2013 EFFICIENCY FORUM REPORT

May 29-30, 2013 | National Renewable Energy Laboratory | Golden, CO

May 29, 2013

Better Buildings Alliance Members and Better Buildings Challenge Partners

May 30, 2013

Better Buildings Alliance Members, Better Buildings Challenge Partners and Commercial Building Stakeholders

Contents

EXECUTIVE SUMMARY

The Better Buildings Initiative announced by President Obama in December 2011 is a broad, multi-strategy initiative designed to reduce by 20% the energy intensity in the commercial and industrial sectors by 2020, catalyze revolutionary change in energy use, achieve billions in energy bill savings, and create high quality American jobs. The Better Buildings Challenge is a public-private partnership program in which leading organizations commit to improve the energy intensity of their building portfolios by at least 20% over 10 years and share their strategies and results with the market. Each Challenge Partner must employ and share replicable strategies through implementations models (IMs) that present successful strategies for overcoming common barriers to energy efficiency, and showcase projects that demonstrate multi-measured approaches that result in significant energy savings in individual buildings.

The Better Buildings Alliance is a voluntary collaboration between the U.S. Department of Energy (DOE) and building owners and operators. Through the Better Buildings Alliance, members work with DOE's exceptional network of research and technical experts to develop and deploy innovative, cost-effective, energy-saving solutions that lead to better technologies, more profitable businesses, and better buildings in which we work, shop, eat, stay, and learn.

On May 29 and 30, 2013, the U.S. DOE hosted the 2013 Efficiency Forum at the National Renewable Energy Laboratory in Golden, Colorado. This 2013 Efficiency Forum report captures the key outcomes and next steps from the two day meeting, as well as speaker presentations and session discussions which serve to direct future projects and activities within the Better Building technology and market solutions teams.

- **May 29** was open to current Better Buildings Alliance Members and Better Buildings Challenge Partners. The goal of Day 1 was to identify pathways to maximize energy savings from program activities, outline barriers to implementation, and identify solutions to overcome them.
- **May 30** was an Executive Exchange with Commercial Building Stakeholders, bringing Better Buildings Alliance and Better Buildings Challenge participants together with senior commercial building stakeholders to recognize major milestones and accomplishments and vet approaches to maximize the energy savings from activities discussed on Day 1. Better Buildings Challenge Partners were recognized for achieving program goals regarding data submission, and sharing showcase projects and strategies for overcoming common barriers.

Better Buildings Alliance members and Better Buildings Challenge Partners pursue energy-saving opportunities through the following Project Teams:

- Energy Management and Information Systems
- Lighting and Electrical
- Food Service
- Laboratories
- Plug and Process Loads
- Refrigeration
- Space Conditioning
- Market Transformation

This report and all presentations given at the Forum are available on the DOE Better Buildings Alliance web site on the 2013 Efficiency Forum page. Public review and comment on the 2013 Efficiency Forum report is encouraged by submitting input to BBA@ee.doe.gov through July 31, 2013.

"The Better Buildings Alliance conference was a good opportunity for Yum! Brands to partner with and learn from industry leaders and the DOE on saving energy. The forum promoted cross collaboration, the sharing of ideas and opportunities to provide real-world experiences."

Adam P. Jarboe, Associate Manager, CEM, Yum! Brands

"I found the forum an energizing and extraordinarily productive gathering."

Michael F. Bloom, Office of Federal High-Performance Green Buildings

*"I was **very impressed with the amount of practical information** that was generated, and came away energized and enthusiastic to continue to move the needle in expanding sustainability throughout our portfolio, and to encourage others to join the party."*

Nicholas E. Stolatis, Sr. Director, Global Sustainability and Enterprise Initiatives, TIAA-CREF

*"It was a fantastic experience and every session I attended was **incredibly relevant** to some project that I have going on."*

Anne White, Program Coordinator, Transwestern Sustainability Services

PLENARY SPEAKERS

Opening Plenary Session, May 29

Welcoming remarks on May 29 were given by Mary Werner, Program Manager for the Building Technologies Laboratory at the National Renewable Energy Laboratory (NREL). DOE's Commercial Partnerships Team Lead, Kristen Taddonio provided highlights of Better Buildings Alliance (BBA) activities from the past year, covering the new program name and logo, and its expansion into the public sector. DOE's Better Buildings Challenge (BBC) Lead for the Commercial and Higher Education Sectors, Holly Jamesen Carr, presented an overview of the BBC, sharing a range of first year successes including Partner showcase projects, IMs and portfolio-wide energy reductions.

Bill Prindle, Forum Facilitator, reviewed the agenda and noted that a goal of the sessions was to collect feedback and attempt to prioritize new and current program activities that meet participant needs. Bill Prindle announced that each day's concluding plenary session would feature report-outs of the key outcomes from each breakout session.

