

The editors would like to thank the following individuals and organizations for their help in producing this White Paper.

Alliance to Save Energy

Jeff Harris

American Institute of Architects

Jessyca Henderson, AIA

Boldt

Andrew Fieber, LEED AP

Busby Perkins+Will

Michael Driedger, LEED AP BD+C
Blair T. McCarry, PEng, PE, ASHRAE,
LEED AP

ccrd partners

Randolph W. Tucker, PE

EHDD Architecture

Glennis Briggs, AIA, LEED AP
Chuck M. Davis, FAIA
Brad Jacobson, AIA, LEED AP BD+C
Scott Shell, FAIA, LEED AP

Electrical Contracting Foundation

Lewis Tagliaferre (ret.)

EVstudio

Dean A. Dalvit, AIA

Facility Engineering Associates

Kristina Koepke, EIT

Ferraro Choi & Associates

William D. Brooks, AIA, LEED AP

HOK

Gerry A. Faubert, CET, LEED AP
John Gilmore
Mary Ann Lazarus, FAIA,
LEED AP BD+C
Bill Valentine, FAIA, LEED AP

Haselden Construction

Philip Macey, AIA, LEED AP

Bruce M. Haxton, LEED AP

Integrated Environmental Solutions

Craig Wheatley, PhD, CEng

Johnson Controls, Inc.

Clay G. Nesler
Derek Supple

The Kubala Washatko Architects, Inc.

Joel Krueger, AIA
Tom Kubala, AIA

Lafarge

Steve Meima

Maclay Architects

William Maclay, AIA

Magnusson Klemencic Associates

Drew Gangnes, PE, SE

NAIMA

Kate Offringa

National Institute of Building Sciences

Ryan Colker, JD

National Institute of Standards and Technology

David Holmberg

National Renewable Energy Laboratory (USDOE)

Adam I. Hirsch, PhD
Ron Judkoff
Shanti Pless, LEED AP
Paul Torcellini, PE, PhD

New Buildings Institute

Dave Hewitt

Odell International

Richard D. Cantwell, PE
David Rittenhouse

Perkins+Will

Russ Drinker, AIA, LEED AP
Zaki Mallasi, PhD, LEED BD+C

Project Time & Cost, Inc.

Tim Babb, CCC

RNL Design

Tom Hootman, AIA, LEED AP BD+C

Rocky Mountain Institute

Cara Carmichael

SmithGroup

Greg Mella, AIA, LEED AP
Russell Perry, FAIA, LEED AP

Stantec

David Okada, PE, LEED AP

U.S. Department of Energy

Erin Pierce
P. Marc LaFrance

U.S. General Services Administration Public Buildings Service

Andrew Bywater
Lance Davis, AIA, LEED AP
David E. Leites, LEED AP
Les Shepherd, AIA

The Weidt Group

Chris Baker, AIA, EIT, BEMP, LEED AP
David Eijadi, FAIA, LEED AP BD+C

WSP Lincolne Scott

Scott Inatsuka, PE

Yudelson Associates

Jerry Yudelson, PE, LEED AP
BD+C/O&M

This White Paper is dedicated to the memory of **Michael Sweeney** 1963 – 2011

DIRECTORY OF SPONSORS



Johnson Controls, Inc.
507 E. Michigan Street
Milwaukee, WI 53202
414-524-4129
www.johnsoncontrols.com



Lafarge North America Inc.
12018 Sunrise Valley Dr.
Reston, VA 20191
703-480-3808
www.lafarge-na.com



North American Insulation Manufacturers Association
44 Canal Center Plaza, Suite 310
Alexandria, VA 22314
703-684-0084
www.naima.org



Sto Corp.
3800 Camp Creek Parkway
Building 1400, Suite 120
Atlanta, GA 30331
800-221-2397
marketingsupport@stocorp.com
www.stocorp.com



U.S. General Services Administration
Public Buildings Service
1800 F Street, N.W.
Washington, DC 20405-0001
www.gsa.gov

Editorial Ethics Policy

Building Design+Construction and its parent company, SGC Horizon LLC, subscribe to the editorial ethics guidelines of American Business Media and the American Society of Magazine Editors. All sponsors of this report have complied with these ethical standards, specifically with the statement that "The chief editor of any magazine must have final authority over the editorial content, words and pictures that appear in the publication."

