

Program



February 7 & 8, 2018
The DoubleTree by Hilton Burlington Hotel
(formerly the Sheraton Burlington)
South Burlington, VT

Putting It All Together—
Integrated Design

How Efficiency Vermont Helped Strengthen Our State in 2016



132,826
MWh saved



136,004
MMBtu saved

\$82,500,000

Net lifetime value of
efficiency investments
Vermonters made in 2016

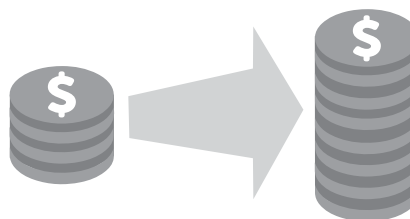


Avoided pollutants

894,251 tons
Carbon dioxide

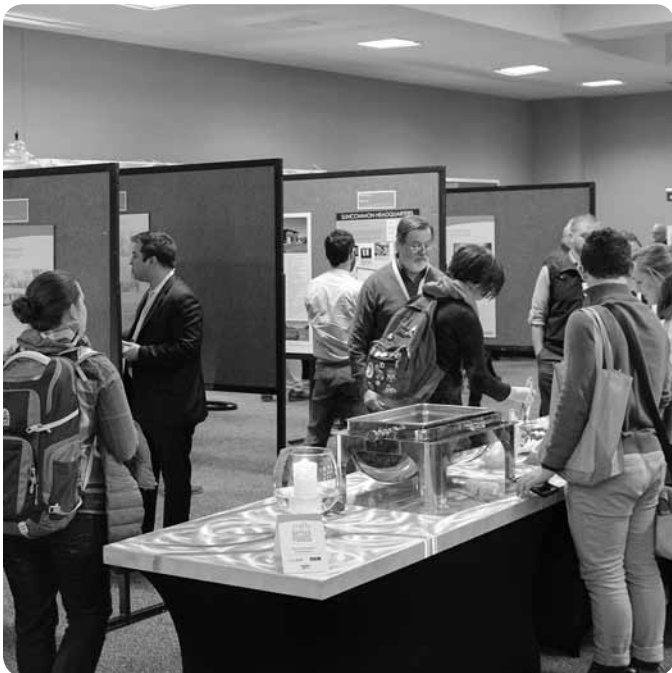
425 tons
Nitrogen oxides

939 tons
Sulfur oxides



Every \$1 invested in
efficiency = \$2 saved¹

¹Investments are Efficiency Vermont's and participants' 2016 costs. Savings are participants' lifetime savings from 2016 investments. Customer Credit is not included.



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Where can you find nearly 1,000 experts on building durability and energy efficiency? At Better Buildings by Design. This annual not-for-profit conference sponsored by Efficiency Vermont brings together top talent in building technology and design from across the country, and helps keep Vermont-area professionals at the forefront of their fields.

Welcome

Welcome to Better Buildings by Design 2018, the region's premier building industry conference!

This year's theme is "Putting It All Together—Integrated Design." New buildings have experienced huge advances in comfort and energy impact through careful design, construction, and detailing of components and systems. As these components and systems continue to evolve, it becomes more important than ever to bring a fully integrated team approach to every project, in order to ensure that buildings are performing as designed. Over the next two days, over 40 workshops will be offered in which you'll learn about success stories, visions for the future, and obstacles to the integrated design process. Our goal is to help you answer the question: How can we foster positive collaboration and a team approach to successful building outcomes?

This year's conference kicks off at 8:30 am Wednesday, February 7, with "Multiple Systems, Multiple Opportunities: Improving Building Performance in the Residential Sector," the keynote address from John Straube of RDH Building Science Inc. and the University of Waterloo.

The workshops that follow will be in five learning tracks: Building Systems, Commercial, Envelope, Healthy Homes, and Lighting. A sampling of workshops: "Passive House Retrofit of a Vermont House," "Why Invest in Building Controls?" "Historical and Contemporary Perspectives on the Viability of Highly Energy-efficient Homes: A Case Study of Alaska," "The Goddess of Green Appraisal Holds Court," and "The Future of Lighting." Many of the sessions carry continuing education credits from AIA, AEE, BPI, and NATE, among others. In the exhibit hall, attendees can speak with more than 60 exhibitors and sponsors displaying the latest commercial and residential building products, technologies, and services. Discover cutting-edge techniques, materials, equipment, and systems for superior building performance, energy efficiency, and indoor air quality.

Award-winning design and construction on display

Winners of Efficiency Vermont's 2018 Best of the Best Awards in Home Performance with ENERGY STAR®, Residential New Construction, and Commercial New Construction will be recognized, and posters of the award winners will be on display throughout the conference.

General public welcome

In addition to the morning keynote, the public is invited and encouraged to attend the Wednesday evening reception. As the largest gathering of building professionals in the Vermont region, Better Buildings by Design is the place to make connections, investigate new practices and technologies, and begin planning any building or renovation project for 2018.

Questions?

We're just a few steps away at the Efficiency Vermont booth, located outside the main exhibit hall.

 Follow us! Better Buildings by Design 2018 on Twitter. #BBD18

Agenda

Wednesday, February 7

7:00 am	Exhibit Hall opens for registration and breakfast	
7:45–11:45	Valuation Resources for Solar Photovoltaic Systems (advance registration required) in Valcour Room	
8:30–10:00	Opening Session: Emerald Ballroom	Welcome
		2018 Efficiency Vermont Awards Keynote Address: Multiple Systems, Multiple Opportunities: Improving Building Performance in the Residential Sector John Straube
10:00–11:50	EEN One-on-One Marketing and Lead Generation Coaching (open to EEN members only; advance registration required) in Willsboro Room	
10:00–10:20	Refreshment break in Lake Champlain Exhibit Hall	
10:20–11:50	Workshops	
11:50–1:20 pm	Lunch in Lake Champlain Exhibit Hall & G's Restaurant	
12:30–1:00	EEN Overview Training in Willsboro Room*	
1:10–5:00	EEN One-on-One Marketing and Lead Generation Coaching (open to EEN members only; advance registration required) in Willsboro Room	
1:20–2:50	Workshops	
2:50–3:15	Refreshment break in Lake Champlain Exhibit Hall	
3:15–4:45	Workshops	
4:00–7:00	Exhibit Hall open to public	
4:45–7:00 pm	Evening reception in Lake Champlain Exhibit Hall	

Thursday, February 8

7:30 am	Exhibit Hall opens for registration and breakfast	
8:30–11:30	Evaluating the Emerging Housing Market: 3-Ms—Modular, Manufactured, and Mobile (advance registration required) in Valcour Room	
9:00–10:30	Workshops	
10:00–11:50	EEN One-on-One Marketing and Lead Generation Coaching (open to EEN members only; advance registration required) in Willsboro Room	
10:30–11:00	Refreshment break in Lake Champlain Exhibit Hall	
11:00–12:30 pm	Workshops	
12:30–1:45	Lunch in Lake Champlain Exhibit Hall & G's Restaurant	
12:30–1:00	EEN Overview Training in Willsboro Room*	
1:30–3:30	Exhibit Hall open to public	
1:45–3:15	Workshops	
3:15–3:30	Refreshment break in Lake Champlain Exhibit Hall	
3:30–5:00	Workshops	
3:30	Exhibit Hall closes, exhibitor tear down	
5:00 pm	Conference adjourns	

* This training satisfies the initial training requirement for EEN enrollment.

Keynote

John Straube, RDH Building Science Inc.



John Straube, Ph.D., P.Eng., is a principal at RDH Building Science Inc., where he heads forensic investigations and leads research projects in the areas of low-energy building design, building enclosure performance,

hygrothermal analysis, and field monitoring of wall assemblies. He is also a prolific writer and a noted public speaker. As one blogger wrote after attending a keynote speech: "he clearly loves what he does."






In addition to his work with RDH, Dr. Straube is a cross-appointed faculty member in the School of Architecture and the Department of Civil and Environmental Engineering at the University of Waterloo. His leadership as a building scientist and an educator has been recognized with multiple awards, including the Lifetime Achievement Award in Building Science Education from the National Consortium of Housing Research Centers (NCHRC) and the Professional Leadership Award from the Northeast Sustainable Energy Association (NESEA).

Exhibit Hall

Stop by the exhibit hall and talk with more than 60 exhibitors and sponsors displaying the latest residential and commercial building products and services.

The exhibit hall is open to the public, free of charge, on Wednesday from 4:00 to 7:00 pm and Thursday from 1:30 to 3:30 pm.

Beverages are available in the exhibit hall during scheduled breaks.

TRACK	DAY 1 • 10:20 AM–11:50 AM	DAY 1 • 1:20 PM–2:50 PM	DAY 1 • 3:15 PM–4:45 PM
 BUILDING SYSTEMS	Adventures in Monitoring Mechanical Systems R & C / Intro • Emerald III	Passive House Retrofit of a Vermont House R & C / Advanced • Diamond I	The Old Hinesburg Police Station—Completing the Zero-energy Project R & C / Advanced • Emerald I
 HEALTHY HOMES	Concrete Detailing for a Low-carbon Future R & C / Advanced • Amphitheatre <hr/> High-performance Homes 1: It's Achievable Now—Integrated Design R / Intro • Diamond II <hr/> Integrated Teams for Young Professionals: Guiding New Homeowners through Deep Energy Retrofits R / Advanced • Emerald II	Design-Bid-Build Is Dead R & C / Intro • Emerald II <hr/> High-performance Homes 2: News from the Field—the Homeowner Experience R / Intro • Diamond II <hr/> Break It Up! How and Why to Separate Interior Spaces R & C / Advanced • Emerald III	The Goddess of Green Appraisal Holds Court R & C / Advanced • Diamond I <hr/> High-performance Homes 3: Selling It—Value, Finance, and Benefits R / Intro • Diamond II <hr/> PVs and Battery Storage in Low-energy Buildings R / Intro • Emerald III
 LIGHTING	Maximize Savings, Maximize Control: The Value of Lighting Design C / Intro • Diamond I	The Future of Lighting R & C / Advanced • Amphitheatre	Lighting in the Connected Transportation Environment C / Intro • Amphitheatre
 COMMERCIAL	Putting It All Together Using Integrated Project Delivery, Passive House, Big BIM, LEAN, Networked Learning, and Respect to Deliver High-performance Buildings at Market Rate C / Advanced • Emerald I	Case Study: Building Enclosure Upgrades at Facilities with High Moisture Emission Rates C / Intro • Emerald I	
 ENVELOPE			Why Are Attics Insulated with Open-Cell Spray Foam So Damp? R / Advanced • Emerald II

DAY 2 • 9:00 AM–10:30 AM	DAY 2 • 11:00 AM–12:30 PM	DAY 2 • 1:45 PM–3:15 PM	DAY 2 • 3:30 PM–5:00 PM
		<p>Real-Life Air Source Heat Pump Performance Testing—Results and Reasons R / Advanced • Emerald I</p> <hr/> <p>Steps to Take Deep Energy Retrofits to Net Zero R / Intro. • Emerald III</p>	<p>Are We There Yet? Air-to-water Heat Pumps and the Journey to Whole Building Renewable Heating R & C / Advanced • Emerald III</p> <hr/> <p>Efficient Pumping Systems: Costs and Cost-Effectiveness R & C / Intro. • Amphitheatre</p>
<p>Hydronic Solutions for Low-energy Homes (Extended Session) R & C / Advanced • Emerald I</p>		<p>Keys to Understanding and Expanding the Market for High-performance, Healthy Homes R & C / Intro. • Emerald II</p>	<p>Sustainable Heating with Automated Wood Pellet Boilers R & C / Intro. • Emerald II</p> <hr/> <p>Is Your Home Making You Sick and Tired? R / Intro. • Emerald I</p>
	<p>Healthy Buildings for Everyone: Tapping into Biology to Grow the Next Generation of Buildings R & C / Intro. • Emerald III</p>		
<p>Making Lighting Controls User Friendly: Limiting the Occupant Revolt C / Advanced • Diamond I</p>	<p>Update on Lighting Standards That Impact Product and System Efficiency and Performance in Vermont and Elsewhere C / Intro. • Amphitheatre</p>	<p>Lighting Design for the Health-conscious Homeowner—How LEDs Compare with Halogen R / Intro. • Diamond II</p>	<p>Smart Buildings and Connected Lighting—the Perfect Partnership? C / Intro. • Diamond I</p>
<p>Putting It All Together—Integrated Design for the Hampshire College R.W. Kern Center in Amherst, Massachusetts C / Intro. • Emerald III</p> <hr/> <p>Retrocommissioning Works C / Intro. • Diamond II</p>	<p>Why Invest in Building Controls? C / Intro. • Diamond I</p>	<p>Inherent Environmental Advantages of Town Living and the Role of the Burlington 2030 District C / Intro. • Amphitheatre</p> <hr/> <p>Establishing a Solid Project Foundation through an Inclusive OPR Process—Lessons from the Field C / Intro. • Diamond I</p>	
<p>Health and Buildings: Demystifying Material Choices in Construction R & C / Intro. • Emerald II</p> <hr/> <p>The Thermal Barrier: Where to Place It? Does It Really Matter? R & C / Advanced • Amphitheatre</p>	<p>Integrative Carbon Building: Embodied Carbon, Net Positive Carbon, and the New Carbon Architecture R & C / Advanced • Emerald II</p> <hr/> <p>Theory and Practice for Attics and Cathedral Roof Slopes in Cold Climates R & C / Intro. • Diamond II</p>		<p>Historical and Contemporary Perspectives on the Viability of Highly Energy-efficient Homes: A Case Study of Alaska R / Intro. • Diamond II</p>