The following statement from the Office of General Counsel was read:

> *"The purpose of today's session is to ask for your input regarding energy efficiency in commercial buildings. To that end, it would be most helpful to us that you provide us, based on your personal experience, your individual advice, information, or facts regarding this topic. It is not the object of this session to obtain any group position or consensus. Rather, the Department is seeking as many recommendations as possible from all individuals at this meeting. To most effectively use our limited time, please refrain from passing judgment on another participant's recommendations or advice instead concentrating on your individual experiences."*

Promising Trends in Building Energy Management: Evidence from the Trenches, May 29

Tim Stout, Senior Director of Strategic Customer Relations at E Source, emphasized the progress achieved in energy efficiency over past decades, and the importance of continuing to drive energy efficiency for future generations. He discussed current challenges utilities face funding the information technology (IT) activities necessary to process and utilize data from smart meters, and observed that more energy program managers work with outside organizations to leverage building data. He noted that the pervasiveness of sensors and software will increase penetration of energy efficient technologies by making people more aware of their energy decisions, and described a need for increased training to facilitate the proper installation and operation of building equipment. The Better Buildings Alliance is helping through the collective sharing of success stories and case studies that, for example, illustrate to a CFO what can be accomplished through an investment in efficiency.

Closing Plenary Session, May 29

All attendees reconvened for the closing plenary session. Bill Prindle asked representatives from each Project Team to provide brief remarks summarizing the key takeaways from their breakout discussions. The key outcomes and next steps are captured in the report in each Project Team session: Energy Management Information Systems, Lighting and Electrical, Food Service, Laboratories, Plug and Process Loads, Refrigeration, Space Conditioning, and Market Transformation. Questions can be submitted to BBA@ee.doe.gov. Kristen Taddonio thanked everyone for their hard work and insights and noted that the next day's Executive Exchange would yield additional insights from expert stakeholders. The day concluded with a series of optional tours on the NREL campus including the LEED Gold-Designed Cafeteria, Thermal Test Facility (TTF), Research Support Facility (RSF) Net Zero Energy Office Building, and the Energy Systems Integration Facility (ESIF) Building Efficiency and Technology Research Tours.

Better Buildings Challenge Partners that received recognition at the Forum:

Corporate Partners

Ascension Health
Cleveland Clinic
Forest City
HEI
IHG
Jones Lang LaSalle
Kohl's
Lend Lease
Macy's
PNC Financial Services Group
Prologis
Shorenstein Properties
Staples
TIAA-CREF
Transwestern
USAA Real Estate
Walgreen Co.
Wyndham Worldwide

Higher Education Partners

Allegheny College
Michigan State University
University of CA, Irvine
University of Utah

Opening Plenary Session, May 30

Bill Prindle welcomed the attendees and provided a recap of the first day's events. Bobbi Garrett, NREL's Deputy Laboratory Director, encouraged taking a collaborative approach to identifying pathways to high efficiency, and as an example, mentioned how NREL works to transfer knowledge with DOE's Building Technologies Program.

Kathleen Hogan, DOE's Deputy Assistant Secretary for Energy Efficiency, emphasized the centrality of energy efficiency in economic stability, job creation and global competitiveness. She reiterated President Obama's State of the Union goal of achieving a 50% energy reduction in homes and business over the next 20 years, while doubling energy productivity. The Building Performance Database and the White House Green Button initiative are helping by standardizing utility data for public access.

Maria Vargas, DOE's Better Buildings Challenge Director, outlined the Challenge's progress, demonstrated by a 2.5% average improvement in annual energy intensity and an annual combined cost savings of $58 million.

Kristen Taddonio, far left and Kathleen Hogan, right, present special recognition awards to Drew Chidester, University of Pittsburg Medical Center and John Scott, Colliers International.

BBC Partners serve as committed leaders, willing to share solutions across market sectors. Current BBC Partners were recognized for achieving portfolio-wide reduction targets, and for transparently sharing showcase projects and unique solutions to common market barriers. The session concluded with Bill Prindle outlining the day's activities, and the plan for the breakout sessions to report-back at the end of the day.

Please see the list of recognized Corporate and Higher Education Challenge Partners acknowledged at the Forum in the box to the right. See the BBC Progress Update here.

Better Buildings Alliance Campaign and Challenge Updates: LEEP Campaign, Advanced Rooftop Unit Campaign, and Wireless Metering Challenge, May 30

Advanced RTU Campaign (ARC): DOE's Jason Koman introduced the Advanced RTU Campaign (ARC), which aims to increase the adoption of high efficiency rooftop units (RTUs) and RTU controls, and offers partnership and technical support to stakeholders. Building owners/operators are asked to evaluate their buildings for opportunities to replace RTUs, or retrofit them with upgraded controls, and to share the energy savings results with the Campaign. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the Retail Industry Leaders Association (RILA) have both signed on as organizers of the Campaign, which will run through December 2014. Both Daikin-McQuay and Carrier have produced products that met the RTU Challenge requirements.