Download all eight BD+C White Papers

The entire contents of "Zero and Net-Zero Energy Buildings + Homes" and seven previous White Papers can be downloaded in pdf form at: <http://www.bdcnetwork.com/whitepapers>.

- 2003 White Paper on Sustainability
- 2004 Green Building Progress Report
- 2005 Life Cycle Assessment and Sustainability
- 2006 Green Buildings and the Bottom Line
- 2007 Green Buildings Research White Paper
- 2008 Green Buildings + Climate Change
- 2009 Green Buildings + Water Performance
- 2011 Zero and Net-Zero Energy Buildings + Homes

PUBLISHED BY:



Building Design+Construction
An SGC Horizon LLC Publication
3030 West Salt Creek Lane, #201
Arlington Heights, IL 60005
847-391-1000
www.BDCnetwork.com

Address all correspondence to:
Robert Cassidy, Editorial Director
847-391-1040
rcassidy@sgcmail.com

SGC Horizon LLC is the publisher of professional publications, websites, and electronic newsletters serving the commercial and residential design and construction industry:

Building Design+Construction
www.BDCnetwork.com

Custom Builder
<http://www.housingzone.com/cb>

Construction Bulletin
<http://www.constructionbulletinmag.com>

Construction Equipment
<http://www.ConstructionEquipment.com>

Professional Builder
<http://www.housingzone.com/pb>

Professional Remodeler
www.housingzone.com/pr

Copyright © 2011 SGC Horizon LLC. All rights reserved.



Printed on 100% post-consumer recycled paper with soy/vegetable inks.



Net Zero Offers an Inspiring Goal

Net-zero energy buildings offer a clear and inspiring goal for both new and existing buildings. The pursuit of this goal will take us a long way toward reducing energy use in buildings, while also significantly reducing the impact that buildings have on the environment.

Net-zero energy commercial buildings exist today. When designed and built using an integrated design approach, net and near-zero energy buildings can be cost-effective when compared to traditionally constructed buildings. Our experience with the IDEAs commercial building retrofit project has demonstrated that net-zero buildings are technically feasible today and will be increasingly cost-effective in the future. More experience with zero energy buildings will also lead to an awareness of best practices that will reduce costs as well as the perception of risk associated with the concept.

Johnson Controls supports the goal of targeting “net and near-zero” energy use in all commercial buildings. This worthy and achievable goal benefits building owners, who will realize lower life-cycle costs and a hedge against higher energy prices. It benefits society by minimizing the impact of the building on the environment. Finally, it also benefits the economy by creating new jobs, stimulating investment in clean energy technology and enhancing energy security.

A handwritten signature in black ink, appearing to read "C. David Myers".

C. David Myers
President
Johnson Controls, Building Efficiency

Lafarge is committed to extracting, processing and manufacturing building materials based on environmental stewardship, economic prosperity and social responsibility. Our focus on the triple bottom line will help us achieve our objectives to be the preferred investment, supplier, community partner, and employer.

The Lafarge Group places innovation at the heart of its priorities. Our world leading building materials research facility is actively developing concepts, processes and products that advance sustainable construction, as well as architectural creativity.

Lafarge North America has supported Habitat for Humanity with many local initiatives to help provide decent, affordable housing. Through these partnerships our contributions make us the largest supplier of cement, concrete, aggregates, and gypsum products to the world's premier building materials charity.

Currently, Lafarge is involved in an integrative design process on a "net-zero energy" duplex in Edmonton, Alberta, Canada. This project will feature the many benefits of precast concrete as the primary building material. The energy performance of this project will be monitored and compared to a similar wood frame structure which will validate the benefits of sustainable concrete construction.