Workshops

DAY 1: WEDNESDAY, FEBRUARY 7

10:20 AM–11:50 AM CONCURRENT WORKSHOPS

Adventures in Monitoring Mechanical Systems R & C / Introductory **EMERALD III**

Marc Rosenbaum, South Mountain Company

How do we know that the mechanical systems we specify are operating the way we think they are? South Mountain Company has a couple of compulsive measurers. This session will examine performance of a high-end energy recovery ventilator over a heating season; the energy usage of residential hot water recirculation systems; operation of multi-zone cold climate heat pumps; and the CO₂ levels and operation of a retrofitted ERV system at an elementary school. If there's time, we may add a segment on radon monitoring. Insights and lessons learned will be freely shared, even the embarrassing ones.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NATE, PHIUS

Concrete Detailing for a Low-carbon Future R & C / Advanced **AMPHITHEATRE**

Russ Miller-Johnson, Engineering Ventures, PC
Ashar Nelson, Vermont Integrated Architecture, PC

Architects, structural engineers, and civil engineers need to contribute to meaningful reductions in carbon from concrete use. In this session, attendees will acquire the technical background and model language to confidently specify and construct more sustainable concrete on every project. The session will cover reductions in Portland cement content, supplemental cementitious materials such as fly ash and slag, and methods for adapting curing time and strength requirements. We will also discuss minimizing the thickness of concrete elements such as slabs on grade, elevated slabs, and walls. In addition, SMART detailing of concrete elements in a building can improve thermal performance and save energy. In exploring the technical aspects of cement reduction, this session will demonstrate how global warming potential can be included in a performance-based specification. Participants will learn about environmental product declarations (EPDs) and how they can be used with or without life cycle analysis (LCA) to verify the global warming potential of various concrete mixes. Ultimately, the session will present model specification language, details, and strategies for achieving more sustainable concrete on all projects.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

High-performance Homes 1: It's Achievable Now—Integrated Design R / Introductory **DIAMOND II**

Karen Bushey, Vermont Energy Investment Corporation
Gregor Masefield, Jr., Studio III Architecture
Cooper Smith-Stackhouse, Silver Maple Construction

High-performance and net-zero homes are gaining remarkable traction in the new construction market. The Efficiency Vermont residential group has worked with well over 100 of these homes in Vermont. This session will begin with the building blocks of efficient home design, exploring the implications of siting, shape, and orientation. It will then dive into slam-dunk, affordable building assemblies, synergies that allow affordable HVAC systems to be incorporated, and how others have transitioned to airtightness levels of 1.0 ACH50 or less. We will discuss items that should never be value engineered, how to get subs on board, and high-performance experience with modular homes. The presenters will speak to how some of the most successful projects have used integrated design work and communication across the project team, and how this can be crucial in achieving benefits such as reduced-cost HVAC and MEP systems. A case study will present the architect and builder perspectives on the process, and how it can result in a building that performs beautifully and affordably.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

Integrated Teams for Young Professionals: Guiding New Homeowners through Deep Energy Retrofits R / Advanced **EMERALD II**

Alex Beck, Brattleboro Development Credit Corporation
Eli Gould, Precraft Services, LLC
Candace Pearson, BuildingGreen
Peter Yost, BuildingGreen

This session will present a particular deep energy retrofit's team structure, decision-making processes, and design challenges through a guided overview of key project components. This pilot project will be of technical interest to many for its use of air-to-water heat pumps, advanced HVAC, and newly available interior insulation materials. Each member of the panel will present his or her own area of expertise and tie it back to the shared vision and goals of the integrated team. For example, one will discuss enclosure, HVAC, and space plan as well as design questions/considerations, another will discuss building envelope and moisture management, and another will talk about healthy and sustainable building products, as well as how her experience facilitating integrated project delivery helped build the current team. The homeowner is a rural economic and community development specialist with a background in environmental science and sustainability, as well as the program director for the Southern Vermont Young Professionals program. He will discuss how a deep energy retrofit/gut rehab can align with nearly all regional and statewide economic development goals, including engaging underserved markets (young professionals and new families).

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

KEY TO WORKSHOP TRACKS

 Building Systems

 Healthy Homes

 Lighting

 Commercial

 Envelope

R = Residential C = Commercial



💡 Maximize Savings, Maximize Control: The Value of Lighting Design C / Introductory **DIAMOND I**

Stephen Beard, NorthEast Electrical Distributors
Ravi Parikh, RAB Lighting

The most common approach to traditional lighting upgrades has been a one-for-one fixture replacement. This approach to lighting upgrades often does not account for proper light levels, occupant comfort and health, or the maximum potential for energy savings. Facilities are beginning to optimize their lighting by reducing the number of fixtures, maximizing utility incentives, implementing networked lighting controls, and making their lighting a dynamic and interactive resource for their staff and patrons. This presentation will discuss these benefits in detail and the resources available to help guide decisions along the way. We will review a local project and describe how lighting design not only offered the benefits listed above but also a few unexpected benefits, all of which helped improve the end user's bottom line.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NCQLP

🏠 Putting It All Together Using Integrated Project Delivery, Passive House, Big BIM, LEAN, Networked Learning, and Respect to Deliver High-performance Buildings at Market Rate C / Advanced **EMERALD I**

Adam Cohen

The climate change imperative combined with political, economic, and social realities in the United States has made a strong case for disruptive change in the building industry. The Build SMART construction system is one tool for high-performance buildings, but it is aimed specifically at the multifamily segment. The presenter has started an initiative to help teams consistently deliver all types of high-performance buildings at market rate using integrated project delivery. The concepts introduced in this session are seeds that need to be tended. Once teams have a basic understanding of concepts, they are invited to become part of a broader community. This community is a no-cost, online, open source networked learning platform designed to help participants hone skills; create, use, and simplify tools and systems; and share best practices in what will be an international community of practice. Each team will adapt to its own environment, and each team will find that some things work and some don't; the vision is that they will share both successes and failures in order

to move the community forward, changing and adapting as they go.

Accreditation: AEE, AFE, AIA LU, ASHRAE, BPI, CSI, LEED, PHIUS

1:20 PM–2:50 PM CONCURRENT WORKSHOPS

🏠 Break It Up! How and Why to Separate Interior Spaces R & C / Advanced **EMERALD III**

John Straube, RDH Building Science Inc.
and University of Waterloo

Expectations for airtightness are steadily increasing. In some areas, builders and architects have become quite good at "building tight" across the building enclosure. But there is less awareness of the hows and whys of sealing between units in multi-unit residential buildings. This session will discuss compartmentalization research and practice, including airtightness test methods, specification, and telltale signs of poor compartmentalization. We will also touch on different HVAC strategies, including the use of individual heat recovery ventilation systems, and look at the pros and cons of each strategy in compartmentalized buildings.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

🏠 Case Study: Building Enclosure Upgrades at Facilities with High Moisture Emission Rates C / Introductory **EMERALD I**

Frederick McKnight, Turner Building Science & Design, LLC

This session will review the upgrade of the building enclosure of a historic landmark building to obtain additional energy efficiencies and the resulting evaluation made to determine the root causes of the moisture-related problems that followed the upgrade of the walls. After completion of the renovation work, which consisted of removing the interior walls (gypsum board, plaster, and lath) and installing insulation within the cavities of the framed wall, and then covering the insulation with a vapor barrier and new gypsum board, the newly applied exterior paint on the clapboard siding began blistering, peeling, and falling off. The presenters' study identified sources of moisture within the facility and the associated migration pathways. This in turn allowed them to recommend a multi-step moisture control system that may lower the current emission rates to levels that can be tolerated by the existing exterior finish system, not require removal and replacement of the exterior finish system, and allow the facility to operate at a high degree of utilization.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

🏠 Design-Bid-Build Is Dead

R & C / Introductory
EMERALD II

Mel Baiser, HELM Construction Solutions, LLC
Erin Rennoldson, HELM Construction Solutions, LLC
Kate Stephenson, HELM Construction Solutions, LLC

This interactive session is designed to introduce builders, architects, and clients to a new way of doing business. Whether it is a clash over who is ultimately responsible for a project going over budget, a struggle getting the architect and client to make timely decisions, or a communication breakdown with the builder, we see the same challenges over and over. As an alternative to the conventional design-bid-build method of creating buildings, the presenters will walk you through what it takes to create an integrated team that benefits all parties. This integrated approach compensates builders for their time in the pre-construction/design and planning phase, helps inform the design by incorporating cost estimating and builder feedback early in the process, and allows the team to create high-performance buildings, both residential and commercial, in which building systems and assemblies work together holistically. Sound complicated? Learn from project managers who facilitate integrated teams, and set your next project up for success.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

💡 The Future of Lighting

R & C / Advanced
AMPHITHEATRE

John Curran, LED Transformations, LLC

The combination of LED and lighting controls represents the future for lighting, as LEDs become the dominant light source and lighting controls become commonplace. This combination will bring new features not possible with conventional sources and systems. However, unlike previous lighting advances, this combination will also upend the industry, forever changing how lighting is used. How will customer needs change? What health benefits will color-changing products provide? Who will support tomorrow's lighting control networks? Why will eliminating (or at least hiding) complexity be the key to future success? What skill sets will tomorrow's companies possess? What do you need to be doing right now to prepare for this future? Attend this presentation and find out.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NCQLP, PHIUS

🏠 High-performance Homes 2: News from the Field—the Homeowner Experience

R / Introductory
DIAMOND II

William Kallock, Integral Analytics
Matt Sargent, Vermont Energy Investment Corporation

High-performance and net-zero homes are no longer a new thing. Hundreds of such homes are now in place across the Northeast, and the time has come to evaluate how they're performing and what we can all learn from the early adopters. One of the presenters recently led a survey in which a dozen of these homeowners were interviewed. He'll discuss perceptions, problems, and what homeowners value most. The session will focus on HVAC in particular. The discussion will include homeowners' (and installers') understanding of cold climate heat pump details (e.g., control settings, thermostat location) and awareness and operation of balanced ventilation systems. The presenters will compare how these HVAC systems are operating versus how those in non-high-performance buildings are operating, and how they impact the homeowners. A case study will also be presented in which the

owner of a high-performance home discusses his experience of the past three years. You'll leave this session with insights gained from others' trials and mistakes and clear takeaways for implementing HVAC systems with fewer problems.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

🔧 Passive House Retrofit of a Vermont House

R & C / Advanced
DIAMOND I

Enrique Bueno, E+ Buildings
Paul Sipple, NECCO, Inc.

This session covers the incremental deep energy retrofit of a 1,200-square-foot house to meet the Passive House standard. The presentation will walk the audience through the energy modeling process to set the retrofit parameters required to meet the Passive House standard, as well as the incremental construction process, materials, and components used through a three-year period to complete the retrofit job. Presenters will compare the initial calculated energy performance of the house with the forecast predicted by the energy model. The house was fully occupied (by two adults and three children) during two of the three phases of the project. The blower door test before the retrofit gave 1,665 CFM50. After the wall cavity insulation and new windows were in place and before outer layers of insulation were completed, a new blower door test showed 48 CFM50, a reduction of 97% of air infiltration.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

3:15 PM–4:45 PM CONCURRENT WORKSHOPS

🏠 The Goddess of Green Appraisal Holds Court

R & C / Advanced
DIAMOND I

Sandra Adomatis, Adomatis Appraisal Service
Jeffrey Gephart, Vermontwise Energy Services, Inc.

