vallee Group
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The Vallee 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.
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802-685-7974


Timeless Architecture
147 School St.
Milton, Massachusetts 02186
617-696-6448
hmaclean@timearch.com
www.timearch.com

Mr. MacLean is an Architect, Educator and licensed Builder who began his career as a Project Manager with a number of large Architectural firms in Boston before he started his own firm, Timeless Architecture in 1988. He has been promoting and teaching Green Design for 25 years, starting with the Boston Society of Architects, where he served as co-chair of the Committee on the Environment (COTE), a sub-committee of the BSA that promotes sustainable design in the New England Region. He has taught and developed ongoing curricula at the Boston Architectural College, Sustainable Design Institute and Master’s program.


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Treehouse Design, Inc., was founded in 1990 to provide architectural and construction management services for the needs of the vibrant, historically-rich coastal communities of Cape Ann.

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Two Storey Building, started by brothers Doug & Bill Storey in 2001 in Bolton, Massachusetts, is a custom builder of fine, energy efficient, healthy homes, and remodeling projects including whole house remodeling, kitchen, bathroom and basement remodeling, home additions, sunrooms, and decks. Two Storey Building built the first Silver LEED certified home in Massachusetts, many Energy Star Certified and Stretch Code certified homes and Doug Storey has received the Certified Green Professional(CGP) designation from the NABE. Two Storey Building is registered with the EPA and is a Lead Safe Certified Firm under the new Renovation, Repair and Painting (RRP) Guidelines issued by the EPA. Doug, Bill and Mat are all Certified Lead Renovators.


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milton, massachusetts 02186
617-696-6448
hmaclean@timearch.com
www.timearch.com

mr. maclean is an architect, educator and licensed builder who began his career as a project manager with a number of large architectural firms in boston before he started his own firm, timeless architecture in 1988. he has been promoting and teaching green design for 25 years, starting with the boston society of architects, where he served as co-chair of the committee on the environment (cote), a sub-committee of the bsa that promotes sustainable design in the new england region. he has taught and developed ongoing curricula at the boston architectural college, sustainable design institute and master’s program.

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two storey building, started by brothers doug & bill storey in 2001 in bolton, massachusetts, is a custom builder of fine, energy efficient, healthy homes, and remodeling projects including whole house remodeling, kitchen, bathroom and basement remodeling, home additions, sunrooms, and decks. two storey building built the first silver leed certified home in massachusetts, many energy star certified and stretch code certified homes and doug storey has received the certified green professional(cgp) designation from the nabbe. two storey building is registered with the epa and is a lead safe certified firm under the new renovation, repair and painting (rrp) guidelines issued by the epa. doug, bill and mat are all certified lead renovators.

specialties: building design & construction, design process, remodeling/der, single family

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specialties: building design & construction, design process, remodeling/der, single family
Uncarved Block, Inc.
78 Carter Rd.
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brad@uncarvedblockinc.com
www.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.

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The United Illuminating Company (UI), Southern Connecticut Gas Company (SCG) and the Connecticut Natural Gas Company (CNG) are administrators of the Residential and Commercial Industrial energy efficiency programs through the Energize Connecticut initiative. Energize Connecticut (SM) is an initiative dedicated to empowering Connecticut citizens to make smart energy choices, now and in the future. We provide Connecticut consumers, businesses and communities the resources and information they need to create it easy to save energy and build a clean energy future for everyone in the state. Energize Connecticut helps you save money and use clean energy.

**Specialties:** Building Design & Construction, Energy Auditing, Energy Conservation

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**Specialties:** Building Design & Construction, Construction Process, Social Services

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**V**

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Valley Home Improvement is a 3 tiered residential design/build remodeling company serving the Pioneer Valley for more than two decades. In conjunction with our full service remodeling work, Valley Solar offers PV design and installation, and our Weatherization division implements a wide range of energy conservation measures.

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laurie.fielder@vsecu.com
www.vsecu.com

VSECU is a Vermont-based, member-owned credit union. When you join, you’re powering a movement for cooperative finance, neighbor helping neighbor to improve all members’ lives. Our special solar and energy improvement consumer loans feature discounted rates, extended terms and are available for NESEA members to invest in their energy-saving goals. Find out more at vsecu.com/vegreen.

**Specialties:** Finance/CPA

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People. It’s always been about people. Wagner Development from the very beginning has been focused on a different model for business, a model Beyond Profit. Giving respect to our employees and empowering them to create a great client experience. Giving a seamless process and value to our clients. Giving time and resources to the community and those who we can help. Its always been that way. Since day one people have been at the core. That is why we are so concerned with the final product but obsessed with the process because in the process is the value of people.


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www.yankeethermalimaging.com
Yankee Thermal Imaging is an full service energy auditing and insulation construction firm specializing in your residential and commercial energy savings needs. Established in 2008, we are a New Hampshire established business based out of Rochester and servicing the entire New England area.

Specialties: Architecture, Commercial & Institutional, Multifamily, Single Family

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Yestermorrow Design/BUILD School is leading a sustainable design revolution, driven by three core beliefs:

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Zehnder America Inc. provides high quality heating and ventilation solutions to promote comfortable, healthy, and energy-efficient indoor living. Zehnder America is a division of the Zehnder Group, headquartered in Switzerland. The Zehnder Group is represented worldwide and specializes in advanced heating, cooling, and ventilation technology.

Specialties: HVAC

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The Zilkha Center for Environmental Initiatives is committed to protecting and enhancing the natural and built environment in which we learn, work, and live. We research, investigate, support, promote and implement sustainability programs and educational initiatives. We work with faculty, staff and students, and local and national organizations to deepen our understanding of our impact on the earth’s resources and our responsibilities for developing a sustainable future. In working towards that future, we aim to support the global effort to advance environmental sustainability. At the core of our approach is the belief that sustainability means meeting the needs of our current generation without compromising the ability of future generations to meet their needs.

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