Presented by

High Performance Buildings Conference: A Focus on Deep Energy Savings

March 12-13, 2012
San Diego, California

Updated: March 6, 2012

approved for AIA LUs approved for NY PDHs approved for GBCI credits for LEED APs

Monday, March 12

Monday, March 12, 2012, 8:00 AM-9:30 AM

Opening Keynote Address

Room: Rio Vista Ballroom A-E

Chair: Kent Peterson, P.E., Presidential Fellow Life Member, P2S Engineering, Inc., Long Beach, CA

This session presents a policy perspective on energy-use reduction in the built environment and provides an overview of the many tools available from ASHRAE to accomplish deep energy savings. California has led the world in striving to reach balance between energy management and economic develop. The CPUC plays an important role in setting strategies and implementing energy efficiency policy in California. California has also set aggressive goals in California's Long-Term Energy Efficiency Strategic Plan. ASHRAE's multi-pronged approach to deep energy savings begins with solid advice in its standards, the Building Energy Quotient program for advance building energy program, advocacy, education and publications, such as the 50% Advanced Energy Design Guides for a multiple building types.

1. Energy Management Meets Economic Development

***Jeanne Clinton**, California Public Utilities Commission, San Francisco, CA*

Jeanne Clinton is Special Advisor for Efficiency at the California Public Utilities Commission (CPUC), appointed by Governor Brown. Previously she was Governor Schwarzenegger's Clean Energy Advisor at the CPUC, during

which time she led the California Solar Initiative and guided California's Long-Term Energy Efficiency Strategic Plan. She frequently testifies at the California legislature on energy policy matters. Jeanne has spent her career working on clean energy issues, sustainable development, and climate mitigation in a variety of roles, from government policy and strategy, to utility and government program delivery, both in the U.S. and internationally.

2. ASHRAE's High Performance Building Initiatives: Sustaining Leadership in Sustainability

Ronald Jarnagin, Member*, Pacific Northwest National Laboratory, Richland, WA*

To complement the attendees' leadership in the sustainability movement in creating high performing buildings, ASHRAE supports those efforts for achieving a sustainable future through tools available today. ASHRAE's multi-pronged approach to deep energy savings begins with solid advice in its standards, the Building Energy Quotient program for advance building energy program, advocacy, education and publications, such as the 50% Advanced Energy Design Guides for a multiple building types. This ASHRAE High Performance Buildings Conference, and those to be scheduled in the near future, are perhaps the best forum for design professionals and policy makers to gain innovative, insightful and applicable tools and techniques for truly advancing the industry's efforts to change the energy-use aspects of the built environment.

Monday, March 12, 2012, 9:45 AM-10:45 AM

HPB Case Studies 1

Room: Rio Vista Ballroom A-E

Chair: Mohammed H. Hosni, Ph.D., Fellow ASHRAE, Kansas State University, Manhattan, KS

This session includes case studies related to employing natural ventilation as a passive air-conditioning method, implementation of net zero energy strategy in a building, and an integrated design approach to reduce energy consumption for future office buildings. The first presentation reviews theoretical design approaches to optimize natural ventilation through calculations, dynamic simulation and CFD analysis. The next presentation breaks down how to implement net zero energy into three steps that include accuracy, awareness, and action using a San Diego office for the case study. The third presenter outlines the design approach which focuses on California's regional transportation, water conservation, and energy challenges and offers energy monitoring data to show how the project is operating 75% below California's Title-24 energy code.

1. Natural Ventilation as a Passive Air-Conditioning Strategy

Julian Parsley, Member*, Buro Happold, Culver City, CA*

The session reviews how natural ventilation can be effectively applied as a passive air conditioning strategy to provide energy savings and meet ASHRAE 55 comfort criteria focusing on mixed mode applications in California. The presentation reviews theoretical design approaches to optimization of natural through calculations, dynamic simulation and CFD analysis. Case studies demonstrate a variety of practical applications and design solutions providing key lessons learned and performance feedback on energy use intensities and modeled vs. experienced internal design conditions. Valuable lessons on the user experience also are presented showing the importance of good education.

2. Net Zero Energy Implementation

Whitney Dorn*, DPR Construction, San Diego, CA*

Most design and construction professionals understand the concepts to achieve net zero energy: reduce energy consumption using passive and active strategies, model the building's energy performance and generate enough energy on-site to offset the building's consumption. This presentation covers how to implement NZE after the design has been done and the building has been built. How do the building's occupants ensure that net zero energy

has been achieved? This presentation breaks down how to implement net zero energy into three steps: accuracy, awareness and action, using a San Diego office as the case study.

3. Designing for Regional Growth: The First Office of the Future

***Brian Berg, P.E.**, Glumac, Irvine, CA*

The Office of the Future Consortium proposes goals that require design, engineering, and utility partners to collaborate closely to demonstrate how the demands of office lighting, power and HVAC systems can be slashed while enhancing workplace functionality and comfort. Attendees are introduced to design strategies embodied in Glumac's engineering office in Irvine, California – the first completed Office of the Future. The presenter outlines the design approach, which focused on California's regional transportation, water conservation and energy challenges. Particular relevance is demonstrated by energy monitoring data that shows the project to be operating 75% below California's Title-24 energy code.

Integrated Building Design

Room: Cabrillo Salon

Chair: James Del Monaco, P.E., Member, P2S Engineering, Long Beach, CA

This seminar presents various design strategies and tools for providing an integrated design as well as using metering to evaluate actual energy use and energy savings. More often than not, design team members focus their attention on those components of the building which affect their work without fully understanding the impact they have on other aspects of the building. Software tools and communication among project team members can help facilitate an integrated design where the end product is a harmonious building where energy savings and indoor environmental quality are optimized. Once buildings are complete, metered data with actual energy use along with software tools for evaluating and implementing Energy Efficient Measures (EEMs) can result in quantifiable energy savings.