Vermont's growing inventory of high-performance homes dramatically outperform their competition. Unfortunately, home performance is usually invisible within real estate transactions. High-performance homes are complex appraisal assignments, as they have unique features compared to traditionally built homes. Most appraisers do not have training about this specialized property type, and without knowledge of the construction methods used and their benefits to the owner, it is difficult for an appraiser to consider them appropriately. Appraiser Sandra Adomatis wrote the book on green appraisal—literally! Where Vermont is making progress in appraiser education and real estate market transformation, it's in great part occurring through application and exposure to training programs she has developed. This session will cover what design, building, and home performance professionals need to do to avoid appraisal problems and to realize contributory value for energy efficiency and renewable energy features as well as identify how available resources in Vermont can support builders' efforts. The real estate market is a system that doesn't function very rationally when energy use and cost aren't accounted for.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

KEY TO WORKSHOP TRACKS

🔧 Building Systems

🏢 Commercial

🏠 Healthy Homes

📦 Envelope

💡 Lighting

R = Residential C = Commercial

🏠 High-performance Homes 3: Selling It—Value, Finance, and Benefits R / Introductory DIAMOND II

Brian Just, Vermont Energy Investment Corporation
Bruce Landry, 5 Star Energy Tech
Jennifer Severidt, Vermont Energy Investment Corporation

In order for consumers and the real estate market to fully embrace high-performance and net-zero homes, both financing and valuation barriers need to be addressed. On the financing side, Efficiency Vermont's residential team is providing new appraisal support documents to enrollees of the high-performance homes (HPH) tier, toward accurate valuing of construction loans. This session will also cover pricing, cash-flow analysis, and bank versus lister appraisal value. We will consider easy-to-quantify items such as energy savings in high-performance homes, and also less well understood factors such as thermal comfort and indoor air quality, whose benefits can be significant. The presenters will introduce tools to evaluate and "price" comfort and air quality in a home and discuss the latest marketing used by others to "sell" high performance in markets across North America. Finally, we will use a recently completed Habitat for Humanity project as a real-world example of costs, financing, and valuation, showing how the pieces can fit together for an achievable high-performance project on a tight budget.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

details. Lessons learned, what worked and what didn't, and tips for future projects will be shared, along with lots of pictures and a video of the construction process.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

🏠 PVs and Battery Storage in Low-energy Buildings R / Introductory EMERALD III

Marc Rosenbaum, South Mountain Company

The next step beyond net-zero energy is pushing to see how much energy used on site can be supplied by the PV system. In sun-tempered superinsulated housing, with a PV system sized to zero out the annual consumption, only about one-quarter of the PV energy is used as it is generated. On-site battery storage makes it possible to drive this fraction up significantly. In this session, we will look at daily and seasonal residential energy use data from low-energy homes. Using a simulation tool that relies on hourly inputs for energy use and PV generation, we'll examine the effects of varying battery and PV array sizing, as well as load variation, on the degree of renewable self-consumption that can be achieved. We'll draw some insights from all this and consider the implications for how we think about design.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

🏠 Why Are Attics Insulated with Open-Cell Spray Foam So Damp? R / Advanced EMERALD II

Martin Holladay, Green Building Advisor

Researchers in all U.S. climate zones are discovering that unvented conditioned attics insulated with open-cell spray foam installed on the underside of the roof sheathing are showing signs of high indoor humidity. In some cases, the moisture content of the roof sheathing in these attics is high enough to raise concerns about possible sheathing rot. The presentation will describe researchers' understanding of the sources of the moisture causing the problem, as well as design guidance to help builders avoid moisture problems in unvented attics. Finally, the presentation will include recommendations for fixing problems in attics that are currently damp.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

💡 Lighting in the Connected Transportation Environment C / Introductory AMPHITHEATRE

Ronald Gibbons, Virginia Tech Transportation Institute
Eric Haugeard, Cree Lighting

Automation is the future of almost all aspects of our lives. For lighting, automation is the key to energy savings, management of the negative aspects of outdoor lighting, and control of the visual environment. The trend toward automation includes transportation, as we move toward autonomous vehicles. Automated and autonomous vehicles are being equipped with sensing systems that replace the human eye and algorithms that replace the cognitive functions that allow humans to drive. This automation will have a significant impact on the infrastructure, and there is huge potential for the integration of lighting in this future. This session will be a discussion of the current status of automated and autonomous vehicles and the possibilities for lighting in this environment.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NCQLP

🔧 The Old Hinesburg Police Station—Completing the Zero-energy Project R & C / Advanced EMERALD I

Richard Faesy, Energy Futures Group
David Pill, Pill Maharam Architects
Chuck Reiss, Reiss Building and Renovation
Andy Shapiro, Energy Balance, Inc.

As a sequel to the 2017 presentation that focused on the design process of converting the old Hinesburg police station to Energy Futures Group's new net-zero energy office building, the 2018 session will present the construction process along with actual energy usage data. How do you turn an 1860s farmhouse into a high-performance building that produces all its annual energy with PV panels on the roof? It's not easy, but the design and construction team kept the zero-energy goal in mind throughout the process and have delivered a high-performance model for future construction projects. The building's owner, architect, energy consultant, and builder will walk through the construction details, highlight key challenges and decisions, and provide energy usage and PV production



8,341

Businesses served



\$9,163,543

Saved by businesses

DAY 2: THURSDAY, FEBRUARY 8

9:00 AM–10:30 AM CONCURRENT WORKSHOPS

Health and Buildings: Demystifying Material Choices in Construction

R & C / Introductory
EMERALD II

Brian Just, Vermont Energy Investment Corporation
Jacob Racusin, New Frameworks Natural Design Build

A growing contingent of homeowners, builders, and architects are interested in the concept of healthier homes. Research points toward the need for wiser material choices—and not just low-VOC paint. Many decisions need to be made early, in the design phase, whereas others come much later, and everyone on the project team must be on board. To make matters more confusing, there are several dozen product certifications or ratings to choose from (e.g., Green Guard, FSC, and Declare). In this session, we will cut through the confusion and outline key strategies to help your team make informed decisions regarding insulation, flooring, countertops, cabinetry, paints, and various other products and finishes. You don't need to be building a LEED, WELL, or Living Building Challenge project to benefit; these solutions work for small renovations and large new construction projects alike. Whether you're looking for simple, low-cost upgrades for a remodeling project or are building for a client with allergies or chemical sensitivities, you'll walk away with ideas that will help put you and your clients at ease.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

Making Lighting Controls User Friendly: Limiting the Occupant Revolt

C / Advanced
DIAMOND I

Shannon Markey, Legrand/Wattstopper

This presentation will offer a practical approach to properly specifying, installing, and commissioning lighting controls. Lighting controls are required by many codes and designed to save energy while enhancing the occupant experience. However, due to improper specification, installation, or commissioning, they often instead become a nuisance to occupants. Building users then bypass the controls (the "occupant revolt") and end up not saving the energy they were intended to save. This seminar will walk attendees through a process that will result in a successful project and happy clients. The presentation will feature real-life examples of the good, the bad, and the ugly. In addition, we will discuss the benefits to owners in terms of ROI and energy savings maximization. All aspects required by energy codes will be covered: occupancy sensors, vacancy sensors, timer devices, daylighting, plug load control, overrides, etc. We will discuss the importance of developing a thorough sequence of operations for each space type in the building. This presentation is meant to be not only informative, but also a bit humorous.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NCQLP

Putting It All Together—Integrated Design for the Hampshire College R.W. Kern Center in Amherst, Massachusetts

C / Introductory
EMERALD III

Chris Chamberland, the Berkshire Design Group
Roger Cooney, Wright Builders, Inc.
Christopher Nielson, Bruner / Cott Architects
Marc Rosenbaum, South Mountain Company

This presentation will give an overview of the Living Building Challenge (LBC) of the International Living Futures Institute. This will include specific LBC "petals" as related to the R.W. Kern Center project at Hampshire College, Amherst, Massachusetts.

The presentation segments will include an overview of the engineering, design, and construction process. We will also take a deep dive into energy requirements and a deep dive into water (pardon the pun), a look at the process needed to make it a reality, the results of the collaborative efforts, and finally the lessons learned along the way! Generous time will be allotted for questions and answers with the panel.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

Retrocommissioning Works

C / Introductory
DIAMOND II

John Grosvenor, Vermont Historical Society
Eveline Killian, Cx Associates
Daniel Tuhus-Dubrow, Cx Associates
Chris Vintinner, Distech Controls Inc.

Retrocommissioning is a whole building approach that seeks to improve how building equipment and systems function together. The mechanism of this work is to focus on the opportunities found through the building automation system (BAS), which has become a feature of not just large but also medium-sized and even small buildings. Retrocommissioning is not a capital improvement project that identifies equipment replacement. Improvements are typically low-cost or no-cost items that correct operational deficiencies such as control sequences and sensor calibration; this can make a huge difference in the building's energy consumption and the occupants' comfort level. Cx Associates and Control Technologies have implemented a retrocommissioning project at the Vermont Historical Society in Barre, Vermont, and have been following the results since May 2017. This presentation will cover the process, the pitfalls, the impact, and the persistence of the benefits, with input from the client.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

The Thermal Barrier: Where to Place It? Does It Really Matter?

R & C / Advanced
AMPHITHEATRE

Laz Scangas, Arnold and Scangas Architects

On which side of the exterior wall should the thermal barrier be located? Does it depend on the building? What if it is a historic building? This presentation will look at two existing masonry exterior wall buildings. One building was a former historic neighborhood school that has been converted into apartments, with the thermal envelope located at the interior side of the existing exterior wall. The other building was a former administration building for the Brandon Training School that has also been converted into apartments, with the thermal envelope located at the exterior side of the existing exterior wall. The presentation will review building components as a whole (thermal envelope, air sealing, windows and doors, mechanical systems, ventilation, electrical systems, and solar) and consider the costs for the installation of each system as well as the current fuel and electrical usage for each building.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

9:00 AM–12:30 PM EXTENDED SESSION

Hydronic Solutions for Low-energy Homes

R & C / Advanced
EMERALD I

John Siegenthaler, Appropriate Designs

Energy codes continue to lower design heating loads. Given these low loads, advocates of low-energy house construction often view hydronic heating as unnecessary. The North American hydronics industry should not concede to the ductless mini-split industry when it comes to keeping occupants

comfortable in low-energy-use houses. This extended session will show how hydronic systems can be tailored to the specific needs of low-energy houses including heating, domestic hot water supply, and even cooling. These solutions offer the benefits of improved comfort, lower distribution energy use, accommodation of many energy sources (both conventional and renewable), and long system life.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NATE, PHIUS

11:00 AM–12:30 PM CONCURRENT WORKSHOPS

Healthy Buildings for Everyone: Tapping into Biology to Grow the Next Generation of Buildings R & C / Introductory EMERALD III

Eric Corey Freed, organicARCHITECT

The way buildings are constructed has remained relatively unchanged for nearly 200 years. The \$9 trillion a year global construction industry is responsible for nearly 60% of climate change emissions, a third of landfill waste, and a shocking array of negative health effects. Even the most advanced construction projects in the world continue to use antiquated techniques of modular assembly, relying on painstaking human effort. Construction is driven by standards and codes to ensure economy and safety, but the process fails to protect people from larger risks. In 2016, the XPRIZE Foundation set out to establish a "moonshot" for construction by creating the XPRIZE for Healthy Buildings. In this session, learn how one team approached this unique opportunity to develop a way to (literally) grow buildings by fusing synthetic biology, genomics, parametric modeling, and 3D printing to create a paradigm shift that could switch us from a PETROchemical world, to a BIOchemical one.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

Integrative Carbon Building: Embodied Carbon, Net Positive Carbon, and the New Carbon Architecture R & C / Advanced EMERALD II

Chris Magwood, Endeavour Centre
Ace McArleton, New Frameworks Natural Design Build
Jacob Racusin, New Frameworks Natural Design Build

Buildings' global carbon impact, and hence our responsibility, is massive: Buildings are responsible for 39–49% of emissions globally. We have made great strides in green building in terms of addressing operational energy consumption (the energy buildings use during their operation), yet our current framework for net-zero energy buildings doesn't account for the carbon pollution created during the manufacturing and distribution of the materials used for green buildings, known as embodied energy. In this session, we will show how systems thinking about carbon and an integrated design approach can change building practices from being a problem to being a solution. We will present data on the impact of the embodied carbon of green buildings; address how to quantify embodied carbon in design/build practices; and discuss present-day carbon-positive construction materials and assemblies, which can reduce the carbon load in the atmosphere, effectively using buildings as carbon-sequestering reservoirs. This can mitigate and even reverse climate change effects. Understanding the carbon cycle, and how we as design/build practitioners can make beneficial choices in our designs, is the next horizon for integrative green building.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

Theory and Practice for Attics and Cathedral Roof Slopes in Cold Climates R & C / Introductory DIAMOND II

Henri Fennell, HC Fennell Consulting, LLC

This session will describe the procedures for diagnosing and correcting insulation and air leakage in attics and cathedral roof slopes, including an overview of the related ventilation issues. Pros and cons of vented and unvented designs will be covered as methods for eliminating problems in advance, or as methods of eliminating problems by changing from one to the other. Presenters will address diagnostic methods and how to prioritize remediation work to maximize return on investment during the presentation of several case studies. The implications of the problems addressed in this process can also be applied to the design and construction of new buildings. Additional program topics will include strategic air sealing (SAS), the use of temperature monitoring in diagnosing and remediating air barrier failures, best practices for avoiding problems in structural foam roof panel installations, and conceptual strategies for approaching ice dam prevention and remediation.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

Update on Lighting Standards That Impact Product and System Efficiency and Performance in Vermont and Elsewhere C / Introductory AMPHITHEATRE

Howard Wolfman, Lumispec Consulting

Traditionally, lighting products and systems have been a slow-moving technology with incremental improvements in efficiency and performance. As LED products and systems have ascended to take over the lighting market, however, their efficiency and performance have reached unprecedented levels and opened new doors of opportunity. This presentation will highlight the rigorous standards development process used in LED product and system standards development; current levels of lighting product and system performance; and issues involving horticultural applications, human-centric design (light and health), flicker, ANSI lighting systems, and DesignLights Consortium Networked Lighting Control systems.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NCQLP

Why Invest in Building Controls? C / Introductory DIAMOND I

Peter Hooper, State of Vermont Department
of Buildings and General Services
Mary Jane Poynter, Vermont Energy Investment Corporation

This presentation will explain how investing in building-wide or campus-wide controls is superior to investing in individual components. Builders can gain more savings from the installation of an efficiency component when thinking more broadly about how the control could be used (for example, having the occupancy sensors that control office lights also send a signal to the DDC system to adjust either the heating/cooling unit or the ventilation). Companies that have more than one site can track performance across multiple buildings with minimal resource investment by the company using a