Tom Watson, ASHRAE's president, expanded on an upcoming grassroots effort to help governments remove regulatory barriers to efficiency in the built environment, spoke of the need to simplify how efficiency solutions are created and of the importance of case studies. ASHRAE is offering a 50% discount from June 19 to July 19 on six related ASHRAE publications for joining ARC and sharing energy savings potential data. Discount codes will be distributed by email after joining. He encouraged all stakeholders to provide feedback on ASHRAE publications so ASHRAE can continue to improve their products.

Wireless Metering Challenge: DOE's Jason Koman announced the start of the Wireless Metering Challenge, and that DOE will be releasing the testing protocols, official rules, and timetables via the web. He also noted that the federal government is actively looking to increase metering and disclosure as required under Congressional mandates, and that Better Buildings Alliance members had expressed strong interest in panel level sub-metering to address a variety of concerns like increasingly common energy disclosure laws.

- **Goal**: Make panel level sub-metering ubiquitous by reducing the price of devices to around $100 per point. DOE has found that the commercial sector is in need of a cost-effective metering system, particularly at the panel level.
- **Materials**: DOE has worked with federal agencies, private building owners and non-profit organizations to create and vet the metering specification to qualify products. Specification-compliant products will be announced as they are tested and deemed compliant, an estimated three to nine months after testing starts.
- **Savings Potential**: Meters are estimated to enable 2% energy savings a year, with a potential $1.7 billion a year in energy cost savings.
- **Testing**: DOE will be testing submitted meters at the Forrestal building in Washington, DC.
- **Dates**: DOE Secretary Ernest Moniz will announce Wireless Metering Challenge partners. Manufacturers can sign up to participate through June.

Lighting Energy Efficiency Parking (LEEP) Campaign: DOE's Jason Koman introduced the LEEP Campaign and summarized the benefits of using the campaign's lighting specification. He reported that 67 participants have planned or implemented more than 100 million square feet of projects since 2012, with an estimated savings of 46 million kWh/year compared to ASHRAE Standard 90.1-2010.

Paul Wessel of the Green Parking Council encouraged attendees to participate in the LEEP campaign, and Karen Penafiel of the Building Owners and Managers Association International (BOMA) encouraged stakeholders who have not joined to provide feedback on why, so that barriers may be identified and overcome.

Closing Plenary Session, May 30

All attendees reconvened for the closing plenary session. Facilitator Bill Brindle requested representatives from each Project Team to provide brief remarks summarizing the key takeaways from their breakout discussions. The key outcomes and next steps are captured in the report in each Project Team session: Energy Management and Information Systems, Lighting and Electrical, Food Service, Laboratories, Plug and Process Loads, Refrigeration, Space Conditioning, and Market Transformation. Questions can be submitted to BBA@ee.doe.gov. Kristen Taddonio concluded the closing session by extending her appreciation for everyone's participation. She noted that the Efficiency Forum Report would be available on the website in the coming weeks and that feedback was welcome via BBA@ee.doe.gov. There was also a written feedback form to provide comments. The day concluded with a series of optional tours on the NREL campus including the TTF, RSF Net Zero Energy Office Building, and the ESIF Building Efficiency and Technology Research Tours.

SECTOR TEAM SUMMARIES

Commercial Real Estate and Hospitality Sectors

The Commercial Real Estate and Hospitality sectors of the Better Buildings Alliance consist of 79 member organizations, including 15 Better Buildings Challenge members. Together, these members own and manage over 8 billion square feet of building space.

The session consisted of presentations from the incoming co-chairs of the sector steering committee, and a panel focused on identifying replicable and scalable activities based on two of the BBC showcase projects. Members provided feedback about potential opportunities from the Market Solutions Team and gauged interested in creating a new Project Team around renewable energy opportunities. The group reconvened the second day in a breakout discussion focused on potential activities that would address market and technology barriers. Please see the sector breakout presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Steering committee chair address

The outgoing steering committee chair congratulated the members and the BBA on progress through collaboration and networking. The chair encouraged participants to remain engaged to further increase adoption of energy efficiency as a best practice across industry and in their organizations.

II. Incoming steering committee co-chair panel

The incoming steering committee co-chairs served in a panel discussion aimed at providing commercial real estate and hospitality sector perspectives on BBA activity: participation at their organizations, top priorities for the coming year, and ways to meet goals for the sector. Sector goals include: an expanded

membership base, crossover engagement with the Better Buildings Challenge partners, and reengagement of subsectors such as retail and multifamily. Panelists highlighted a need for:

Deb Cloutier, JDM Associates, Carlos Santamaria, Glenborough, and John Scott, Colliers International chat during the Efficiency Forum.