1. Integrated Tools, Methods and Strategies for Designing High Performance Sustainable Buildings at Various Stages of Design

***Liam Buckley, Associate Member**, IES Ltd, Boston, MA*

This presentation focuses on how the technical applications of software tools and the design strategies affect the performance, certification and rating of buildings. The tools include integrated dynamic simulation engines for whole building performance analysis. Learn how the performance simulation of a 'virtual building' can assist compliance for ASHRAE Standard 90.1 Appendix G and LEED EAc1. This building performance and simulation analyses can simultaneously capture various indoor environmental quality metrics, such as thermal comfort as per ASHRAE 55 and LEED IEQc7.1, daylight for LEED IEQc8.1 and increased ventilation as per ASHRAE 62.1 and LEED IEQc2.

2. GSA Case Study, Part 1: Systems Tailored to Meet Performance – Technical Deep Dive into Energy Targets and Innovative Systems

***Charles Chaloeicheep, P.E., Member**, Built Ecology, San Francisco, CA*

As an ARRA funded project and part of the GSA's Design Excellence program, the Federal Center South Redevelopment responds to aggressive sustainable design and energy efficiency mandates. Currently under construction, this design-build project is anticipated to be one of the most sustainable office buildings of its time. A two-part series of presentations by members of the project's design team discusses the energy target management and highlight key energy saving strategies involving the high-performance building envelope, daylighting, optimized site orientation, passive chilled beam cooling and an innovative central plant that incorporates ground source and phase change material-based thermal storage systems.

3. Metered, Modeled and Integrated Measures to Achieve over 30% Energy Savings in a Full Service Hotel

***Anne Wagner, Member**, Pacific Northwest National Laboratory, Portland, OR*
In the hospitality industry, saving energy is important but a positive guest experience is essential. Through the U.S. Department of Energy's Commercial Buildings Partnerships program, a full service hotel project identified energy efficiency measures that are predicted to deliver approximately 2 million kilowatt-hours (kWh) in energy savings and reduce total building energy consumption by 31% with potential cost savings of 37%. This presentation provides an overview of metered data, EEMs, modeled savings, status of initial measures implemented and lessons learned that can have a much broader influence— providing energy use and energy efficiency improvement experience in the hospitality sector.

Monday, March 12, 2012, 11:00 AM-12:00 PM

Building Performance 1

Room: Cabrillo Salon

Chair: Senthil kumar Arunachalam, Member, Partner Energy, Irvine, CA

Many new high performance buildings are designed and constructed throughout the country using sustainability metrics and codes. It is a challenge for owners and property managers to properly operate and maintain these buildings for sustained performance. This seminar provides an overview of various qualitative and quantitative measures that can be used to improve and sustain performance of buildings. This seminar also provides techniques to identify post occupancy operation of a high performance building and by comparing post occupancy operation to sustainability standards.

1. Integrated Measurements, Operations and Maintenance Practices for High Performance Buildings
***Om Taneja, Ph.D., P.E., Member**, US, General Services Administration, Manhattan, NY*
Experience from public and private property management demonstrates that integration of key policy, administrative and technical measures can drive improvements and sustenance of performance of building systems and infrastructure elements. Such measures adopted from concept stage through design, construction, commissioning and operations not only facilitate meeting the original design intent, but also allow to make adaptive changes with changes in occupancy, functionality, codes, standards or security requirements and thereby assures sustenance of energy and environmental performance over the life cycle of systems and buildings.

2. A Dialogue between a Sustainability Metric and Building Performance: A Post Occupancy Evaluation in LEED Buildings for Thermal Performance and Visual Performance
***Eddy Santosa**, HMC Architects, Ontario, CA*
Currently, the green building movement has been focused on implementing sustainability metrics green building codes. The implementation of the metric and codes that form high performance buildings assist designers to determine their sustainability target during the design process. However, there is always a gap between the target and the real performance of the buildings especially in thermal performance and visual performance. By attending the presentation, the attendees learn how the process of the verification by using POE after the project completion, and the strength and the weakness of the sustainability metrics to address user satisfaction.

HPB Case Studies 2

Room: Rio Vista Ballroom A-E

Chair: Devin A. Abellon, P.E., Member, Uponor, Phoenix, AZ

This seminar explores various examples where advanced simulation, energy modeling, measurement and controls applications were used to carefully optimize the energy-efficiency of high-performing buildings. While the design of a building's HVAC system may at times be focused almost entirely on the selection of specific energy-efficient system components, the use of such tools can help ensure that the integrated system will perform according the requirements and expectations of the owner/occupants. This seminar will present specific examples of projects in operation and demonstrate how the use of these analysis tools has improved the overall effectiveness of the building systems.

1. The Cube: From Design to M&V of Germany's First LEED Platinum Building

Oliver Baumann, Associate Member*, Ebert & Baumann Consulting Engineers, Inc., Washington, DC*

The Cube, the new Headquarters for the Deutsche Boerse AG (German Stock Exchange) in Eschborn/Frankfurt, is the first LEED Platinum certified building in Germany. This presentation shows how simulation and energy modeling was used to optimize the design concept and how operation diagnostics was applied as part of the Cx process to optimize the overall performance of the building. The presentation also shows M&V results from the performance monitoring during the first year of operation.

2. A Large Scale Net Zero Energy Building: An Early Look at Measured Energy Performance and Lessons Learned of NREL's RSF

Chad Lobato, Associate Member, Shanti D. Pless, Member, Michael Sheppy, Associate Member and ***Paul A. Torcellini, Ph.D., Member****, National Renewable Energy Laboratory, Golden, CO*

The Department of Energy's National Renewable Energy Laboratory moved into its new 220,000 ft2 Research Support Facilities (RSF) in June of 2010. The RSF will be the largest completed office building designed to meet net zero energy in North America. This presentation includes an overview of the research NREL has conducted on net zero energy buildings. Measured vs. modeled end use performance trends and the necessary operational practices are presented to document how a large scale net zero energy office building can meet these aggressive energy goals.