KEY TO WORKSHOP TRACKS

 Building Systems

 Commercial

 Healthy Homes

 Envelope

 Lighting

R = Residential C = Commercial

SCADA, or supervisory control and data acquisition, system. This presentation will lay out three options for data collection and controls integration: good, better, and best, for companies of all sizes in Vermont.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NATE

1:45 PM–3:15 PM CONCURRENT WORKSHOPS

Inherent Environmental Advantages of Town Living and the Role of the Burlington 2030 District C / Introductory AMPHITHEATRE

Jenna Antonino-Dimare, Burlington 2030 District
Jennifer Green, Burlington 2030 District
Curt McCormack, Vermont House of Representatives
Gretchen Schimelpfenig, Cx Associates

The Burlington 2030 District is working to reduce building energy consumption, water usage, and transportation emissions by 50%. By establishing the business case for these reductions, the district aims to increase owners' asset value, reduce operating costs, and create a healthier environment. This presentation will describe how the district is working to achieve these goals, including the management and structure of the district, and how it connects with the wider 2030 district movement. This presentation will also serve to encourage other communities to create their own 2030 district, and join the wider 2030 Districts Network, a U.S. registered 501(c)(3) nonprofit organization made up of the established 2030 districts throughout the world. The organization's vision is to establish a thriving network of high-performance building districts and cities, uniting communities to catalyze transformation in the built environment and the role it plays in mitigating and adapting to climate change.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

Establishing a Solid Project Foundation through an Inclusive OPR Process—Lessons from the Field C / Introductory DIAMOND I

Jennifer Chiodo, Cx Associates
L. David Keelty, University of Vermont Medical Center

The owner's project requirements (OPR) define the goals for construction projects. Whether it is a new building, a remodel, or a system upgrade, defining the objectives up front for the team helps to ensure project success. Learn all about the OPR document in this interactive session led by professionals experienced in the development and deployment of OPRs on large and small construction projects. The session will cover what an OPR is, its roots in commissioning and LEED, why it is important, how it is used, and details of the OPR development process. Audience participation will be encouraged as we jointly craft an OPR for a conference room meeting space. Participants will receive a sample OPR based on their input two weeks after the session.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED

Keys to Understanding and Expanding the Market for High-performance, Healthy Homes R & C / Introductory EMERALD II

Peter Troast, Energy Circle

The term *high-performance home* can mean many things to a consumer looking to build or retrofit an existing home, especially in a growing marketplace of recognizable brands and certifications, such as Passive House, net zero, and others. During this session, the presenter will review how consumers identify the high-performance home, take a close look at

what statistics exist on who exactly is buying, and discuss how to reach the most likely buyers in the sustainable building arena. He will review search data in aggregate for the energy efficiency industry, helping unpack the homeowner mind-set about trending topics like Passive House, healthy homes, and general green building. The presenter will also cover the foundations of building a brand and online presence that is user-centric and compliant with best practices for maximizing a company's presence in the digital sphere. Participants will walk away with a few strategies for ensuring that their site is designed for lead generation and customer acquisition.

Accreditation: AEE, AFE, AIA LU, ASHRAE, BPI, CSI, LEED, PHUIUS

Lighting Design for the Health-conscious Homeowner—How LEDs Compare with Halogen R / Introductory DIAMOND II

Donna Leban, Light/Space/Design

Homebuyers interested in building or renovating a modern, healthy home are also interested in healthy lighting. How do you make this part of an integrated design rather than an afterthought? What exactly is meant by "healthy lighting"? How do LED light sources compare with halogen in this arena? In this session, we will discuss various concerns people may have read about in magazines and newspapers involving visual color spectrum, color rendering, color temperature, daylighting, low voltage, EMFs, and more. We'll discuss what the known health effects are and how these issues can be addressed with LEDs in residential lighting design. This talk will be based on a case study in which much research was done in satisfying the owner's strict requirements for healthy lighting. The participants in this discussion will be rewarded with a wealth of new knowledge about using LEDs in beautiful and innovative ways that bring lighting design to the forefront in new home design.

Accreditation: AEE, AFE, AIA LU, ASHRAE, BPI, CSI, LEED, NCQLP

Real-Life Air Source Heat Pump Performance Testing—Results and Reasons R / Advanced EMERALD I

Bruce Harley, Bruce Harley Energy Consulting

There's been a dramatic increase in recent years in the use of ductless (and ducted) air source heat pumps in the Northeast. This session will provide an opportunity to learn about cold climate heat pumps from an expert in HVAC and building science. In this session, we'll look at the results of some recent field research, including the presenter's own house, as well as ongoing codes and standards work related to heat pump efficiency. We'll discuss a range of heat pump applications, installation practices that affect efficiency, and some key issues and resources to consider when specifying and sizing heat pumps. This session will include plenty of time for questions and answers, so if you have heat pump experiences or issues you'd like to make sense of, please bring them along.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NATE, PHUIUS

Steps to Take Deep Energy Retrofits to Net Zero R / Introductory EMERALD III

John Call, Home Energy, Inc.

Deep energy retrofits are the poor stepchild of net-zero homes. The same concepts apply although the conditions for each home differ. This session will apply the concepts to three homes built from 1900 to the present. Each home presented different control layer challenges, such as fieldstone foundations and pine board sheathing. The presenter will discuss how to take a deep energy retrofit home to net zero

with renewable energy. He will present solar, air source and ground source heat pump, and heat pump hot water options.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

3:30 PM–5:00 PM CONCURRENT WORKSHOPS

Are We There Yet? Air-to-water Heat Pumps and the Journey to Whole Building Renewable Heating R & C / Advanced EMERALD III

Jake Marin, Vermont Energy Investment Corporation

People in the Northeast are excited about air-to-water heat pumps—for good reason. The majority of our homes are heated with boilers and delivered hot water. Interest in heat pumps is growing rapidly as cold climate options increase in availability. The vast majority of the heat pump installations to date have been ductless. In parallel to the growing popularity of ductless mini-split heat pumps, many in our region are looking for a whole building heat pump solution that utilizes their existing hydronic distribution. Despite the excitement surrounding air-to-water heat pumps, however, the technology has not taken off here the way it has in other parts of the world. This presentation tells the story of this technology: what is holding it back from success, products currently on the market, and what we can expect to see in the future. For those not quite ready to take the leap, we will also discuss how to design a hydronic system to be air-to-water ready at little to no additional cost.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NATE, PHIUS

Efficient Pumping Systems: Costs and Cost-Effectiveness R & C / Introductory AMPHITHEATRE

Stephen Putnam, Grundfos Pump Corporation

Pumping systems account for nearly 20% of the world's electrical energy consumption, but are often overlooked as an opportunity to cut energy consumption and costs. Many users of pumping systems are using old technology and thus unnecessarily overpaying in energy and maintenance costs. Using common terminology and metrics that facilities use to define a cost-effective project, this presentation will illustrate a typical case study that can be found in almost any building in Vermont. We will look at how the controlling ability of the pump will affect the annual costs and life cycle cost of ownership as well as how Efficiency Vermont's incentive programs can impact the cost-effectiveness of a pump replacement project. There's no need to be a pump expert (or even technically savvy), as this session will not cover pump theory; rather, we will show you how to uncover major energy and cost savings opportunities you may have never before considered.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NATE

Historical and Contemporary Perspectives on the Viability of Highly Energy-efficient Homes: A Case Study of Alaska R / Introductory DIAMOND II

Yasmeen Hossain, University of Alaska Fairbanks

This presentation will explore historical and contemporary perspectives on the viability of highly energy-efficient homes in a cold climate region. The case studies used in this presentation are all situated in Alaska. The Alaskan climate is on the extreme end of the spectrum, allowing for the research findings to be adapted to other cold climate regions of the world. The first part of the session will consist of a historical survey of Alaskan homes from pre-contact dwellings to modern homes. Some of the pre-contact homes' energy efficiency features have

been reintroduced in some modern homes, such as a low ratio of square feet to occupant. Following this exploration, the contemporary motivations and barriers to building and owning highly energy-efficient homes are explored. The data was gathered through interviews conducted with homeowners of highly energy-efficient homes and other stakeholders in the building, real estate, and financing industry.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

Is Your Home Making You Sick and Tired? R / Introductory EMERALD I

Ty Newell, Build Equinox

Too many building professionals are designing and constructing homes that sacrifice human health and well-being in order to save energy. This session will discuss how smart ventilation systems can efficiently and automatically maintain excellent indoor air quality. Multiple modes of operation are required for efficient smart ventilation operation. Carbon dioxide, VOCs (volatile organic compounds), and particulates are not effectively managed by passive control in today's high-performance homes. The energy cost of fresh air ventilation in relation to the cost impact on human health and productivity is very low. Field data will be presented that demonstrates the effectiveness of smart ventilation in several homes located in varying climatic regions.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, PHIUS

Smart Buildings and Connected Lighting—the Perfect Partnership? C / Introductory DIAMOND I

John O'Connell, Philips Lighting

IoT, IP convergence, SMART—whatever the terminology, next-generation buildings are now a reality. A range of IP-enabled applications are available, so the challenge for business is understanding how best to design and implement the right solution. In this session, the presenter will share Philips's view on smart buildings and digitization, and how IoT and lighting are delivering additional value for end users and clients, with value beyond illumination through connected lighting. The presentation will include new use cases, project case studies, information about the technology that can make this a reality, and an exploration of the future potential.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NCQLP

Sustainable Heating with Automated Wood Pellet Boilers R & C / Introductory EMERALD II

Emma Hanson, Vermont State Wood Energy Coordinator
Jeffrey Rubin, Sustainable Heating Outreach & Education, Inc.

Get the tools to communicate effectively with your clients who are interested in renewable energy. This presentation will compare and contrast the environmental implications of the best heating options, with particular emphasis on wood pellet boilers. We will take a deep dive into behavioral economics, and discuss the real motivations behind people's green energy choices. This discussion has implications for your business in the new green energy economy. Many clients arrive at the process with preconceptions about their energy choices; this session will help you add effectively to that conversation.

Accreditation: AEE, AFE, AIA LU/HSW, ASHRAE, BPI, CSI, LEED, NATE, PHIUS

KEY TO WORKSHOP TRACKS

 Building Systems

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 Healthy Homes

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 Lighting

R = Residential C = Commercial



Presenters

Sandra Adomatis

Sandra K. Adomatis, SRA, LEED Green associate, is a national speaker on valuing high-performance features. Her background as a real estate appraiser, Realtor, instructor, and course developer brings insight to share with builders, lenders, and real estate professionals. She is the author of *Residential Green Valuation Tools* (2014). She spearheaded the *Appraisal Institute Residential Green and Energy Efficient Addendum*, used by builders, appraisers, and energy organizations around the country. Sandra's delivery is energetic and humorous, featuring life lessons that brought her to be known as the "Goddess of Green Appraisal."

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Jenna Antonino-Dimare

Jenna serves as Burlington's 2030 district director. She is responsible for strategic planning, coordination with, and support for the Burlington 2030 District Steering Committee, oversight of the ENERGY STAR Portfolio Manager Benchmarking Process, and general oversight of the City's 2030 direction and progress. Jenna also serves as the director of the Vermont Green Building Network. She holds a master's degree in landscape architecture (MLA) from Cornell University and a B.A. from Brown University, where she studied ecological design and environmental policy. She also is principal and founder of Elegant Ecology | Landscape Design and Environmental Planning.

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Mel Baiser

Mel Baiser is a partner in HELM Construction Solutions, which works with owners, designers, and builders to create high-performance and sustainable buildings and businesses. Mel has over a dozen years of experience in the construction industry, both in the field as a carpenter and weatherization installer and in the office as a project manager and estimator. Mel has completed certifications with the Building Performance Institute and the Passive House Institute US. Mel is passionate about weaving together efforts for climate justice, building high-performance homes, improving the process of doing construction, and maintaining triple-bottom-line business principles for the professionals involved.

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Stephen Beard

Stephen Beard, LC, has 23 years of experience in electrical distribution, with a focus on lighting project management. He earned his NCQLP Lighting Certification in 2011, is a member of the IES, and is a participating designer in Efficiency Vermont's Lighting Design Program. Stephen enjoys working closely with lighting manufacturers and electrical contractors to find the best solutions to the real-world energy usage, functionality, and budgetary problems that his clients face.

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Alex Beck

Alex Beck studied and worked in rural sustainable development in Ecuador, China, Liberia, and Rwanda, before settling in Brattleboro, Vermont, at the Brattleboro Development Credit Corporation, Windham County's regional development group. As a workforce specialist, he trains, supports, retains, and recruits the millennial and young professional population the Vermont economy needs to thrive. He collected a team of New England's most skilled builders and building scientists to turn a nearly blighted home from the 1850s into a perfect starter family home in downtown Brattleboro. Alex holds an M.A. in sustainable development and a B.S. in environmental science.

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\$503,394

Saved by low-income Vermonters

Enrique Bueno

Enrique Bueno holds a degree in chemical engineering and has 40 years' experience in process industry. For the past six years, he has been a certified Passive House consultant working as senior engineer at E+ Buildings. Enrique is a founding member of the Vermont Passive House organization, presently serving as the board's chair for the organization, and has worked in new construction as well as retrofit energy modeling jobs to meet the Passive House standard.