- Quantifying qualitative benefits of energy efficiency in commercial real estate;
- Continued understanding, evaluation and incorporation of data and EMIS into real estate operation;
- Variable speed device technology implementation resources and cost-benefit evaluation guidance;
- Indoor air quality (IAQ) resources; and
- Increased social media activity for communications and marketing, such as interactive conversation platforms for membership.

III. Better Buildings Challenge showcase project panel (Forest City and TIAA-CREF)

Following a brief introduction to the Better Buildings Challenge, members discussed replicable success stories and shared ideas and lessons learned via presentations by Better Buildings Challenge members.

Showcase panel discussion topics:

- **Forest City showcase project**: South Bay Galleria (retail) comprehensive renovation project was prioritized due to the age of the facility and underperformance of equipment; many of the upgrades and improvements were industry best practices. Combined savings of 17% to 22% of energy use are expected.
- **TIAA-CREF showcase project**: 811 Barton Springs Road is a suburban office building targeted for low/no cost energy efficiency improvements and investment grade projects. Lessons learned include the role and value of streamlined communication with the property management team and other contractual counterparts to accelerate project traction and maximize energy and cost savings.
- The following roundtable discussion was focused around three primary topics:
  - Data access and transparency;
  - Policy setting and governance; and
  - Technology selection and deployment: EMS and demand response (DR), variable frequency drives (VFDs), optimizing the use of data and energy management information systems (EMIS), and data analysis platforms.

IV. Market Solutions Team Overview

A Market Solutions Team lead provided an overview of on-going activities. Members expressed interest in the following issues specific to the Commercial Real Estate and Hospitality sector:

- Tenant and broker engagement activities.
- Green leasing recognition and implementation best practices in existing lease renewal.
- "Train the trainer" opportunities for building operations and other topics.
- Overcoming privacy barriers as it relates to data access and coordination with utility providers.

- Demonstrating the value of high-performing buildings in the appraisal and valuation process.
- Benchmarking practices as it relates to asset acquisitions and sales, and the value of data.
- Data accuracy through manual data entry.
- Audits and anomaly detection.
- The importance of cooperation and synergistic values with tenants, property management team and ownership.

NEXT STEPS FOR FURTHER CONSIDERATION

The attendees were allowed to self-select participation in a series of tabletop discussions with expert facilitators from the industry on green leasing, better data/EMIS, deep energy retrofits, lighting opportunities, and appraisal and valuation. Each table brainstormed potential activities that could be considered by the BBA for feasibility and impact. A number of topic areas were identified for further exploration in the coming year by the Commercial Real Estate and Hospitality sectors as listed below:

- **Green leasing**: Consider how best to engage brokerage community and make data access, energy efficiency and high performing building operations more normative components of leasing provisions.
- **Better data /EMIS**: Continue to discuss how to overcome the challenges of using data in an effective manner and communicating results to others.
- **Deep energy retrofits**: Expand of pilot projects and test sites; involvement of new construction and design teams in addition to operating teams; obsolescence of new technologies; integration of technology using varying protocols.
- **Lighting opportunities**: Greater visibility for Lighting in Energy Efficient Parking (LEEP) Campaign and wireless parking controls.
- **Appraisal and valuation**: Develop an energy efficiency and sustainability standard lexicon for the industry; help to quantity the value of energy efficiency benefits for appraisers to accept and leverage; work with the investment community – including lenders, financial allies, and corporate real estate associations; understand the "legal department's" perspective to mitigate liability; investigate opportunities to infiltrate the appraisal analysis and due diligence activities.
- **Technology selection and deployment**: Address the need for an unbiased analysis of individual energy efficiency products to mitigate risk in these areas.

Healthcare Sector

The Better Buildings Alliance Healthcare Sector has 57 member organizations, including four Better Buildings Challenge Partners, representing about .8 billion square feet. The Healthcare Sector breakout group provided feedback on potential new initiatives, heard from two members on notable projects that were applicable to the group, and agreed to explore several new sector focused initiatives. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. New Topics Team

DOE requested feedback on a potential new team focused on strategic use of renewables to help businesses reduce energy costs and environmental footprint. Renewable energy technologies could be explored in the form of guides, case studies, or demonstrations.

- Interest was expressed in technologies suitable for urban hospitals where space is limited: combined heat and power (CHP), fuel cells, and solar thermal technologies for water heating.
- Technologies should be able to stand on their own financially without too many incentives. Some hospitals have a two-year or less payback requirement.
- A participant recommended Advanced Energy Design Guides for guidance on the payback of solar technologies by climate zones.

For follow up, DOE will share CHP resources with the group and will consider a new group focus on the technologies of interest to the group.