3. Evaluating "Building Controls 2.0": Case Studies of Three Advanced Software Product Installations at Silicon Valley Campuses

Peter R. Pollard, P.E., Member*, kW Engineering, Oakland, CA*

Many new software products have been entering the building HVAC system controls market promising energy savings potential beyond what is offered by current building automation system (BAS) controls. Three such software products were installed in office/lab buildings in two corporate campuses in Silicon Valley. This presentation provides an objective summary of these case studies, including a description of the capabilities and limits of each product and the verified energy savings results achieved at each pilot installation. Finally, recommendations are offered regarding the best applications for each type of "Building Controls 2.0" software product evaluated.

Noon – 1:15 p.m.

Posters on Display

Room: Rio Vista Ballroom F-G

Lunch

Room: Rio Vista Pavillion

Monday, March 12, 2012, 1:30 PM-3:00 PM

Building Performance 2

Room: Cabrillo Salon

Chair: Mark Frankel, New Buildings Institute, White Salmon, WA

This session presents different ways to evaluate building performance: for the evaluation of the efficiency of a retrofitted building, a high resolution monitoring system for rooms, apartments and engineering system was installed; another study focuses on the 'operational variables' that affect building performance after the building is designed, built and occupied; another study shows that envelope improvements achieved over the past 20 years are often offset by excessive ventilation rates in the units and corridors; and, finally, recommendations for system design changes to enable enhanced outdoor air flow balancing and control are presented.

1. Rebound Effect Related to Retrofit Solutions for Residential Housing: Field Test Monitoring vs. Simulation Modeling

***Davide Calì**, Energy Efficient Buildings and Indoor Climate, Aachen, Germany*

A large number of buildings constructed in the second half of the twentieth century consume a large amount of energy due to marginal insulation and inefficient/obsolete heating systems. In this work, the complete refurbishment of three buildings, each containing thirty apartments of 72 m² over three entrances (ten apartments per entrance), is presented. For the evaluation of the efficiency of each retrofit solution, a high resolution monitoring system for rooms, apartments and engineering system has been installed. Data from the monitoring system show heat consumption for space heating on average 25% higher than the heat demand due to rebound-effect.

2. Comparing the Impact of Design, Operation and Tenant Behavior on Building Energy Performance

***Jonathan Heller, P.E., Member**[1], Morgan Heater, P.E., Associate Member[1] and Mark Frankel[2], (1)Ecotope, Inc., Seattle, WA, (2)New Buildings Institute, White Salmon, WA*

A common perception is that responsibility for building energy performance is all in the hands of the design team and is relatively set once the building is constructed. This misunderstanding reflects an inaccurate perception about how buildings work and is a significant barrier to substantially improving building energy performance. One focus of this study is on the 'operational variables' that affect building performance after the building is designed, built and occupied. Another focus was to identify the relative magnitude of impact of various design and operational decisions on the total building energy use in various climates.

3. Multifamily Post Occupancy Building Performance

***Jonathan Heller, P.E., Member**, Shawn Oram, P.E., Member and Kevin Geraghty, Ecotope, Inc., Seattle, WA*

To reduce energy use in multifamily buildings, we must have a complete picture of end-uses. Regional energy codes and conservation programs have focused almost exclusively on reducing unit space heating loads. This study indicates that envelope improvements achieved over the past 20 years are often offset by excessive ventilation rates in the units and corridors. The study also shows that common area bills (i.e. those paid by the owner) make up 40%-60% of the building's total energy use. This study can guide code and conservation programs by targeting areas of high energy use, such as DHW and corridor ventilation/pressurization systems.

4. In-Situ Study of HVAC Minimum Ventilation Rate Performance

***Jim Meacham, P.E.**, CTG Energetics, Inc., Irvine, CA*

This presentation covers the results and recommendations derived from an in-situ survey of HVAC minimum outdoor air ventilation performance across the State, conducted to support the Title 24 Codes and Standards Enhancement (CASE) process. The relative accuracy of various airflow measurement techniques, system outdoor air flow rate performance under various load conditions, and performance of systems with and without dynamic

minimum ventilation controls are explored. Recommendations for system design changes to enable enhanced outdoor air flow balancing and control are presented.

Policy/Benchmarking 1

Room: Rio Vista Ballroom A-E

Chair: Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

The HVAC industry is using energy benchmarks to judge the design of energy efficient buildings. This session looks at several ways of implementing policies to drive building energy efficient design through benchmarks. Policy mandates by the US Army and by the State of California Green Building Standards Code will be reviewed. An incentive approach will be reviewed by a utility company. An independent review of different benchmark approaches will compare the push of policy and the pull of incentives to achieve energy efficient design.

1. U.S. Army Net Zero Policy, Initiatives and Progress

Katherine Hammack, Member*, US Army, Washington , DC*

The Army is the largest facility energy user in the Federal Government, with an energy bill that exceeded $1.2 billion in FY10. To improve energy security, reduce energy costs and achieve Federal mandates, we are executing an Army-wide "Net Zero" Initiative. Net Zero embraces a "systems of systems" approach to reducing water and energy requirements, eliminating waste, saving money and increasing capability. An initial group of 17 Army installations was announced that will participate in a pilot project to achieve Net Zero by 2020 in one of four categories: energy, water, waste or all three.

2. NSTAR: High Performance Buildings and the Implementation of Targeted Incentive Programs that Work

Carlos Alonso-Niemeyer*, NSTAR Electric and Gas Corp., Westwood, MA*

Learn how NSTAR is making high performance buildings a key component of their efforts to meet the required energy efficiency goals for the state of Massachusetts. By implementing an aggressive program targeted to architects in conjunction with an outreach to mechanical engineers, lighting designers and large chiller equipment manufacturers, NSTAR is capturing and converting new large construction projects into buildings that use 15$-30% less energy than state code. The program utilizes generous incentives for high performing buildings and a robust offering of prescriptive and performance based paths that ensure that every effort is rewarded with the maximum incentive available.