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Karen Bushey

Karen S. Bushey, AIA, LEED AP, CPHC, joined Vermont Energy Investment Corporation in 2014 as a residential energy consultant with the goal of helping homeowners, builders, and architects create comfortable, durable, low-energy homes that optimize building performance. A licensed architect, certified Passive House consultant, and PHIUS+ rater, Karen has over 20 years of experience in the field of architecture. Karen earned a bachelor of architecture degree from Carnegie Mellon University. Her knowledge of high-performance design and experience working closely with numerous contractors has been key to the success of many residential and commercial projects in New England. Karen is secretary of Vermont Passive House.

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John Call

John J. Call is the president of Home Energy, Inc. He is the principal owner of the business, which was established in 1980. His company built its first energy-efficient home in 1985. Since then, it has built several net-zero homes and performed several deep energy retrofits. John has been installing PV, ground source, and air source heat pumps since 2008. He holds a B.A. in history and political science from Bridgewater State College.

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Chris Chamberland

Chris Chamberland is a civil engineer with the Berkshire Design Group, an award-winning firm of landscape architects, civil engineers, and land surveyors specializing in park and recreation design, site planning, and commercial development based in Northampton, Massachusetts. Recently, Chris has been occupied by the Living Building Challenge's Net Positive Water imperative, which has required him to find solutions that help his projects clear both technical and regulatory hurdles. Chris has a B.S. in civil engineering from Notre Dame and a master's degree in civil engineering from Columbia.

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Jennifer Chiodo

Jennifer Chiodo is a principal of Cx Associates, an engineering consulting firm that improves energy performance for commercial and industrial facilities through energy analysis, strategy recommendation, and implementation and verification of savings. She has over 30 years of experience creating and managing new approaches to energy efficiency in the business sector. She has

fostered the growth of Cx Associates into both a widely recognized leader with deep knowledge of buildings and energy use and a socially responsible business that puts people and the planet ahead of profits. She is engaged in addressing global warming through her professional work and through volunteer roles.

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Adam Cohen

Adam Cohen is a leading North American Passive House practitioner whose innovative work on market-rate delivery of commercial high-performance buildings has touched projects across North America. He has presented technical papers at both national and international conferences. His leadership in commercial Passive House design has made him a sought-after speaker, consultant, and teacher of advanced courses in ultra-low-energy design. He served as vice chair of the Passive House Institute US technical committee for five years and is co-creator and teacher of the Passive House Institute US's builder training curriculum. Adam is a board member of Yestermorrow Design/Build School and Passive Buildings Canada.

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Roger Cooney

Roger Cooney is the vice president of design, sales, and estimating at Wright Builders Inc. (WBI), a general contractor and construction manager based in Northampton, Massachusetts. Wright Builders is Western Massachusetts's leading construction expert and builds to the EPA's ENERGY STAR, USGBC's LEED, and ILFI Living Building Challenge standards. Recently WBI completed construction of the R.W. Kern Center at Hampshire College and the Hitchcock Center for the Environment, also on the Hampshire campus. Both projects are built to the Living Building Challenge standard.

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John Curran

John Curran has spent over 30 years in the area of product development. With 28 patents issued, he has been responsible for a wide range of products. Currently he is president of LED Transformations, LLC, a New Jersey-based technology consulting company specializing in providing guidance to companies entering the solid-state lighting field. He is a member of SPIE, IESNA, OSA, and ASA. He has given numerous talks to the lighting industry on the correct use of LED technology for general illumination applications both for his own company and on behalf of the U.S. Department of Energy.

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Equipment suppliers

Richard Faesy

Richard Faesy is a principal and co-founder of Energy Futures Group in Hinesburg, Vermont. As a certified energy rater, LEED accredited professional, and DOE Home Energy Score assessor, he specializes in residential buildings, technologies, and markets. He has expertise in residential new construction and retrofits; energy rating and labeling; building codes; financing; green building; the integration of renewables and energy efficiency; and effective energy efficiency policy, program design, and implementation. He currently works with clients throughout the U.S. and Canada.

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Henri Fennell

Henri Fennell is a building envelope specialist and architect with 45 years of experience in energy conservation design, manufactured products, and services. His experience has included working as an architect and as a building envelope remediation and commissioning consultant. Henri's major historic projects include the Guggenheim Museum. He has designed several new micro-load buildings, including a cutting-edge net-zero energy research structure in Antarctica. He holds four energy-related U.S. patents, and is often cited in articles related to energy conservation and building performance. He earned a bachelor's degree in architecture from Carnegie Mellon University.

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Eric Corey Freed

Eric Corey Freed is founding principal of organicARCHITECT, a visionary design leader in biophilic and regenerative design. Eric is the author of 11 books, including *Green Building & Remodeling for Dummies* (For Dummies, 2007). In 2012, his business was named one of the 25 "Best Green Architecture Firms" in the U.S., and he was named one of 10 influential green architects. He also holds a prestigious LEED Fellow award from the U.S. Green Building Council.

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Jeffrey Gephart

Jeffrey Gephart is president of Vermontwise Energy Services, Inc., an energy services company in Rochester, Vermont, founded in 1997. He has over 20 years of experience providing residential new construction energy efficiency program design, marketing, and implementation for utilities and, since 2000, for Efficiency Vermont. Jeff works with architects and builders who are building to Efficiency Vermont standards as well as ENERGY STAR Homes, LEED for Homes, National Green Building Standard, and Passive House projects. Jeff leads the Vermont Green Home Alliance (VGHA), which works to increase education and information sharing with appraisers, home inspectors, mortgage lenders, real estate agents, and others.

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Ronald Gibbons

Ronald Gibbons is the director of the Center for Infrastructure-Based Safety Systems at the Virginia Tech Transportation Institute (VTTI). He is also VTTI's lead lighting research scientist. He studies the spectral effects of new light sources on roadways, the visibility of police vehicles, and adaptive lighting on roadways. He is also the PI and project manager for a safety project sponsored by the Federal Highway Administration. The author of over 80 published papers on roadway lighting, photometry, and target visibility, he is also a past president of the Illuminating Engineering Society of North America.

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Eli Gould

Eli Gould left his hometown in southern Vermont in the early 1990s to develop a new dual-major track at Yale in architecture and forestry and then founded the design/build firm Ironwood Brand. After working in the national timber-frame and custom prefab markets, Eli returned to Vermont to lead a small firm dedicated to top-tier projects. The Ironwood Brands now include dedicated manufacturing under PreCraft Inc. and wood product focus under STIX, L3C. Eli's project highlights include a "Best of the Best" Passive House and the Open_1 Prototype home by Bensonwood. Recently he has focused on broader and more affordable mainstream practice.

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Jennifer Green

Jennifer Green staffs the City of Burlington's Sustainability Program, including oversight of the Climate Action Plan and work on BED's net-zero energy strategy. Based in the Burlington Electric Department, Jennifer has over 30 years of community development experience. She has worked in gender equity, national environmental planning, and environmental management with the Peace Corps, CARE International, and the World Resources Institute. In addition to working for the City, Jennifer teaches sustainable development courses at the University of Vermont. She has a master's degree in public administration from Columbia University and earned her Ph.D. in environmental sociology from American University.

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John Grosvenor

John Grosvenor is currently the finance director of the Vermont Historical Society and has lived in Cabot and worked in that capacity for other mission-based organizations for over 25 years, including the Vermont Housing and Conservation Board, High Mowing Seeds, and Hunger Mountain Coop. He has a bachelor's degree from Bowdoin College in environmental studies and government.

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Bruce Harley

Bruce Harley is a recognized expert on energy-efficient residential construction and retrofit. His three decades of experience include hands-on diagnostics, retrofit, and installation of homes and HVAC systems; teaching building science; developing energy software and savings models; and contributing to technical policy and standards development. Known for his ability to provide complex information in an engaging and understandable style, he has authored the acclaimed books *Insulate and Weatherize* (Taunton Press, 2012) and *Cut Your Energy Bills Now* (Taunton Press, 2008), along with numerous articles. Bruce is currently an independent consultant, and was previously technical director of the Applied Building Science group at CSG and CLEAResult.

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Eric Haugaard

Eric Haugaard is the director of product technology for Cree Lighting. His career of 30 years includes a variety of positions focused primarily on advanced lighting systems development. Eric holds a bachelor of science degree in mechanical engineering and completed his post-baccalaureate program studies at NASA/Ames Research Center. He holds 48 U.S. and 16 foreign patents related to lighting technology.

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Martin Holladay

Martin Holladay is a senior editor at Green Building Advisor and *Fine Homebuilding*. His weekly blog, "Musings of an Energy Nerd," focuses on energy-efficient residential construction. He built his first passive solar house in northern Vermont in 1974, and has lived off the grid since 1975. Before working as an editor, Holladay was a roofer, remodeler, and builder. He has also worked as a project manager for a nonprofit developer of low-income housing.

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Peter Hooper

Peter Hooper is an electrical engineer and project manager with the State of Vermont's Energy Office. He works primarily in project development and oversight work, including the planning, completion, and verification of energy efficiency, energy conservation, and renewable energy projects. Prior to working at the State of Vermont, Peter was employed by Northern Power Systems, where he worked on the development and installation of utility-scale wind turbines. He holds a B.S. in electrical engineering from Norwich University.

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Yasmeen Hossain

Yasmeen Hossain recently received her Ph.D. in sustainable development from the University of Alaska Fairbanks. Her expertise is in energy-efficient, sustainable buildings, specifically the role buildings can play in climate change mitigation and adaptation. She has been a research consultant at the Cold Climate Housing Research Center, the Solar Power Electric Association, and the World Bank. She also worked in the solar power industry in utility-scale solar. Yasmeen holds a master's degree from the London School of Economics.

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Brian Just

Brian Just manages Efficiency Vermont's Residential New Construction team and works on a variety of energy efficiency initiatives at Vermont Energy Investment Corporation. He is a mechanical engineer who, after beginning his career designing large-scale custom test equipment, slowly shifted his focus to energy and health. While obtaining his master's degree at the University of British Columbia, Brian researched biomass combustion and indoor air quality. He is RESNET, Passive House (CPHC), and LEED accredited professional certified, and is committed to serving Vermont's residential design and construction community as its members pave the way to a future of highly efficient, healthy, durable homes.

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William Kallock

For the past 27 years Bill Kallock has worked with utilities around the country, designing and evaluating energy efficiency and renewable energy programs, including residential new construction programs. Bill currently works for Integral Analytics, providing analytics tools to the electric industry to optimize the electricity distribution grid to include as much energy efficiency and local renewable generation as possible. In 2012 Bill and his family pursued their dream of building a high-performance house that saves valuable resources and has a strong financial return.

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L. David Keelty

Dave Keelty, B.S., CEM, CHFM, CHC, is the director of facilities planning and development at the University of Vermont Medical Center. He is responsible for sustainable new construction and major renovation projects across the hospital campus as well as in over 30 ancillary facilities. With over 40 years of experience, he has pioneered the use of the owner's project requirements (OPR) document to obtain end-user input, ensuring that design and construction teams have a guide detailing the needs of the people who will use, clean, and maintain construction projects after they are built. Dave has presented at ASHE, VHES, Better Buildings by Design, and more.

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Retailers

Eveline Killian

Eveline Killian is an architectural engineer with over 20 years' experience in commercial and industrial project management and energy analysis. She has extensive experience in energy-efficient building design and operation, efficiency program design and implementation, and measurement and verification of energy efficiency measures. She has performed retrocommissioning of existing buildings as well as new construction commissioning and has calibrated energy models on large commercial and institutional buildings. She has managed the Vermont Forward Capacity Market and the NYSERDA new construction program evaluation engineering teams on the M&V and data analysis for over five years.

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Bruce Landry

Bruce Landry is a BPI-certified ENERGY STAR contractor, DOE qualified home energy assessor, Zero Energy Now contractor, and EPA lead RRP and EMP certified contractor. He was the lead consultant on a multifamily unit in Montpelier with VHCB. His latest project is a net-zero certified Passive House for Habitat for Humanity. His goal is to educate and assist homeowners in making their home as energy efficient as possible, no matter what its age. Bruce also serves his community by volunteering his time and talent as a BPPA board vice chair, Central Vermont Habitat for Humanity Affiliate board vice chair, and Affiliate Building Committee chair.

5 Star Energy Tech

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Donna Leban

Donna Leban is an NCQLP certified lighting designer. Licensed as an architect in 1982, she practiced in Pennsylvania and New Jersey and moved to Vermont to help develop Green Mountain Power's first energy efficiency programs. With one foot in the engineering world and the other in the creative world of lighting, Donna offers lighting design and consulting services to architects, homeowners, businesses, and municipal clients. She also provides professional development seminars and technical review, conducts training courses, and has written a book and articles on lighting for professional publications. Donna holds a bachelor's degree in architecture and an M.S. in advanced building studies from Carnegie-Mellon University.

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Chris Magwood

Chris Magwood is obsessed with making energy-efficient, beautiful, and inspiring buildings without wrecking the planet. He co-founded Camel's Back Construction and has designed or built many homes and commercial buildings, mostly with straw bale technology and renewable energy systems. Chris has authored multiple books on sustainable construction methods, including *Essential Sustainable Home Design* (New Society Publishers, 2017). Chris is director, curriculum developer, and instructor at the Endeavour Centre in Ontario, Canada. He has won numerous design and teaching awards, including a Home Sweet Home Award for Affordable Housing. He is currently finishing his master's degree with a thesis about regulation of embodied carbon for buildings.