As part of the Lafarge and WWF partnership, we are focusing our efforts to preserve biodiversity, restore the eco-balance of quarries and forests, and mitigate global climate change. Lafarge North America regularly teams with the Wildlife Habitat Council (WHC), community groups, and individuals on the conservation of wildlife habitat.

Lafarge is developing ways to contribute to sustainable building. Our memberships in the U.S. Green Building Council and Canada Green Building Council demonstrate the company's interest in partnering with "leaders from across the industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work."

Our products play a decisive role in sustainable construction. They contribute a sustainable component to a growing number of LEED®-rated projects across North America. Lafarge is proud to have a significant number of LEED accredited employees to best serve the environmental needs of the design and building community.

www.lafarge-na.com



ADVERTISEMENT

NAIMA

**NORTH AMERICAN INSULATION
MANUFACTURERS ASSOCIATION**

The idea of a net zero energy building has quickly moved from concept to reality. In fact, it is now a compelling and integral part of the “green construction movement.” Tomorrow’s net zero energy buildings will improve this country’s energy balance and help put the U.S. back on a path toward greater energy security and sustainability.

Energy efficiency is the key to its success. The availability of existing, yet energy and environmentally efficient technologies, such as high-performance insulation systems, is one of the reasons the net zero building concept has advanced so quickly. At the forefront of these discussions is the North American Insulation Manufacturers Association (NAIMA).

The North American Insulation Manufacturers Association is a trade association of North America’s leading fiber glass, rock wool and slag wool insulation manufacturers. NAIMA has a 75-plus year history in the energy efficiency arena, and its fundamental objective is to promote energy efficiency, sustainable development, and environmental preservation through the safe use of high-performance fiber glass, rock wool and slag wool insulation.

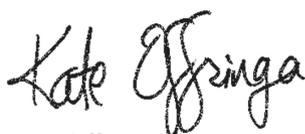
Insulating the Building Envelope: Maximizing Energy Efficiency on the Road to Net Zero Energy Buildings

NAIMA firmly believes that the first step toward net zero energy buildings must be maximizing energy efficiency in the building envelope. Today’s thermal envelope systems are designed specifically to reduce energy consumption and improve occupant comfort. The good news is these insulation technologies are one of the few that can be implemented immediately and installed to meet the energy code requirements of today and energy demands of the future. Unlike many of the other technologies targeted for net zero energy buildings, insulation requires no additional energy such as electricity to function. And, most importantly, these insulation systems will enhance the performance of additional energy efficiency technologies as they are designed into or added to the buildings.

Architects, specifiers, builders, homeowners, and policymakers are all part of the process to building a sustainable future. To help these important audiences in their building and construction decisions, NAIMA maintains a large literature library filled with free (and many downloadable) specification tools, scientific research, installation recommendations, and codes and standards information. In addition, our website (www.naima.org) maintains current information on the status of building energy codes, federal and local tax incentives as well as links to our members, who offer advanced insulation thermal envelope systems.

NAIMA is active in the Commercial Buildings Consortium and other formal and informal dialogues on the topic of net zero energy buildings. As an industry leader in the energy efficiency discussion, NAIMA has always taken an active role in the many leading U.S. and global organizations that are helping to develop policies and implement educational programs that will make their way into the net zero energy building arena.

Insulate today. Save tomorrow.



Kate Offringa
President and CEO
North American Insulation Manufacturers Association (NAIMA)
www.naima.org
703-684-0084



For more than 50 years, Sto Corp. has been committed to the concept of sustainability. Our mission statement, summarized by the three words "Building with conscience," focuses on this commitment to environmental, economic and social sustainability. Simply put, it means doing the right thing for our customers, our community and the environment.