3. Getting to Zero: A Look at the Costs, Features and Policy Direction of Zero-Energy and Zero-Capable Commercial Buildings

Dave Hewitt*[1], Cathy Turner[1] and Adam Scherba[2], (1)New Buildings Institute, Vancouver, WA, (2)New Buildings Institute, White Salmon, WA*

New Buildings Institute recently conducted an extensive national search for information on zero- energy and very-low-energy (zero-capable) buildings. These early findings provide a broad look at documented zero-energy buildings and the costs, features and trends in these leading examples. Combined with the larger set of zero-capable buildings, the findings can inform designers, owners, program managers and policy makers regarding the technologies, designs and methods used on the path to zero energy.

4. California Green Building Standards Code (CALGreen) 2010: New Challenges and Opportunities

Maia R. Speer, P.E., Member*, Guttmann & Blaevoet, San Francisco, CA*

The California Green Building Standards Code took effect in January 2011, establishing minimum standards for most new non-residential and residential construction projects in California, and affecting over 10% of the U.S. population. This is the first mandatory statewide green building code in the United States, and affects planning, energy efficiency, water efficiency and conservation, indoor pollutant control and environmental quality, water

efficiency, commissioning and building operations. We present an overview of the Code, focusing on major changes. We'll present examples of how the Code is changing design and construction practices and lessons learned in the first year after adoption.

Monday, March 12, 2012, 3:15 PM-4:45 PM

Plug Load Reduction Strategies

Room: Cabrillo Salon

Chair: Bing Liu, P.E., Member, Pacific Northwest National Laboratory, Richland, WA

Plug loads can consume significant amounts of energy in commercial buildings and represent the segment of energy end users that are rapidly increasing, even as other types of loads have steadily progressed toward energy reduction. In some buildings, plug loads have overtaken lighting or HVAC loads as the largest single electrical energy load source. This seminar presents various technologies and strategies to reduce plug loads base on real world experience, including the plug loads sub-metering, occupant behavior changes and emerging technologies to combine lighting and plug load controls. This seminar will also present a field monitoring study in two high performance office buildings and explore opportunities for plug load energy savings in these buildings.

1. Workstation Plug Loads: Developing a Baseline, Sub-Metering, and Encouraging Behavioral Change
Ian Metzger, Member*, National Renewable Energy Laboratory, Golden, CO*
Recent research shows that desk-based technologies and electronics in office settings can consume significant amounts of energy that are often not taken into account in energy monitoring and reduction strategies. These technologies are generally under the control of individual workers, making it difficult to track their energy consumption levels. This presentation discusses the results from two pilot projects which have implemented different plug load sub-metering and control systems and have encouraged behavioral change through multiple mechanisms such as prompting and occupant competitions. Energy reduction results are presented along with lessons learned from implementation and behavioral change approaches.

2. Plug Load Opportunities: Results from a Commercial Office Field Monitoring Study
Chris Calwell*, Ecova, Durango, CO*
Plug loads represent the segment of commercial building energy consumption that has continued to increase, even as efficiency policies and programs have steadily progressed toward reducing other types of loads. This presentation summarizes the final results of a commercial office plug load field monitoring study conducted on behalf of the California Energy Commission's Public Interest Energy Research Program. The purpose of this study was to characterize the energy consumption of plug load devices in two high performance buildings in California and explore opportunities for plug load energy savings in these buildings.

Policy/Benchmarking 2

Room: Rio Vista Ballroom A-E

Chair: Mary Ann Piette, Associate Member, Lawrence Berkeley National Laboratory, Berkeley, CA

This session presents current ways to achieve benchmarking results, and different ways to achieve those results, including the development of automated fault detection and diagnostics in the context of market transformation and policy-making activities and applying Energy Savings Performance Contracts to practice.

1. Energy Benchmarking: Not One Size Fits All

Karin Giefer *and Juliet Walker, Arup, New York, NY*

The focus of energy benchmarking in the U.S. for policymakers, commercial RE owners and occupiers has long been EnergyStar. However, how does this translate for a company with a global footprint? How can you build on the principles of EnergyStar and turn it into a global tool? What if you operate a building type that isn't in CBECS? What are the major challenges in getting a benchmarking system up and running within an organization and how does having the right information turn into results? Benchmarking isn't the same for every organization and it isn't always perfect, but there are always benefits.

2. Moving Fault Detection and Diagnostics Forward with Policy and Market Transformation

Kristin Heinemeier, Ph.D., P.E., Member[1] *and Mark Cherniack, Member*[2]*, (1)Western Cooling Efficiency Center, Davis, CA, (2)New Buildings Institute, White Salmon, WA*

Automated fault detection and diagnostics is a technology that uses hardware, sensors, and software to detect and diagnose problems with rooftop units. This technology has been pursued by developers for decades, although recent advances suggest that it may be reaching a "tipping-point," where the technology will soon begin to advance rapidly. Efforts are underway to help advance this technology by looking at both market transformation and policies related to AFDD. This presentation introduces some of these market transformation and policy-making activities and describes how they are changing the prospects for AFDD.

3. Compared to What? Building a case for Benchmarking, Measured Performance, and Case Studies

Cathy Higgins[1]*, Mark Frankel*[1]*, Cathy Turner*[2] *and Adam Scherba*[1]*, (1)New Buildings Institute, White Salmon, WA, (2)New Buildings Institute, Vancouver, WA*

New Buildings Institute has three recent areas of research with outcomes that offer improved information on building performance and enhance the basis for benchmarking and comparisons. This presentation reviews results from 1) energy performance at 22 'new' high performance buildings in California, 2) a national search for deep energy savings in existing buildings and for documented zero-energy buildings and 3) application of NBI's database of over 1,000 buildings and other sources to provide feedback and comparison of energy performance. Case studies are used to demonstrate the specific energy outcomes, technologies and designs used to achieve low-energy-use commercial buildings.