II. Beaumont Health: Kaizens Approach – Presented by Kay Winokur

Kay Winokur presented how the Kaizens approach is used to engage the whole organization in sustainability, including energy efficiency, water, IAQ, healthy food, and more.

- Beaumont delivers an internal two-hour course that certifies employees as green officers. A team of facilities technical experts conducts walk-throughs to observe where there is waste and make quick changes.
- Branding is consistent and very important. Beaumont translates savings into facts that employees can understand such as number of households and individual American's energy or water use. Participants discussed ways to engage senior leadership through emphasizing the health benefits rather than the payback. The healthcare participants were very interested in this presentation and agreed to share their techniques to get leadership buy-in, training programs, and related case studies.

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III. University of Pittsburgh Medical Center (UMPC): Retro-commissioning and Energy Information Systems (EIS) – Presented by Drew Chidester

Drew Chidester discussed the tie between retro-commissioning and EIS systems: maintaining the commissioned-state of the systems requires facilities managers to monitor data from the systems.

- The first step is to track energy usage data and trending and to pool this information so that facility managers can analyze it.
- UMPC discussed their red/green lights approach which through a set of algorithms helps identify problems in a building system's operations through monitoring meters.
- UMPC's building system's operations have come online at different times with various systems. Integrating all of this information is difficult and poses unique challenges. Central systems are expensive. Organizations should budget accordingly and have stop points in case funding comes short.

The group discussed their unique approaches to metering. Several had also partnered with engineering schools to sponsor students and have them develop metering strategies and algorithms for fault detection. Utilizing data and developing systems to manage energy could be a good topic for a follow on discussion.

IV. Market Solutions Projects for Healthcare

The Market Solutions Team sought input from healthcare members on opportunities to reflect the needs of Better Buildings Alliance members across all sectors in Market Solutions activities. The team

discussed barriers specific to hospitals that are characterized by multiple Building Automation Systems (BAS) types with varying ages across portfolios. It is a challenge to aggregate/integrate/centralize data across multiple systems and to build a simple framework for staff to use these data effectively. Some participants had attended the BBA – and PNNL – sponsored re-tuning training in October 2012.

The main training issues raised by healthcare participants were:

- Making the case to management to invest in employee training is difficult. Hospitals that have invested in employee training have seen increased engagement and higher performance from staff but it is expensive.
- Engaging facilities staff to implement proactive vs. reactive approaches. Members shared that a way to engage staff is to make the opportunity cost case: Ask facilities staff about what else they could be doing with their time instead of replacing inefficient equipment (e.g. light bulbs).
- Participants felt the re-tuning training assumes an advanced understanding of the BAS and extracting data from the system. Many of the hospital staff who operate the building are not advanced BAS users.
- Training resources: U.S. General Services Administration created a free training resource for facility managers at fmi.gov.

Participants at the 2013 Efficiency Forum share best practices during a technology solutions team session.

The Market Solutions Team and DOE will explore ways to make the training more applicable to a wider range of hospitals with varying level of BAS systems and staff capabilities.

V. Debrief on Forum Sessions and New Initiatives

- **Space Conditioning:** Hospitals spend the most money per square foot on space conditioning. Several key issues related to space conditioning that members are currently tackling include:
  - *Reducing air flow rates in unoccupied space:* Ascension Health is piloting the effort to reduce air flow rates in unoccupied rooms and tracking energy use. One point of resistance is from infection control staff.
  - *Pressure in operating rooms:* Hospitals are pulling in a lot of outside air and hospitals are generally negatively pressured.
  - *Retro-commissioning:* This is important and complicated because of additions to buildings. Both UPMC and Ascension Health have energy savings data. Hospitals must be equipped to do retro-commissioning. Guide for hospitals could be useful. Potentially collaborate with ASHE efforts.
  - *Retrofitting Pneumatic Controls:* Members are interested in best practices with retrofitting pneumatic controls. UPMC and Ascension are interested in talking with Siemens (or similar vendor) to see if they could do a case study or white paper on retro-commissioning pneumatics systems at smaller hospitals. Two key topics:
    - Look at smaller hospital and retro-commissioning with pneumatics and compare with retro-commissioning with direct digital controls (DDC) – savings may be 20-30% vs. 15%.

- Address barriers to retrofitting, requirements for maintaining, and payback for each option or take a hybrid approach: convert to digital only where cost effective.

- **Training and staff engagement**: The relationship between directors and electricians and how to motivate workers to be proactive vs. reactive.
  - The group reiterated applicability of Beaumont's Kaizen method.
  - One participant recommended a way to engage site facility managers: use existing, nationally recognized documents - such as the ASHRAE 90.1 or DOE's AEDG/AERG series - as a foundation to form several teams to review them in detailed way and find ways to implement or improve them. This would empower site facility managers to become experts in some areas, provide networking opportunities, and facilitate validation/improvement of key documents which would benefit DOE or ASHRAE.