Sto Corp., based in Atlanta, Georgia, is an innovative leader and producer of a broad range of versatile cladding and coating systems for building construction, maintenance and restoration. Sto Corp. is ISO 14001:2004 as well as ISO 9001:2008 certified and operates production plants strategically located to serve more than 200 distributor shipping locations across North and South America. At research and development laboratories in the U.S. and Europe, Sto continues to revolutionize the industry with the highest quality products and application technology. Sto is also the world's largest manufacturer of exterior thermal insulation systems with 27 subsidiaries operating at 21 factories worldwide.

Sto recognizes the impact that buildings can have on the environment and on their occupants. That is why our mission is to maintain the value of old and new buildings for their owners, investors and users, by researching, developing, producing and marketing product systems and services that improve a building's energy efficiency, durability and aesthetic appeal. Through collaboration with like-minded customers and partners, we want to act as a pacesetter and play a leading role in helping to ensure that the world in which we live is designed in line with environmental requirements and our needs as human beings.

Sto products are designed to support sustainable building practices. We produce products that protect the building from degradation, are long lasting and energy efficient. We use low-VOC materials that are environmentally friendly and safe for the workers that apply them. We constantly look for innovative solutions to building issues and ways to improve our products' effectiveness and value. Sto Corp. manufactures insulated wall claddings, fluid-applied waterproof air barriers, and even coatings that have pronounced self-cleaning properties. These products are key components in sustainable construction today.

Sto supports sustainability throughout our operations. Sto Corp. manufactures our products in factories that are located strategically throughout the U.S. to best serve our markets. As of 2009, all of our North American facilities have implemented an ISO 14001 certified Environmental Management System, which we use to guide our efforts toward continual improvement of our environmental footprint. Sto Corp. has achieved a huge reduction in materials sent to landfill through company-wide recycling programs including paper products and electronics recycling. Other areas of improvement include: reduction of electricity use in all facilities; waste water reduction and recycling in our manufacturing processes; and a program for airborne particulate capture and exposure reduction. These efforts all help Sto minimize our carbon footprint, and we continually look for new ways to reduce the impact that our operations have on the environment.

Sto Corp. is committed to energy conservation, environmental protection and sustainability. Sto Corp. continues to demonstrate environmental consciousness in the three key dimensions of our business: our products, our processes, and environmental benefits to our customers. For more information on Sto Corp., please visit www.stocorp.com.

Sincerely,

A handwritten signature in black ink, appearing to read "David Boivin".

David Boivin
President and CEO

Imagine an 18-story icon designed by a Pritzker Prize-winning architect, which is also an exemplar of automated mixed-mode ventilation.

Imagine a busy campus located in the middle of a desert, whose integrated photovoltaic panels produce all necessary electricity. Imagine a similar complex, where the kinetic energy of vehicular movement powers administrative spaces.

Imagine a tired mid-century office fortress transformed into a high-performing green building in part by an unprecedented second skin that wraps the original building envelope.

GSA



These buildings are not daydreams.

They are being constructed today, by the U.S. General Services Administration.

GSA is one of the largest public real estate organizations in the world. The agency manages a portfolio totaling 362 million square feet of federal workspace.

GSA also is one of its most progressive landlords. The agency installed its first green roof in 1975, and in the last year GSA has assumed a pole position in the green movement.

We call it Zero Environmental Footprint. ZEF has inspired GSA to raise its minimum LEED rating for new construction and major renovation projects to Gold. ZEF launched an initiative to increase acceptance of innovative buildings technologies and practices—and even beta-test new strategies. And ZEF is the reason why GSA has pursued cutting-edge projects like the Morphosis-designed San Francisco Federal Building, land ports of entry in Columbus, New Mexico, and San Ysidro, California, and the Peter W. Rodino Federal Building modernization in Newark.

ZEF is the uncharted territory of phytoremediation, bifacial photovoltaics, enthalpy wheels, trombe walls, and more. But it promises buildings that give back more, too. More energy, more clean water, more natural habitat. **Just imagine.**