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Jake Marin

Jake Marin is the program manager for HVAC and refrigeration at VEIC/Efficiency Vermont. He developed Vermont's first heat pump program and has continued to develop programs and guidelines for the entire Northeast and mid-Atlantic region through his collaboration with NEEP. During the last few years of tracking equipment performance and the diversity of offerings, he has seen the technology improving by leaps and bounds. Although ductless mini-splits get the most attention, there is tremendous potential for air-to-water heat pumps in Vermont given the state's large concentration of hydronic distribution. Jake is excited to bring this new information to the thriving Better Buildings by Design community.

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Shannon Markey

Shannon Markey, LC, LEED AP, IESNA, has been involved in specifying and selling lighting controls for over 20 years in the Western U.S. at the manufacturer's representative and manufacturer level. The majority of this time has been spent within the specification and installation processes, working directly with architects, electrical engineers, lighting designers, electrical contractors, and end users. He is passionate about delivering a positive experience to all customer levels within the construction process.

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Gregor Masefield Jr.

Gregor Masefield, AIA, NCARB, CPHC, owns Studio III architects in Bristol, Vermont. His firm is committed to design with sensitivity to our unique Northeast climate, commitment to the use of native materials, and strong partnerships with talented local craftsmen and builders. Recently Studio III completed two Passive Houses in Addison County, in an evolving quest to develop prototypes for affordable, energy-efficient homes. Gregor holds a master's degree from Rensselaer Polytechnic Institute and a bachelor's degree in geology from St. Lawrence University. He is a member of the AIA and the AIA Vermont Board, and has served on other boards.

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Ace McArleton

Ace McArleton founded New Frameworks Natural Design Build in 2006 to offer green remodeling and new construction services, blending natural building materials and methods with high-performance design. Ace teaches in the Natural Building certificate program at the Yestermorrow School, is co-author of *The Natural Building Companion* (Chelsea Green, 2012), and led his business's conversion to a worker cooperative in 2016. Ace is passionate about finding practical, regional solutions to build healthy, just communities now and into the future.

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Curt McCormack

Curt McCormack was a member of the Vermont House in the 1980s and 1990s representing Rutland. Since 2013 he has represented Burlington's Old North End and downtown in the House. He has chaired the Natural Resources and Energy Committee and the Joint Committee on Energy; he is the co-chair of the National Conference of State Legislatures Natural Resources and Infrastructure Committee. Curt is a LEED-certified environmental consultant and master electrician. Clients have included USAID, the Peace Corps, the State of Vermont, and the City of Burlington. His work includes environmental operations assessments, energy audits, and solid waste system design.

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Frederick McKnight

Frederick McKnight is the senior vice president of building science at Turner Building Science & Design. He has over 30 years of experience in HVAC design, indoor air quality evaluations, and building enclosure commissioning in commercial environments. Frederick McKnight and Turner Building Science are members of ABAA (the Air Barrier Association of America) and BCxA (the Building Commissioning Association). He is a registered professional engineer with the State of Vermont. In addition, he is a LEED accredited professional and certified commissioning authority. He has shaped his career with design, implementation, and commissioning of energy-efficient and healthy building environments.

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Russ Miller-Johnson

Russ Miller-Johnson, P.E., senior engineer/principal, has 37 years of progressive experience in sustainable structural engineering design, including lead engineer roles in management and execution of projects. Russ has been involved in sustainable projects throughout his practice. He is currently serving on the American Society of Civil Engineers (ASCE) Structural Engineering Institute's (SEI's) Sustainability Committee. In this capacity, he co-authored the masonry section of ASCE's *Structural Engineer's Guide to Sustainability*. Russ chairs the SEI Sustainability Committee's

Thermal Bridging Working Group. He leads the EV Green Team's implementation of structural material reuse, life cycle analysis, and CO₂ load work.

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Ashar Nelson

Ashar Nelson is a lifelong Vermonter with extensive experience in design and construction. As co-founder of Vermont Integrated Architecture, occasional faculty member in the architectural studies program at Middlebury College, and past faculty advisor to the college's Solar Decathlon, he is committed to promoting sustainable building designs and innovative construction methods. Ashar believes that an integrated design process, representing users, constructors, estimators, and craftspeople, is essential in achieving high-performance buildings. He holds a bachelor's degree from Middlebury College and a master's degree from the University of Oregon. Ashar prides himself on helping his clients make well-informed decisions about energy and resource use in their buildings.

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Ty Newell

Ty is a co-owner and co-founder of Build Equinox, which manufactures the CERV smart ventilation system for residences. He retired from the University of Illinois as an assistant dean in the College of Engineering and is an emeritus professor of mechanical engineering. Ty has lectured around the world on indoor air quality, comfort, solar energy, building energy efficiency, and resource conservation. He was a Fulbright Scholar in Argentina. Ty lives in a 100% solar-powered home that includes automated fresh air control and rainwater harvesting. Build Equinox is located in a 4,500-square-foot facility that is also 100% solar powered.

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Christopher Nielson

Christopher is an architect with Bruner/Cott Architects. He is interested in design that builds community while addressing the impact of climate change. With a high level of expertise in construction technology, community outreach, and high-performance design, Christopher leads project teams to identify common goals and specific solutions. Most recently, Christopher managed the R.W. Kern Center project at Hampshire College. A natural teacher, he has lectured at the University of Oregon, Middlebury College, Hampshire College, and the Boston Architectural College. Currently, Christopher serves as a committee member on the Climate Action Protection Committee for the city of Cambridge, Massachusetts.

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John O'Connell

John O'Connell is the director of end user sales at Philips Lighting. John positions Philips's smart building technologies to the office, industry, and healthcare vertical markets.

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73,554

Households served



\$9,154,075

Saved by households

Ravi Parikh

With years of experience managing and implementing utility efficiency programs, Ravi Parikh now works as business development manager for RAB Lighting, where his focus is educating industry members on the value in maximizing energy savings through the use of lighting design and networked lighting controls. As a member of the IES Energy Efficiency Program Committee and Efficiency Maine's Networked Lighting Controls Advisory Group, Ravi has established himself as an advocate for energy-efficient lighting. His work includes education and training for various local utility programs, including Efficiency Vermont, Burlington Electric Department, National Grid, Eversource, and Efficiency Maine.

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Candace Pearson

Candace Pearson is currently a student at Vermont Law School, where she is studying how to draft integrated project delivery contracts for high-performance buildings. Candace got her start as a writer at BuildingGreen, Inc., where she published articles on such topics as healthy materials and indoor air quality. As she moved into consulting, she began facilitating integrative process workshops and was amazed to see how offering building professionals the chance to collaborate resulted in an altogether better project. She has since worked to execute the first integrated project delivery contract in New England for the construction of a circus trapezium in Brattleboro, Vermont.

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David Pill

David Pill is the principal of Pill-Maharam Architects, a small firm in Shelburne, Vermont. He has a master's degree in architecture from Washington University and a bachelor's degree in philosophy and art history from Lake Forest College. David has been a practicing architect for 25 years licensed in New England and New York. David founded Pill-Maharam Architects in 1991 and has been involved with sustainable design practices since its inception. David's passion lies in creating sculptural and pragmatic environmentally responsible buildings that produce zero carbon emissions. Pill-Maharam Architects' work has been widely published, and the firm has received a number of local and national awards.

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Mary Jane Poynter

Mary Jane Poynter is a senior energy consultant at the Vermont Energy Investment Corporation. She specializes in commercial, governmental, industrial, and multifamily building energy projects, working primarily with Efficiency Vermont and DC Sustainability Energy Utilities. A 20-year veteran of the energy efficiency industry, she has worked on projects across the spectrum of new construction and renovation, and in the affordable housing market. Mary Jane is a certified energy manager, a certified master gardener, and a 17-year member of her local ASHRAE chapter. She holds a B.S. in mechanical engineering from the University of Minnesota.

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Stephen Putnam

In 2011, Stephen Putnam joined the Grundfos commercial buildings competency center as an applications engineer managing large-scale pumping projects. In 2015, Stephen became the inaugural member of the Grundfos utility engagement team, working with electric utilities across North America on the implementation of efficient pumping system incentive programs. Currently, he is the national accounts manager for the Grundfos domestic buildings team, managing relationships with national wholesalers. Stephen holds a degree in economics and business from the Virginia Military Institute. He is also an executive MBA candidate at the College of William & Mary.

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Jacob Racusin

Jacob Deva Racusin is co-owner of New Frameworks Natural Design Build, offering green remodeling, new construction, consultation, and education featuring natural building technologies. Through his work as a designer, builder, consultant, and educator, Jacob is able to merge his passions for fine craft, ecological stewardship, relationship to place, and social justice. Jacob is program director of the certificate in building science and net-zero design at the Yestermorrow Design/Build School, and is a BPI-certified contractor and certified Passive House consultant. Jacob wrote *Essential Building Science* (New Society, 2016) and *The Natural Building Companion* (Chelsea Green, 2012), which he co-authored with Ace McArleton.

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Chuck Reiss

Chuck Reiss is the owner of Reiss Building and Renovation, building high-performance, net-zero energy homes and moving existing homes closer to net-zero energy since 1982. Chuck is one of the founding members of Building for Social Responsibility and a director of the Building Performance Professional Association of Vermont. A certified BPI professional and a Home Performance with ENERGY STAR contractor, he is dedicated to getting existing homes off fossil fuel through a combination of energy efficiency, renewable energy, and heat pumps. Chuck is also an adjunct professor at UVM and is chair of the Hinesburg Energy Committee.

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Erin Rennoldson

Erin Rennoldson is a project manager at HELM Construction Solutions, a Vermont-based firm working with owners, designers, and builders to create high-performance and sustainable buildings and businesses. Erin has spent the past decade in the construction industry. Her knowledge of interior design, kitchen and bathroom cabinetry, windows and doors, and plumbing and lighting fixtures positions her well to support clients during the selection process. With a B.A. in environmental science, Erin is constantly seeking ways to lessen our footprint on the planet, from the simple tasks of specifying locally sourced and sustainable materials, to the big picture of being a part of creating high-performance buildings.

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Marc Rosenbaum

Marc Rosenbaum, P.E., is a longtime student of making great buildings. He uses an integrated systems design approach to help people create buildings and communities connected to the natural world, supporting both personal and planetary health. Much of his recent work has been net-zero energy buildings, deep energy retrofits, and Passive Houses. His work has been recognized nationally by ASHRAE, AIA, EEBA, and NESEA, but they didn't see all the mistakes along the way.

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Jeffrey Rubin

After 30 years of running an ad agency it was time to switch gears and pay it forward. Over the past 10 years, Jeffrey's core project has been to unlock the puzzle of market awareness for wood pellet boilers—an industry in which he has both worked professionally and volunteered countless hours. He was drawn to this cause because of its potential to reduce CO₂ emissions, protect forests, and create economic resiliency. He founded Sustainable Heating Outreach & Education, Inc., together with a team of industry, branding, and financial experts with the mission of creating a grassroots environmental movement.

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Matt Sargent

A former builder and current senior energy consultant within the Efficiency Vermont residential new construction team, Matt has three decades of building and consulting experience. He was involved in a number of Vermont's early high-performance homes, helping design and construction professionals bridge the gap between standard practice and the next generation of materials, design, and construction methods. He is passionate about helping Vermonters transform the residential building market.

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Laz Scangas

Laz Scangas, AIA, is a principal at Arnold and Scangas Architects, located in downtown Saint Albans, Vermont. Laz believes in providing clients with efficient, comfortable, and healthy living environments that are easy to use, easy to maintain, energy efficient, and beautiful. He is committed to balancing innovative green building technologies with long-standing good design practice and understands that sustainability begins with an integrated team process. The firm specializes in restoring and renovating historic buildings and working on efficient, tight building envelopes, as well as comfortable and well-designed affordable housing projects.

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Gretchen Schimelpfenig

Gretchen Schimelpfenig, P.E., serves as the Burlington 2030 District's project engineer. In this role, Gretchen provides technical expertise to the steering committee and property owner members. She provides building benchmarking services and develops technical resources, works directly with members to help them take action on energy efficiency opportunities, and supports the district

director in strategic planning and progress reporting. Gretchen is also an engineer at Cx Associates, a building commissioning firm providing energy efficiency consulting services to commercial building projects across New England. Gretchen received her M.S. in civil engineering from Stanford University and her B.S. in architectural engineering from the University of Wyoming.

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Jennifer Severidt

Jennifer Severidt has been in the building energy industry for 12 years, getting her start as an auditor at a local weatherization agency. Two of her passions are residential buildings and environmental conservation, and at Vermont Energy Investment Corporation she is able to pursue both. As a residential energy consultant, Jen applies her knowledge to the new construction industry, helping homes get built right the first time, and continues to work with low-income customers as needed. She is a graduate of Mount Holyoke College, a member of the SEON Building Science Guild, and an accredited green verifier for the National Green Building Standard.