4. Achieving Deep Retrofit with ESPC in Government Facilities

Kinga Porst, Associate Member*, U.S. General Services Administration, Washington, DC*

The General Services Administration, Office of Federal High Performance Green Buildings (OFHPGB) developed a program to identify ways to improve the Energy Savings Performance Contract (ESPC) process and expand use of ESPCs to finance installation of energy saving technologies and practices in existing government buildings. The presentation will provide practical advices and case studies for reaching deep retrofits with ESPCs.

4:45 p.m. – 6:00 p.m.

Posters on Display

Room: Rio Vista Ballroom F-G

Reception

Poolside

Tuesday, March 13

Tuesday, March 13, 2012, 7:30 AM-8:30 AM

Dodo-Sapiens:
How Our Way of Life Is Killing Us and the Need for Regenerative, Bio-Based Buildings

Room: Rio Vista Ballroom A-E

Chair: Kent Peterson, P.E., Presidential Fellow Life Member, P2S Engineering, Inc., Long Beach, CA

***Eric Corey Freed**, organicARCHITECT, San Francisco, CA*

We are victims of our own stupidity. Seemingly harmless decisions about our buildings made decades ago and now throwing all of our natural systems into decline. While every other technology has made vast improvements (cell phones, computers, automobiles), our buildings continue to be boring, energy-wasting and toxic. In this talk, you'll tour bold, new ideas for transforming our cities and suburbs into regenerative and restorative places. By learning from Nature, we'll uncover lessons to apply to our built environment that will save energy, water, resources and be healthier in the process. This brand new "bullet-point free" talk is presented by the author of "Green Building for Dummies."

Tuesday, March 13, 2012, 8:30 AM-9:30 AM

High Performing Building Magazine Roundtable: What We Are Learning

Room: Rio Vista Ballroom A-E

Chair: Kent Peterson, P.E., Presidential Fellow Life Member, P2S Engineering, Inc., Long Beach, CA

The editorial mission of HPB Magazine is to present case studies that include performance data in addition to as designed projections of energy use and other sustainability factors. While many buildings are said to be "green," "low energy," or "high performance," only some of those buildings can provide operating data which support their claims. The editorial advisory board for ASHRAE's HPB Magazine will share the lessons they have learned from reporting on the experiences of the designers, contractors, suppliers and owners of buildings that have been featured in the magazine. Performance data collected from featured buildings has been assembled in a data base allowing for the identification of planning and operating strategies that have proven successful – along with assumptions that have fallen by the wayside.

Tuesday, March 13, 2012, 9:45 AM-10:45 AM

HPB Case Studies 3

Room: Rio Vista Ballroom A-E

Chair: Chris Weixelman, P.E., Member, Newmatic Engineering, San Diego, CA

This seminar will present case studies based on High Performance Buildings in the public sector, two recently completed public schools and a university library under construction. Each building was designed to create the lowest electrical demand while maximizing the efficiency of the systems selected to serve those loads. The measures, systems and technologies used to achieve these efficiencies will be discussed. Each design reviewed multiple energy efficiency options, then based on the value, life cycle cost and impact to users, implemented day lighting and HVAC systems which could be monitored to provide feedback on the system performance. The data on the building performance so far to date will be part of the presentation.

1. Finn Hill Junior High: A Net- Zero Ready School in the Real World

***Shane Day, P.E.**, Arup, Seattle, WA*

The Lake Washington School District has set a goal to be the most energy- efficient school district in the state of Washington. Finn Hill Junior High is a new 114,000 sf facility that the District saw as a perfect opportunity to greatly reduce its energy load. To help achieve this goal, the design team provided a net- zero ready design. When the building opened in September 2011, its Energy Use Index was 17 kbtu/sf-yr, which is a 62% reduction over an average new school in the district. With future photovoltaic panels installed, the building will be net-zero energy.

2. Redding School for the Arts: ZNE or Bust, Warts and All

***James R. Benya, P.E.**[1] and James E. Theimer[2], (1)Benya Lighting Design, West Linn, OR, (2)Trilogy Architecture Urban Design and Research, Redding, CA*

The authors were key members of the design team responsible for the Redding School for the Arts, opening Fall 2011. The project is a 77,000 square foot school designed for zero net energy performance. The project relies on daylighting, conservation and careful design to permit an unusually small photovoltaic system to provide the necessary renewable energy source. The presentation explains the daylighting solutions, HVAC and other energy use systems. Six months of data are analyzed and reported, including a frank discussion of what worked, what showed promise, and what failed – "warts and all."

3. Case Study: Mary Idema Pew Library Striving for Energy Savings through the Commercial Building Partnership

*Michelle Dionello, P.E., Member[1] and **James Moyer**[2], (1)Arup, San Francisco, CA, (2)Grand Valley State University, Allendale, MI*

The presentation covers the case study of the Mary Idema Pew Library and the work completed through the Commercial Building Partnership to achieve 50% energy savings compared to an ASHRAE 90.1-2007 baseline energy model. The energy conservation measures proposed affected lighting design, mechanical system and equipment purchasing practice. The building was designed to be high-performance; therefore, the team addressed not only the building services but the future library's occupants as well. The presentation covers the life-cycle analysis of the ECMs and discusses Grand Valley State University's method to unlock the hidden potential in energy efficiency through occupant engagement.

HPB Envelopes Strategies 1

Room: Cabrillo Salon

Chair: Kent Peterson, P.E., Presidential Fellow Life Member, P2S Engineering, Inc., Long Beach, CA

This session presents a case study and a model for evaluating envelope design options. A project design team presents energy target management and key energy saving strategies involving a high-performance building envelope. Another presentation compares what is required in energy codes and ASHRAE standards when determining U-factors for compliance purposes, with examples of 2-D/3-D thermal models of typical conditions, to show how assumed U-Factors differ from the more refined calculations.