- **Better Buildings Challenge Partners Support**: Members were interested in talking more frequently to share ways that they are making progress towards the BBC goal. There are a growing number of healthcare organizations in the BBC. Members suggested reporting on progress.
- **Sector specific meetings**: Increase engagement with sector members who are currently unresponsive to share best practices. Do not replicate efforts of other organizations who hold healthcare focused calls/meetings – rather build upon their progress.
- **Green Revolving Loan Funds**: Boston initiative is working to encourage green revolving loan funds. Mixed reactions from healthcare members. Members may be interested if case studies on hospitals are available.
- **Keep healthcare members up to date on BBA activities**: Members responded positively to the idea of an email highlighting healthcare related technology Project Teams meetings or activities.
- **Implementation models**: Transwestern's "Good, Better, Best" system was applicable to healthcare members.

NEXT STEPS FOR FURTHER CONSIDERATION

Below is a summary of future activities that will be considered by DOE for this sector group. These include collaborating with organizations and associations, increasing communications across the sector, and identifying opportunities to develop case studies or white papers to address technical issues.

- **Increase engagement of healthcare members**: Explore opportunities to coordinate with associations such as Healthcare Without Harm and Practice Greenhealth that have discussions and initiatives for healthcare members.
- **Training resources**: Market Solutions may explore expanding re-tuning training to accommodate healthcare sector members. The group will share resources, such as Beaumont's Green Team training curriculum. Consider engaging site director level staff as described above.
- **Communications**: Develop healthcare sector specific communications that capture applicable activities monthly.
- **Case Studies**: Develop guidance, white papers, or case studies on activities related to reducing air flow rates in unoccupied spaces, retro-commissioning, energy management systems, and retrofitting pneumatic controls. Assess interest from larger group on these key topics to determine priority activities.

Higher Education Sector

The higher education sector of the Better Buildings Alliance is comprised of 22 members representing over 200 million square feet in building space, seven of whom are also Better Buildings Challenge Partners. The first session focused on the showcase projects of four BBC Partners, and representatives from three sector associations were invited to discuss common barriers in the second session. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

Four Better Buildings Challenge Partners discussed their showcase projects. Additional details on these showcase projects are available on the 2013 Efficiency Forum website.

I. Better Buildings Challenge Showcase Project Panel

- **Michigan State University**: Lynda Boomer, Energy and Environmental Engineer, provided an overview of the Anthony Hall showcase project. This is a 317,200-square-foot facility in East Lansing, MI, with expected energy savings of 34% and expected cost savings cost savings of $536,000.
- **Allegheny College**: Eric Pallant, Professor of Environmental Science, provided an overview of their Richard J. Cook Center for Environmental Science showcase project. This is a 21,000 square foot renovation within 47,500 square foot Carr Hall in Meadville, PA, with expected energy savings of 23%, and expected cost savings of $13,000 per year.
- **University of Utah**: Jeff Wrigley, Energy Manager, provided an overview of the Dumke Health Professions Education Building (HPEB) showcase project. This is a 53,000 square foot facility in Salt Lake City, UT, with expected energy savings of 22%, and expected cost savings of $30,500 per year.
- **UC Irvine**: Wendell Brase, Vice Chancellor for Administrative and Business Services, provided an overview of their Smart Labs Initiative/Natural Sciences II showcase project. This is a 146,000 square foot facility in Irvine, CA, with expected energy savings of 51%, and expected cost savings of $180,000 per year.

II. Open discussion – Tips for success

- Facility "information layers" enable ongoing monitoring, maintenance, and performance. The Smart Lab approach creates a rich information layer that facilitates active building management and allows for granular data tracking.
- Occupants' behavior is considered the "wildcard" in the equation. Some members noted that they have the ability to monitor the use of equipment like laboratory fume hoods, and send notices to users who are operating them wastefully.
- Participants noted the importance of collaboration between departments of environmental health and safety (EHS) and facilities on energy efficiency to reinforce message. Others mentioned this as an on-going problem.

III. Higher Education Associations Panel – Discussing Common Sector Barriers

- Representatives of three leading associations in the higher education sector were invited to join the group and discuss common barriers. These representatives were:
  - Stephanie Gripne, Representing the Sustainable Endowments Institute
  - Kristin Ferguson, Representing the U.S. Green Building Council (USGBC)

- Dave Newport, Representing The Association for the Advancement of Sustainability in Higher Education (AASHE)

- Several common barriers discussed were:
  - A lack of credible information about savings options. The Green Revolving Investment Tracking System (GRITS) offers a way to manage, track, and share information about projects implemented through an institution's green revolving fund (GRF).
  - A lack of buy-in from senior staff at institutions (e.g., CFOs).
  - Case studies can have limited value because of local factors like climate, tax rates, and incentives. One member noted that cost savings estimates must take into account the marginal cost of each kilowatt-hour (kWh) avoided, rather than average cost.
  - Insufficient access to capital, particularly for public institutions. The following sources of funding for efficiency projects were suggested: operating budgets, endowment funds, utility funds, cost savings revenue, student fees, donations and grants, investment banks, social impact bonds, and green bonds.