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Andy Shapiro

Andy Shapiro, president of Energy Balance, Inc., has provided high-performance building energy analysis, design, and monitoring consulting services for 30 years to clients including owners, architects, engineers, builders, housing developers, universities, businesses, and efficiency programs. He provides guidance in conceptualization, design, construction, commissioning, and post-occupancy assessment, for optimizing the environmental impact of the building, indoor environmental quality, operating and maintenance costs, and building durability. He works with new and existing buildings, from single-family homes up to larger institutional buildings. He is also the director of science and engineering for the Vermont Energy Education Program, bringing along the energy literacy of the next generation.

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John Siegenthaler

John Siegenthaler, P.E., is a mechanical engineering graduate of Rensselaer Polytechnic Institute, a licensed professional engineer, and professor emeritus of engineering technology at Mohawk Valley Community College. "Siggy" has over 35 years of experience in designing hydronic systems. He is a member of the Radiant Panel Association Hall of Fame and principal of Appropriate Designs, a consulting engineering firm. He is the author of two textbooks: *Modern Hydronic Heating* (Delmar Cengage Learning; 3rd ed., 2011) and *Heating with Renewable Energy* (Delmar Cengage Learning, 2016). He has worked closely with NYSERDA on implementation of hydronic-based biomass heating systems.

Appropriate Designs
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Paul Sipple

Paul Sipple is the owner of the New England Construction Company (NECCO, Inc.) and has been operating as a general contractor for 33 years. Paul started in the residential market and after a few years pursued the public-sector construction market. He kept his hands in the residential market and, four years ago, became a certified Passive House builder. In those four years Paul has completed deep energy retrofits on apartments, offices, and single-family houses. They now all use heat pumps as their sole source of heat. Paul's current project will be one of the few retrofitted to a Passive House standard in Vermont.

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Cooper Smith-Stackhouse

Cooper Smith-Stackhouse is a second-generation carpenter, living in Addison County, Vermont. Employed by Silver Maple Construction in New Haven, he specializes in building high-performance homes. Cooper has been instrumental in the recent successful completion of several high-performance homes and Passive Houses in Vermont.

Silver Maple Construction
50 River Road, New Haven, VT 05742
802-989-7677 • cooper@silvermapleconstruction.com

Kate Stephenson

Kate Stephenson is a partner in HELM Construction Solutions, which works with owners, designers, and builders to create high-performance and sustainable buildings and businesses. She's worked with businesses and nonprofits to achieve triple-bottom-line metrics, develop business systems, and plan for a dynamic and resilient future. She led the Yestermorrow Design/Build School for over 13 years. Kate is a facilitator for NESEA's BuildingEnergy Bottom Lines program, chairs the Montpelier Energy Advisory Committee, and serves on the board of the Urban Death Project and the Vermont Council on Rural Development. She holds an M.S. in management from Antioch University New England.

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Peter Troast

Peter Troast is recognized as one of the country's foremost authorities on marketing for home performance, HVAC, and other efficiency-related contracting companies. He and his team work with over 350 companies in 49 states to grow their business through services like website design and development, search engine optimization, lead generation, and strategic content production. He is a popular and high-ranking speaker about marketing for builders and contractors at ACI, RESNET, ACCA, BPI, and EGIA conferences and events. In 2015, Peter received the Tony Woods Award for excellence in advancing the home performance industry.

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Daniel Tuhus-Dubrow

Daniel Tuhus-Dubrow, LEED AP BD+C, O+M, BEMP, EIT, is a mechanical engineer focused on improving energy efficiency and reducing energy costs in buildings. He has over 10 years of experience in energy auditing and retrocommissioning activities, including several for Local Law 87 (New York City) and Executive Order 88 (New York State) compliance as well as throughout New England. He has experience with LEED certification, energy modeling, and energy efficiency design and measure implementation verification.

Cx Associates
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Chris Vintinner

Chris Vintinner is a sales support engineer for Distech Controls Inc., where he is driven to make the built environment smarter, more comfortable, and more energy efficient. Chris has worked closely with building owners, operators, and engineers in commissioning, retrocommissioning, and building retuning projects. He is experienced in both the design and optimization of intelligent building systems including lighting, HVAC, and building data analytics.

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Howard Wolfman

Howard Wolfman, P.E., has a career that spans decades of engineering and technical work with an emphasis on both creative and strategic thinking. In 2008, he started Lumispec Consulting, whose clients include many lighting manufacturers, government bodies, and nonprofit organizations. His current activities include serving as an adjunct professor at the University of Illinois at Chicago College of Engineering. Howard also has served on many U.S., Canadian, and international standards development bodies and has received numerous awards. He has served as a member of several Lightfair International Innovation Awards selection committees. Howard holds a B.S. degree in electrical engineering and an MBA.

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Peter Yost

Peter Yost is a principal and vice president of building performance with BuildingGreen, Inc. in Brattleboro, Vermont. He has been building, researching, teaching, writing, and consulting on high-performance homes for more than 25 years. His expertise includes construction waste management, advanced framing, energy efficiency, and building durability. Peter was the principal author of the NAHB Advanced Green Building: Building Science course materials and a co-author of the USGBC REGREEN workshop curriculum. Peter is currently technical director for GreenBuildingAdvisor.com and an instructor for several prestigious institutions. He holds a B.S. in agronomy from Virginia Tech and an M.S. in resource economics from UNH.

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 www.swaneylighting.com

Since 1991, Swaney Lighting Associates has provided complete interior, exterior, and controls lighting packages to Maine, New Hampshire, and Vermont. Our applications personnel can provide lighting and controls layouts for all projects.

ThermalBuck Stakeholder Sponsor / Booth: Second Floor
 John Brooks
 1270 Route 66, New Bethlehem, PA 16242
 888-814-2825 • jbrooks@brincbp.com
 www.thermalbuck.com

ThermalBuck is a high-performance window buck, designed to solve the challenges of installing nail flange windows with continuous insulation. It extends the mounting point for windows and doors to create a flush plane for cladding, and insulates with an R-value of 4.4 per inch, limiting thermal bridging in the building envelope.

Thermostat Recycling Corporation Booth: Second Floor
 Danielle Myers
 500 Office Center Drive, Suite 400, Fort Washington, PA 19034
 267-513-1726 • danielle.myers@thermostat-recycle.org
 www.thermostat-recycle.org

Nonprofit stewardship organization that facilitates and manages the collection and proper disposal of mercury-containing thermostats.

Turner Building Science & Design Booth: 26
 Hayley Bryant
 27 Locke Road, Concord, NH 03301
 603-228-1122 • hbryant@hlturner.com
 www.turnerbuildingscience.com

Turner Building Science & Design is a team of mechanical engineers and building scientists dedicated to the development of healthy environments in new and existing buildings.

Vermont Builder/Architect Magazine Stakeholder Sponsor / Booth: Second Floor
 Dick Nelson
 P.O. Box 1076, White River Junction, VT 05001
 603-448-6707 • dicknelson1224@gmail.com

Vermont Builder/Architect Magazine is a 22-year-old full-color, quarterly publication for the building trades, sent cost-free to approximately 2,000 builders, architects, remodelers, and other building professionals in Vermont and Western New Hampshire.

Vermont Business Magazine Stakeholder Sponsor / Booth: Second Floor
 John Boutin
 365 Dorset Street, South Burlington, VT 05403
 802-863-8038 • john@vermontbiz.com
 www.vermontbiz.com

Vermont's only statewide business news, economic, and political monthly magazine; and three annual publications: Vermont Manufacturers Directory, Book of Lists, and Profiles in Business.

Vermont Department of Health

Booth: Second Floor

Marielle Strong
P.O. Box 70, 108 Cherry Street, Burlington, VT 05402
802-865-7742 • marielle.strong@vermont.gov
www.healthvermont.gov

The Vermont Department of Health encourages builders to use radon-resistant new construction (RRNC). RRNC can help reduce the occurrence of lung cancer caused by radon exposure.

Vermont Eco-Floors

Stakeholder Sponsor / Booth: Second Floor

Karen Frost
260 Ferry Road, Charlotte, VT 05445
802-425-7737 • contactus@vermontecofloors.com
www.vermontecofloors.com

Vermont Eco-Floors uses local stone aggregates, diamond-grinding technology, dyes, and sealers to create polished concrete floors that are beautiful, durable, and easy to maintain. Our environmentally friendly floors have contributed to successful green building projects throughout Vermont and New England. Visit our gallery to see examples of our fine work.

Vermont Energy Contracting & Supply Corp

Booth: 5+6

Mark Stephenson
188 Krupp Drive, Williston, VT 05495
802-658-6055 • mark@vtenergy.com
www.vtenergy.com

Vermont Energy provides quality mechanical systems for home and business owners in Northwest Vermont including design, installation, and service.

Vermont Energy Investment Corporation

Partner Sponsor

Jim Madej
128 Lakeside Avenue, Suite 401
Burlington, VT 05401
802-658-6060
jmadej@veic.org
www.veic.org



VEIC is a leader in the design and delivery of energy efficiency and renewable energy services for residents, businesses, and industrial customers.

Vermont Gas

Partner Sponsor / Booth: 4

Tom Murray
85 Swift Street
South Burlington, VT 05452
802-863-4511
tmurray@vermontgas.com
www.vermontgas.com



Vermont Gas is a natural gas and energy efficiency utility.

Vermont Passive House (VTPH)

Booth: Second Floor

Chris Clarke Miksic
1526 Lower Road, Plainfield, VT 05667
802-249-1052 • chris@montpelierconstruction.com
www.phausvt.org

Vermont Passive House (VTPH) is a nonprofit organization whose mission is to promote the Passive House Building Energy Standard in Vermont. Through public outreach, education, advocacy, and trainings, VTPH provides opportunities for practitioners, industry professionals, policy makers, and the general public to collaborate and participate in a shared mission, ensuring the success and vitality of the Passive House Building Energy Standard.

VHV Company

Booth: 21

Richard Wilcox
16 Tigan Street, Winooski, VT 05404
802-861-6181 • dwilcox@vhv.com
www.vhv.com

VHV Company, Inc. is a full-service mechanical construction contractor specializing in the design and installation of high-quality plumbing, piping, and air systems for the commercial, industrial, and institutional markets.

Visible Light

Booth: 48+49

Scott Kimball
24 Sticknet Terrace, Hampton, NH 03842
603-918-6496 • skimball@visible-light.net
www.visible-light.net

We provide design and specification assistance for high-performance LED lighting and controls. Unified building management and lighting control. Asset tracking through networked smart lighting with sensors.

VSECU

Stakeholder Sponsor / Booth: Second Floor

Laurie Fielder
P.O. Box 67, Montpelier, VT 06501
802-317-5162 • lfielder@vsecu.com
www.vsecu.com

VSECU is a Vermont-based credit union supporting members' energy efficiency and renewable energy goals by providing affordable residential and business financing and green money market accounts. Learn more at vsecu.com/vgreen.

Windows & Doors By Brownell

Booth: 8+9

Jackie Turtur
800 Marshall Avenue, Williston, VT 05495
802-862-4800 • jackie@wdbrownell.com
www.wdbrownell.com

Windows & Doors By Brownell is a locally owned business committed to the residential, commercial, and installed sales of Marvin Windows and Doors since 1991.

Yestermorrow Design/Build School

Booth: Second Floor

Claire Gear
7865 Main Street, Waitsfield, VT 05673
802-496-5545 • claire@yestermorrow.org
www.yestermorrow.org

The Yestermorrow Design/Build School is a not-for-profit, residential, open enrollment education institution with 37 years of teaching students the integrated process of design/build.