1. GSA Case Study, Part 2: Form Shaped by Performance -- Optimizing Orientation and Facade to Enable Energy Efficient Systems

***Christopher Flint Chatto**, ZGF Architects LLP, Seattle, WA*

As an ARRA funded project and part of the GSA's Design Excellence program, the Federal Center South Redevelopment responds to aggressive sustainable design and energy efficiency mandates. Currently under construction, this design-build project is anticipated to be one of the most sustainable office buildings of its time. A two-part series of presentations by members of the project's design team will discuss the energy target management and highlight key energy saving strategies involving the high-performance building envelope,

daylighting, optimized site orientation, passive chilled beam cooling, and an innovative central plant that incorporates ground source and phase change material-based thermal storage systems.

2. Improving Building Envelope Thermal Performance Accuracy in Energy Models

***Joseph P. Piñon, P.E., Associate Member**, Simpson Gumpertz & Heger Inc., San Francisco, CA*

To accurately evaluate building energy use and envelope design options, the U-Factors of the walls, windows, and roofs, have to be correctly inputted into the project's energy model software. Too often, unrealistically low average U-Factors are used that do not include thermal bridges or the effects of system/assembly interfaces that can significantly and reduce the predicted amount of energy savings. This presentation compares what is required in energy codes and ASHRAE standards when determining U-factors for compliance purposes, with examples of 2-D/3-D thermal models of typical conditions, to show how assumed U-Factors differ from the more refined calculations.

Tuesday, March 13, 2012, 11:00 AM-12:00 PM

Lighting/Daylighting Strategies

Room: Rio Vista Ballroom A-E

Chair: Mohammed H. Hosni, Ph.D., Fellow ASHRAE, Kansas State University, Manhattan, KS

This session includes presentations regarding recent developments in lighting that affect the construction industry; the "Daylighting Pattern Guide," which explores the interrelationship of sky, site, aperture and space planning; and advances in workstation specific, task/ambient office lighting and control strategies and how these strategies are changing the design and building practice. The latest lighting technologies to help building designers toward net-zero building design are discussed and future trends in lighting are explored. Several case studies are presented to explore successful daylighting strategies for common space types and visual comfort criteria. Furthermore, case studies of three recent projects in Southern California are used to illustrate evolving collaborative design practice and performance results for task/ambient office lighting and control strategies.

1. High Performance Lighting Solutions

***Mark Lien HBDP**, Lighting Solutions Center-Hubbell Lighting, Greenville, SC*

We can become part of the solution if we are informed or we can be blindsided by the quick pace and radical game changers we face. This presentation is designed to inform about recent developments in lighting that will affect the construction industry. The latest lighting technologies to help us toward net-zero building design and a glimpse into what the next five years will offer are included in this presentation. Attendees will be able to identify trends that enhance their credibility, enable them to visualize new solutions and understand upcoming industry shifts.

2. Leveraging Proven Daylighting Strategies for the Design of Low Energy Buildings

***Mark A. Lyles**[1], Kevin Van Den Wymelenberg[2] and Christopher Meek[3], (1)New Buildings Institute, Vancouver, WA, (2)University of Idaho, Boise, ID, (3)University of Washington, Seattle, WA*

New Buildings Institute, in partnership with the University of Idaho and University of Washington, has developed a freely available interactive tool for the design of proven daylighting strategies in a variety of building types. Users will be introduced to the *Daylighting Pattern Guide* while exploring the inter-relationship of sky, site, aperture and space planning. The *Guide* uses a combination of built examples and advanced simulation to set the stage for substantial reductions in lighting power consumption. In addition, several case studies offer further exploration of successful daylighting strategies for common space types and visual comfort criteria.

3. Practice Makes Perfect: Case Studies in High-Performance Office Lighting and Controls

***David R. Pfund**, The Lighting Quotient, West Haven, CT*

A truly high-performance building must demonstrate deep energy savings and achieve high levels of occupant satisfaction. This combined goal remains largely elusive to those who continue to apply conventional wisdom and follow traditional project design delivery paths. Alternatively, we must embrace the notion that "What got us here

won't get us there." This session focuses on advances in workstation specific, task/ambient office lighting and control strategies and how these strategies are changing the design and building practice. Case studies of three recent projects in Southern California are used to illustrate evolving collaborative design practice and performance results.

Low Energy Techniques 1

Room: Cabrillo Salon

Chair: Devin A. Abellon, P.E., Member, Uponor, Phoenix, AZ

This seminar presents various strategies to dramatically reduce the energy usage of office buildings in an urban setting by examining approaches on both a district scale and a standalone building scale. The integration of separate building systems to create a centralized district energy solution provides opportunities for significant overall energy use reduction. From there specific recommendations, as outlined in the New ASHRAE 50% Advanced Energy Design Guide, on successful prescriptive solutions and integrated design strategies at the building level will be discussed. Case studies comparing the two approaches will be presented.

1. Is Net Zero District a Better Alternative than Net Zero Buildings?

Luke Leung, P.E., Member*, Skidmore, Owings and Merrill LLP, Chicago, IL*

In urban settings, it has become clear that the highest performance opportunities can be achieved at the district scale rather than at the building scale. Just as in human society we cannot imagine each person living in independent isolation without sharing, should the urban environment be focus to make buildings individually net zero? Powerful synergies and significant efficiencies can be created when buildings are considered in district scale. This presentation critically compares net zero buildings vs. net zero districts in urban settings with examples from around the world, including Southworks in Chicago.