- A large number of related resources were provided to participants in the slides.

IV. Market Solutions Team Overview

A Market Solutions Team lead provided an overview of on-going activities. Members expressed interest in the following issues specific to the higher education sector:

Participants at the 2013 Efficiency Forum discuss initiatives during a technology solutions team session.

- Split incentive on larger scale, i.e. between owners and occupants/users in an institutional context (overlap with hospitality sector).
- Behavioral issues with students perceiving that they have the right to use unlimited resources since they pay tuition.

V. Renewable energy opportunities presentation

DOE is considering developing a new Project Team around renewables. Examples of renewable technologies discussed: solar photovoltaics (PV), solar thermal, and hybrids of these; biofuels and biogas; small-scale wind; and fuel cells. Members expressed interest in the following:

- Regulatory issues with regards to biofuels in particular.
- How to get to 100% renewables economically.

NEXT STEPS FOR FURTHER CONSIDERATION

From the discussion, DOE will consider working with the sector to:

- **Collaborate with the Market Solutions Team** to continue to identify sector-specific support activities. Ideas include, but are not limited to:

- Addressing the split-incentive issue whereby procurement personnel are not incentivized to capture energy efficiency opportunities.
- Building on existing tenant engagement work to address occupant behavior issues at universities. This is relevant for students, facility staff and users of campus laboratories.

- **Gauge member interest in arranging smaller sub-group discussions.** Ideas included, but are not limited to:
  - Building bridges to the health and safety community as key to getting deep savings (in conjunction with related and on-going Laboratory team activities).
  - Implementing a green revolving fund to finance energy efficiency or renewable energy projects at a college or university.
  - Exploring alternative sources of external project funding, and particularly those with terms that can compete with endowment returns and interest rates on borrowed money.
  - Engaging the CFO and other key finance staff around energy efficiency investments.

Retail, Food Service and Grocery Sectors

The Retail, Food Service, and Grocery sectors of the Better Buildings Alliance consist of 59 member organizations, including six Better Buildings Challenge members. Together, these members manage and own over 2.4 billion square feet of building space. Members from all three sectors attended the 2013 Efficiency Forum.

The group heard presentations from two BBC showcase projects. They also provided feedback about potential opportunities from the Market Solutions Team and gauged interested in a new Project Team on renewable energy opportunities. For the second session, the group recapped key takeaways from the Forum sessions, including: highlights, helpful sessions, and ideas for next year's forum. Please see the sector breakout presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Better Buildings Challenge showcase project panel (Walgreens and Staples)

Retail, grocery, and food service members discussed success stories, cross-cutting barriers and opportunities identified by showcase projects, and shared ideas and lessons learned via presentations by Better Buildings Challenge members. Showcase panel discussion topics included:

- **Staples showcase project**: On behalf of Bob Valair (Director of Energy and Environmental Management at Staples, Inc.), Patrick Maher, a consultant to Staples on energy issues, presented on the Staples Orlando Fulfillment Center and their comprehensive approach for identifying and implementing a host of energy efficiency measures, based on an "eco-Treasure Hunt" program. This fulfillment center is a 550,000 square foot facility, with expected energy savings of 22%, and expected cost savings of $101,000.
- **Walgreen Co.'s showcase project**: Jamie J. Meyers (AIA, LEED AP), Manager of Sustainability at Walgreen Co., presented on the Walgreens retail pharmacy in Goodyear, Arizona which features daylight harvesting and other new energy efficiency measures. This pharmacy is a 15,000 square foot facility, with expected energy savings of 45%, and expected cost savings of $8,400.

- Discussion around lessons learned and how to implement energy efficiency measures more widely across a company portfolio; workforce engagement and training (e.g., engaging staff at fulfillment center level); vendor engagement and lessons learned; and how company policies impact project successes.
- Technologies discussed included energy management systems (EMS) and demand response (DR), spot cooling and roof top units (RTUs) with variable frequency drives (VFDs), daylighting with skylights, LED lighting, rooftop solar panels, and electric vehicle charging.
- Members also discussed financing and return on investment (ROI) concerns, noting that how depreciation is handled in the tax codes can prevent retrofits and taking advantage of advances of new equipment.