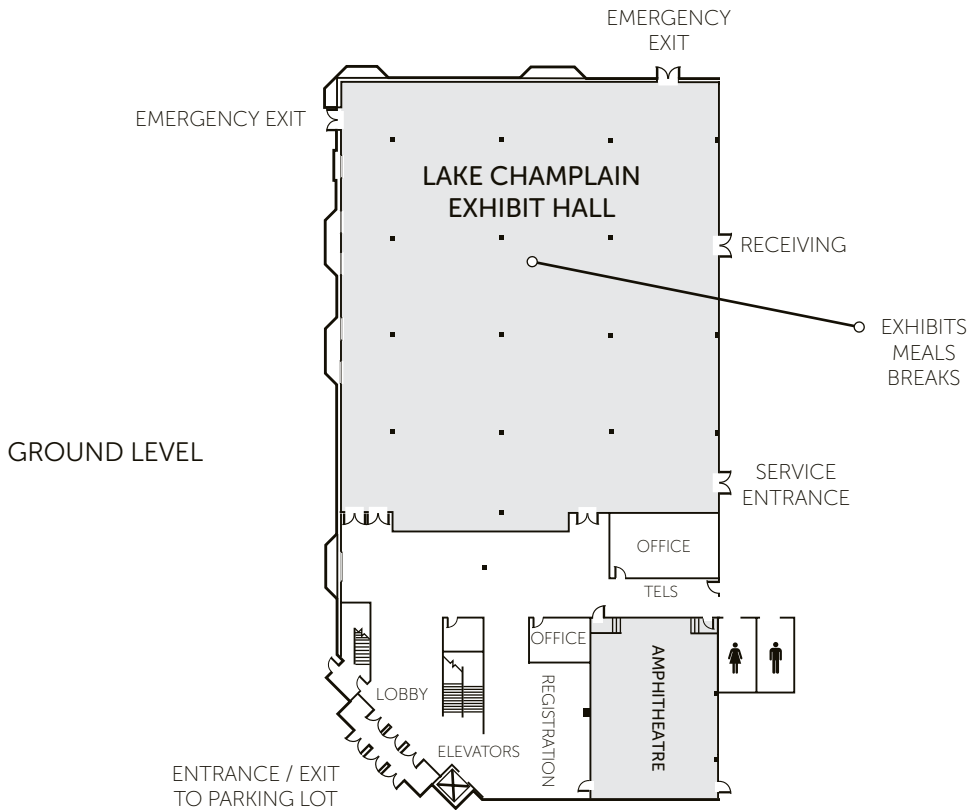
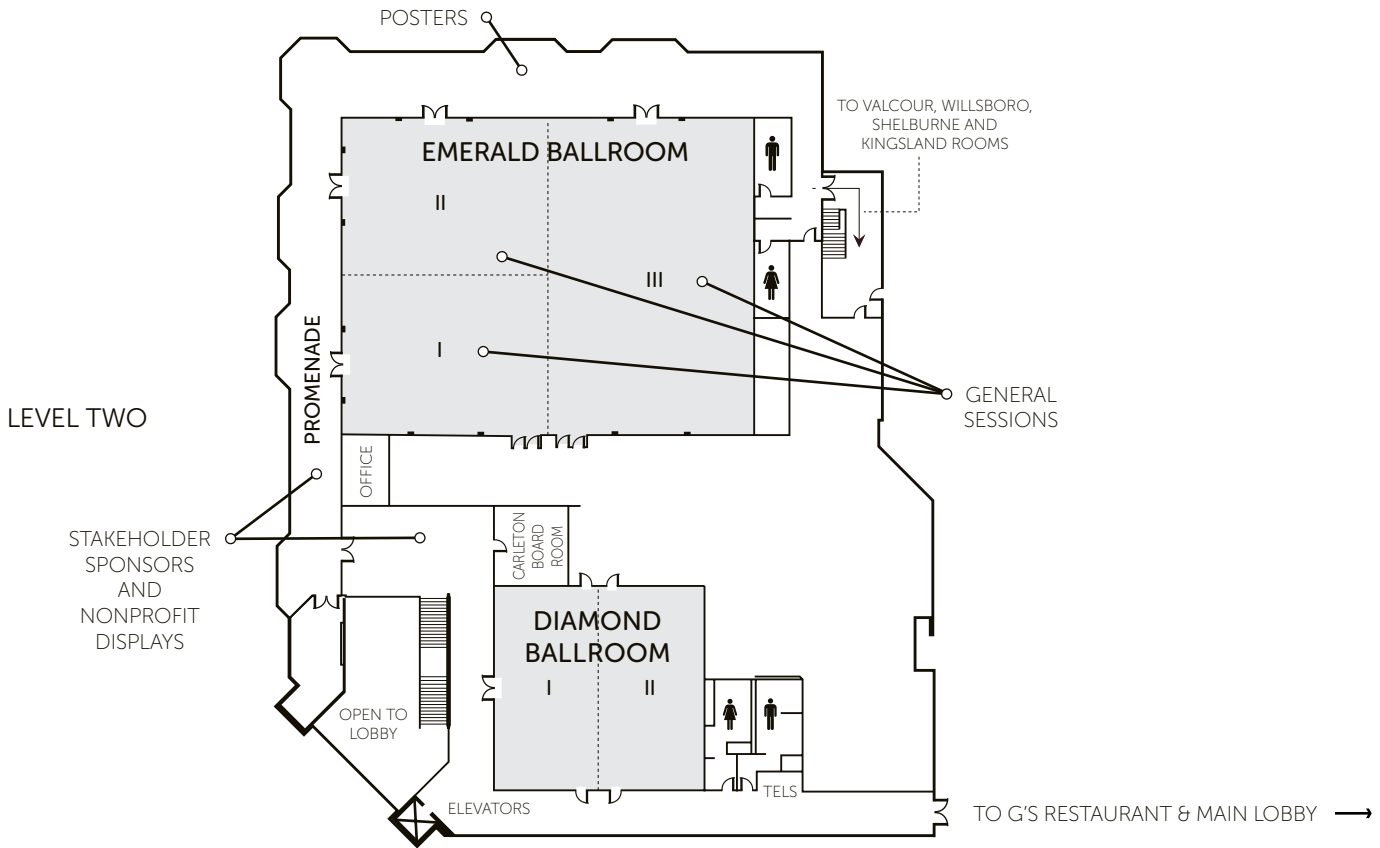
Zehnder America

Booth: 50

John Rockwell
6 Merrill Industrial Drive, Suite 7, Hampton, NH 03842
508-932-2600 • john.rockwell@zehnderamerica.com
www.zehnderamerica.com

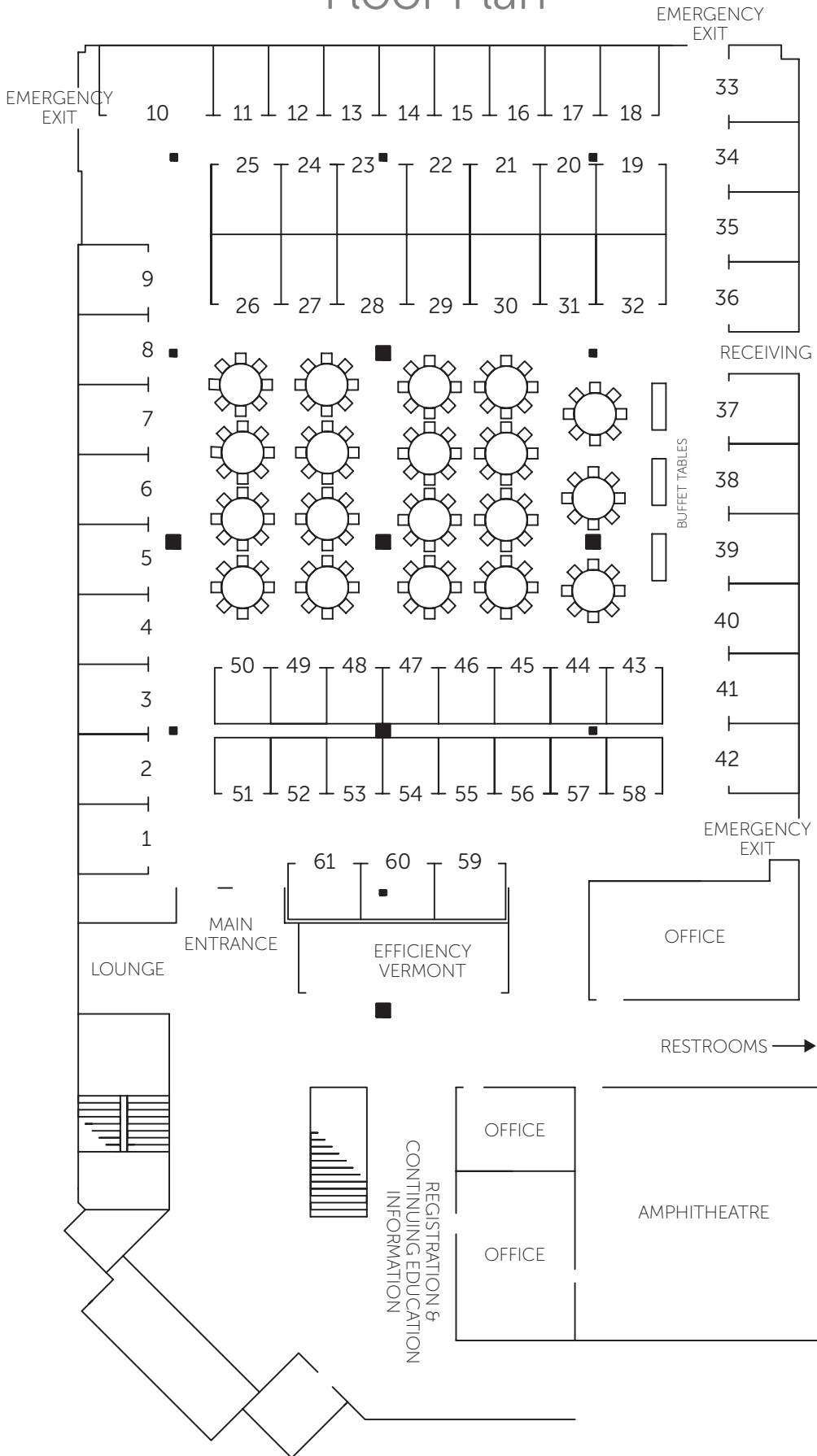
Zehnder is a world leader in comfortable, healthy, energy-efficient ventilation.

Hotel Floor Plan



CONCURRENT WORKSHOPS will be held in Emerald I, II, and III, Diamond I and II, and the Amphitheatre. See Agenda (page 5) and Workshop Schedule (page 6) for details.

Lake Champlain Exhibit Hall Floor Plan



3E Thermal	2nd Floor
475 High Performance Building Supply	10
A.O. Smith / State Water Heaters (Urell)	55
Accurate Dorwin	2nd Floor
Barron Lighting Group	2nd Floor
Broan	18
Builders Installed Products	16 + 17
Building Energy	43 + 44
Burlington Electric Department	2nd Floor
Carroll Concrete	31
Charron Incorporated	59 + 60
Curtis Lumber Co., Inc.	2
Daikin North America	51 + 52
Department of Environmental Conservation	2nd Floor
EDOS Manufacturers' Reps, Inc.	47
Emerson Swan	22 + 23
Energy Federation Inc	28
Energy Panel Structures	19
ESS—Electrical Systems Solutions	11 + 12
Flynn & Reynolds Agency, Inc.	13 + 14
Foard Panel Inc.	27
GreenFiber	35
Green Mountain Electric Supply	58
Grundfos (Urell)	53 + 54
Heatcraft Worldwide Refrigeration	2nd Floor
Huber Engineered Woods	2nd Floor
Langlais Group	37 + 38
LFD—Lighting for Distributors	20
LifeBreath / Airia Brands	24
Loewen Window Center of VT & NH	61
Mitsubishi Electric Cooling & Heating	57
Needham Electric Supply	32
New England Foam and Coating, Inc.	56
Panasonic	7
Parksite	36
Pella Products Inc.	2nd Floor
Philips Lighting	39 + 40
Pinnacle Window Solutions	42
Preferred Building Systems	1
Progress Lighting	45
RAB Lighting	41
Renewable Energy Vermont	2nd Floor
Rexel USA, Inc.	2nd Floor
Rockwool	3
RST Thermal	25
Siemens—Building Technologies Division	2nd Floor
SIGA	33
Smart Vent Products	29
SpacePak	34
Spring Lighting Group	15
SunWood Biomass	46
Swaney Lighting Associates	30
ThermalBuck	2nd Floor
Thermostat Recycling Corporation	2nd Floor
Turner Building Science & Design	26
Vermont Builder/Architect Magazine	2nd Floor
Vermont Business Magazine	2nd Floor
Vermont Department of Health	2nd Floor
Vermont Eco-Floors	2nd Floor
Vermont Energy Contracting & Supply Corp	5 + 6
Vermont Gas	4
Vermont Passive House (VTPH)	2nd Floor
VHV Company	21
Visible Light	48 + 49
VSECU	2nd Floor
Windows & Doors By Brownell	8 + 9
Yesterday Design/Build School	2nd Floor
Zehnder America	50



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Stakeholder Sponsors

- Barron Lighting Group
- Burlington Electric Department
- Heatcraft Worldwide Refrigeration
- Huber Engineered Woods
- Pella Products Inc.
- Rexel USA Inc.
- Siemens—Building Technologies Division
- ThermalBuck
- Vermont Builder/Architect Magazine
- Vermont Business Magazine
- Vermont Eco-Floors
- VSECU

Exhibitors

- 475 High Performance Building Supply
- A.O. Smith/ State Water Heaters (Urell)
- Broan
- Builders Installed Products
- Building Energy
- Carroll Concrete
- Charron Incorporated
- Curtis Lumber Co., Inc.
- EDOS Manufacturers' Reps, Inc.
- Emerson Swan
- Energy Federation, Inc.
- Energy Panel Structures
- ESS—Electrical Systems Solutions
- Flynn & Reynolds Agency, Inc.
- Foard Panel Inc.
- GreenFiber
- Green Mountain Electric Supply
- Grundfos (Urell)
- LFD—Lighting for Distributors
- LifeBreath / Airia Brands
- Loewen Window Center of VT & NH
- Mitsubishi Electric Cooling & Heating
- Needham Electric Supply
- New England Foam and Coating, Inc
- Panasonic
- Parksite

- Pinnacle Window Solutions
- Preferred Building Systems
- Progress Lighting
- RAB Lighting
- Rockwool
- RST Thermal
- SIGA
- Smart Vent Products
- SpacePak
- Spring Lighting Group
- SunWood Biomass
- Swaney Lighting Associates
- Turner Building Science & Design, LLC
- Vermont Energy Contracting & Supply Corp
- VHV Company
- Visible Light
- Windows & Doors By Brownell
- Zehnder America

Nonprofit Exhibitors

- Department of Environmental Conservation
- Renewable Energy Vermont
- Thermostat Recycling Corporation
- Vermont Department of Health
- Vermont Passive House (VTPH)
- Yestermorrow Design/Build School

Thank You!