2. Overview of the New ASHRAE 50% Advanced Energy Design Guide for Small and Medium Office Buildings

Ms. Erin McConahey, P.E., Member[1] *and Bing Liu, P.E., Member*[2]*, (1)Arup, Los Angeles, CA, (2)Pacific Northwest National Laboratory, Richland, WA*

This session introduces the main technical and design integration recommendations embedded within the recently published *Advanced Energy Design Guide for Small to Medium Office Buildings: Achieving 50% Energy Savings Toward a Net Zero Energy Building*, a document developed by a combined effort from representatives of ASHRAE, AIA, IESNA, USGBC, and U.S. DOE. The presentation introduces the organization of the guide, the details of the successful prescriptive solutions, the recommended integrated design strategies and the methods by which Integrated Project Delivery approaches can be used to achieve low-energy buildings.

Noon – 1:15 p.m.

Posters on Display

Room: Rio Vista Ballroom F-G

Lunch

Room: Rio Vista Pavillion

Tuesday, March 13, 2012, 1:30 PM-3:00 PM

HPB Envelopes Strategies 2

Room: Rio Vista Ballroom A-E

Chair: Kent Peterson, P.E., Presidential Fellow Life Member, P2S Engineering, Inc., Long Beach, CA

This session covers broad strategies for improving envelope performance. Strategies addressed include high performance glazing and external shading devices; using building performance modeling tools – climate, solar, energy, daylighting, and air flow – to inform decision making early in the design process; current levels of thermal performance of existing building enclosures and strategies to obtain high R-value enclosures; and elements of advanced enclosure design: performance, sustainability and constructability.

1. High Performance Building Facades

Kyounghee Kim, Ph.D.*, University of North Carolina at Charlotte, Charlotte, NC*

Two case studies - Aurora Tower and Broad Art Museum -- address how effectively high performance glazing and external shading devices contribute to energy reduction. Aurora Tower is a 308m tall office and residential building located in Kuala Lumpur, Malaysia, Climate Zone 2. Broad Art Museum is a 50,000sq.ft located in East Lansing, MI, Climate Zone 5. In accordance with ASHRAE 90.1, solar heat gain through these high performance facades is verified through analytical and numerical methods. Analysis results and recommendations are presented.

2. A Building Physics Approach to Renovation and Expansion of a Higher Education Community Building

Robert Bolin, P.E., Member*, Syska Hennessy Group, Chicago, IL*

This presentation describes the building physics approach that the project team engaged in, using building performance modeling tools – climate, solar, energy, daylighting, and air flow – to inform decision making early in the design process and then throughout the design's development of a near or net zero design. Particular attention is given to the interaction at the building envelope in developing a balanced strategy to control solar gain, enhance natural illumination, reduce issues related to glare, and provide operability and user controllability to embrace the use of natural ventilation as the primary conditioning strategy.

3. High Performance Enclosure Strategies for Thermally Efficient Buildings

Graham Finch, P.Eng., Associate Member *and Brittany Hanam, RDH Building Engineering Ltd., Vancouver, BC, Canada*

High performance building enclosures are fundamental to high performance buildings. Reducing the heating and cooling loads through highly insulated enclosures is an important step in creating a low-energy building. Building codes and standards continue to push the minimum insulation levels and thermal performance of building enclosures, however high enclosure thermal performance is still difficult to achieve in practice. This presentation discusses current levels of thermal performance of existing building enclosures and strategies to obtain high R-value enclosures.

4. Advanced Building Enclosure Design: Performance, Sustainability, Constructability

Christopher Decareau, Associate Member*, Simpson Gumpertz & Heger, Inc., New York, NY*

Building enclosure design must consider performance throughout the expected lifespan of the building. High performance design requires structural integrity, energy efficiency, thermal comfort, solar control and integrating all the systems that affect performance. A sustainable building enclosure must be durable and use appropriate materials, but also provide the desired aesthetics. Because building enclosure construction is expensive and very difficult to adjust after-the-fact, constructability must be considered during design. This talk provides guidance for architects, engineers and contractors on these essential elements of advanced enclosure design: performance, sustainability and constructability.

Improving Operations

Room: Cabrillo Salon

Chair: Senthil kumar Arunachalam, Member, Partner Energy, Irvine, CA

This seminar presents methods and techniques to improve operations on high performance buildings (HPB). Improving operations on such buildings reduces building operating cost, energy usage and improves comfort. This session presents various approaches which were used to identify and quantifying the energy usage on HPB buildings. This seminar also presents various energy conservation measures that were implemented to improve operations on these buildings. There is always been a gap between actual and predicted performance on a LEED-NC rated building. This seminar address key steps to indentify these gaps and to improve operations on the HPB buildings.

1. Optimizing Existing Building Performance through Energy Auditing at Harvard University: An In-Depth Look into How Harvard Created an In-House Energy Auditing Service and the Results to Date

Eric Potkin *and Kevin Bright, Harvard University, Cambridge, MA*

In order to help meet a 30% greenhouse gas reduction goal by 2016, Harvard University has created their own in-house energy auditing service to help identify ECMs for buildings throughout campus. Since its formation three years ago, the team has audited over 1.1 million square feet of space and identified nearly 500 ECMs. This presentation discusses the process of creating an in-house auditing service and some of the tools developed to help streamline the auditing process as well as case studies highlighting some of the more innovative ECMs identified.

2. Designing, Benchmarking and Maintaining a High Performance Building: The Path from LEED NC Platinum to LEED EB Platinum Certification

Kevin Bright*, Harvard University, Cambridge, MA*

In 2006, Harvard University earned its first LEED Platinum project under the New Construction rating system. After construction, personnel realized the building was not performing as well as predicted in its energy model. This presentation focuses on the analysis process and reviews the building's historical energy performance, dissects its energy model, reviews the lessons learned in its evaluation and identifies the key adjustments made to its operation. This case study aims to share the lessons learned of a high performance building project in order to educate the green building community.

3. High Performance Buildings: Achieving Superior Performance for Life

Neil Maldeis*, Trane, White Bear Lake, MN*

Adopting “high performance building” concepts can reduce energy and operating expenses by 30% - 50% over the course of a building’s life cycle, typically 50 to 75 years, and also creates an environment where employees can thrive and productivity can soar. The presenter shares how energy efficiency, service and maintenance approaches can optimize capital budget, reduce maintenance and operating costs and improve the indoor environment to ultimately help businesses add value and stay competitive.

Tuesday, March 13, 2012, 3:15 PM-4:45 PM

Low Energy Techniques 2

Room: Cabrillo Salon

Chair: Mark Frankel, New Buildings Institute, White Salmon, WA

The case studies and techniques in this session should spark some innovative ways to achieve low energy. These innovative techniques include biomimicry, which solves human problems by looking at nature for solutions. At a headquarters building, the computer-integrated lighting and HVAC systems influence each other, continuously adjusting with the ebb and flow of occupants, sun wind and temperature, forming a system that functions like a living body. Or, exploring emerging HVAC systems for generating and using high temperature chilled water to surprising effect, looking at suitable systems and climates, case studies and analysis techniques. And, process -- addressing the gap of communication and knowledge between the energy modeler and architect and how to utilize the energy model during the early design.

1. Evolving Efficiency: Using Biomimicry to Improve Building Performance
Douglas Pierce AIA*, Perkins+Will, Minneapolis, MN*
Biomimicry solves human problems by looking at nature for solutions. At the Headquarters of Great River Energy, Minnesota's second largest electricity provider, the computer-integrated lighting and HVAC systems influence each other, continuously adjusting with the ebb and flow of occupants, sun wind and temperature, forming a system that functions like a living body. The architects, engineers and operators used the Living Design Process to coax the building into running at its best, by imagining it as an evolving ecosystem, instead of thinking of it as a set of parts and pieces assembled into a machine.

2. High Temperature Cooling Techniques
Andrew D. Corney, Member*, WSP Flack + Kurtz - Built Ecology, San Francisco, CA*
Emerging HVAC systems that separate cooling from ventilation are becoming increasingly popular for their improved energy efficiency and comfort. Often these systems generate opportunities to see significant additional energy savings (50% or more in chilled water energy) by using high temperature chilled water (water supplied at ~55-60F) in many parts of the system. This presentation explores many methods for generating and using high temperature chilled water to surprising effect, looking at suitable systems and climates, case studies and analysis techniques. Attendees learn how to apply these techniques to achieve savings on their project designs.

3. An Energy Simulation in Early Design Stage Application for Improving Energy Efficiency Strategy
Eddy Santosa*, HMC Architects, Ontario, CA*
This presentation addresses the gap of communication and knowledge between the energy modeler and architect and how to utilize the energy model during the early design. If the gap can be eliminated, the goal of the high performance building can be achieved easier. The presentation focuses on the application of the energy model in non-residential buildings, especially schools and healthcare facilities, during the early design stage. Typical problems and architects expectations for the energy simulation support during the early design stage are discussed.

Realizing ROI

Room: Rio Vista Ballroom A-E

Chair: Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

Energy decisions are normally a balance of costs versus benefit. Cost versus benefit is often evaluated using a life cycle cost analysis to arrive at a return on investment. This session looks at several case studies analyzing multiple energy efficiency measures and the decision making process used to decide on the various options.

1. Life-Cycle Commissioning: Maximizing Investment in Construction, Operation and Maintenance
Cullen Choi, P.E.*, Architectural Energy Corporation, Boulder, CO*
High performance buildings begin with sustainable criteria and responsible design. As has been proven time and again, the new building commissioning process ensures that high performance buildings are designed, constructed and delivered to the owner in a state that meets those sustainable design criteria. For existing buildings, owners

and managers periodically engage in retro-commissioning, ongoing-commissioning or measurement and verification activities. While these processes provide a measurable benefit, no single activity can result in a truly high performance building. In order to maximize the capital, operating and strategic investments in any facility, life-cycle commissioning is a necessary evolution for an efficient building.

2. Caltech Energy Conservation Investment Program: A Holistic, Dual View (owner/vendor) Discussion on the Integration of Energy Auditing, Benchmarking, Economic Analysis, Implementation and Operations of Energy Retrofits in High Performance Buildings

Matthew Berbee, Member[1] *and Charles Fletcher, Member*[2]*, (1)California Institute of Technology, Pasadena, CA, (2)EMCOR Services - Mesa Energy Systems, Irvine, CA*

This presentation features a dynamic conversation around the success of the Caltech Energy Conservation Program by the owner and vendor. The benefit to the audience is two-fold in that the discussion will be more than a story of building energy audits, commissioning, benchmarking, economics and efficiency strategies. It is a process outline of how to integrate these topics and ultimately design, deliver and operate the HVAC retrofit solutions.

3. Net Zero Energy ROI Case Study

Zachary Pannier*, DPR Construction, San Diego, CA*

This presentation is a case study of the economics of design, construction and operation of two net zero energy buildings constructed in San Diego and Phoenix. The case study discusses the following financial considerations of each project: return on investment, net present value, system life cycle analysis, design and construction premiums, consumption data and internal rate of return/CAP rate.

4. Guiding the Net Zero Energy Strategy for a County Government Center: A Simple Financial Metric for Comparing Efficiency and Renewables Projects

Peter R. Pollard, P.E., Member*, kW Engineering, Oakland, CA*

Net zero energy is an ambitious target for existing buildings and presents great challenges and complexities. For each site, the team must determine an optimal balance of efficiency and renewable generation projects. The County of Santa Clara set ambitious targets towards achieving NZE at their existing County Government Center. This presentation describes a financial metric developed for comparing energy projects. This methodology was used to help determine the County's NZE strategy based on the most cost-effective combination of options. Graphing the results gives an immediately understandable comparison of the relative costs and energy contributions of all energy projects.

4:45 p.m.– 5:30 p.m.

Closing Comments

Room: Rio Vista Ballroom A-E