II. Renewable energy opportunities presentation

DOE presented on a potential new Project Team focused on renewable energy technologies. The team would be a source of unbiased advice and shared experience, navigate regulations, business models, utility policies, etc. Examples of renewable technologies discussed were: solar PV, solar thermal, and hybrids of these; biofuels and biogas; small-scale wind; and fuel cells.

- Overall, by a show of hands, approximately 10 were interested in a potential new Project Team around renewable energy.
- Members expressed interest in case studies and Common Area Maintenance (CAM) solutions.
- There may be a need for standard language for solar provider, landlord, and lessee. It is important to work with landlords, since they have important interests (e.g. building value, depreciation, maintenance). In some cases where renewable energy projects have been implemented, landlords and lessees extended lease terms.

III. Market Solutions Team overview

Market Solutions activities include: data access and benchmarking, overcoming the split incentive, financing, training and workforce development, appraisals and valuation. The Market Solutions Team could assist with possible solutions via business case development, coordination with Project Teams, and dissemination of IMs.

There was interest in:

- Green leasing (striving to identify common leasing issues in retail space, possibly develop case studies), data access and benchmarking (tenant and building level), financing, and building re-tuning/re-commissioning.
- Adding depreciation to RTU calculator/tools, and also considering ways to quantify or build the business case for intangibles that contribute to energy efficiency and energy reduction. When payback is shorter than depreciation the result is cash-flow positive.

IV. Upcoming industry event attendance

A BBA representative from DOE, ICF International, or Navigant may be attending the RILA Retail Sustainability Conference in Orlando, FL from Sept 30-Oct 3, 2013 and/or the Edison Electric Institute (EEI) Key Accounts Workshop in Las Vegas, NV from Oct 6-9, 2013. DOE may consider engaging in additional events of interest to members.

Participants at the 2013 Efficiency Forum discuss initiatives during a Market Solutions Team session.

V. "Tech spec" site demonstration opportunities

DOE conducts field evaluations of products that meet the technical specifications in order to collect real-world energy savings data for efficient technologies. For more information, members can contact account manager or technology team leads. Site hosts receive: a discounted or free product, depending on the technology; an energy audit of their current system; and a case study analyzing their building and the energy savings gained through upgrading to the high-efficiency product.

VI. Feedback on the Forum

The sessions closed with key takeaways from the Forum and suggestions for next year's Forum:

- Comments expressed that the Forum is a great opportunity/environment to share with peers.
- Members thought other key stakeholders – e.g., landlords, utilities, internal stakeholders –could be very helpful to have at the Forum.
- Chief Financial Officers (CFOs), or persons playing a similar role, would be valuable to participate in discussions. There was a strong interest in the question of how to present energy efficiency projects to CFOs.

NEXT STEPS FOR FURTHER CONSIDERATION

From the discussion, DOE will consider working with the sector members to:

- **Tailor Project Team updates** for the retail, grocery, and food service membership (quarterly or bi-annually) to provide an overview of sector relevant projects related to heating, ventilation, and air conditioning (HVAC), lighting, refrigeration, EMIS, and Market Solutions Teams.
- **Engage CFOs**. Explore ways to support members in engaging their Chief Financial Officers (CFOs) to show the value of energy efficiency projects to get financial support for projects.
- **Engage stakeholders**. Host seminar for members to engage with manufacturers and vendors in an environment that is less vendor-driven and allows members to ask "tough" questions.
- **Arrange smaller sub-group discussions**. Plan sub-group call for small to medium sized retail portfolios and supermarkets. Interest in energy management and efficiency best practices in warehouses and distribution centers for retail, grocery.

- **Collaborate with the Market Solutions Team** to continue to identify sector-specific support activities, for example, tax code changes and regulation updates affecting energy efficiency projects.

Commercial Building Stakeholders

The stakeholder session held May 30 focused on relationships to suppliers. Goals for the session were to identify how to get market uptake of highlighted BBA technologies currently available, faster.

I. Stakeholder feedback

Paul Torcellini started the discussion by asking stakeholders to discuss major takeaways and potential next steps for suppliers that were generated out of discussions in the previous breakout sessions. DOE will consider the following supplier feedback:

Potential Supplier roles:

- Suppliers could provide guidance to the Better Buildings Alliance in regards to expanding efforts into other areas of building efficiency design (building envelope, in particular).
- Contribute to a finance "task force" that evaluates current financing mechanism and to provide peer review for DOE's market-facing resources.

Potential DOE role:

- Engage utilities, particularly with respect to data collection, disclosure, access, and analysis.
- Package and disseminate DOE resources in a way that gets the necessary information to on-the-ground decision makers such as energy managers.
- Develop new technology Challenges aimed at market transformation.
- Consider expanding the scope of Better Buildings Alliance efforts (to building envelope, building performance data disclosure, access, and evaluation).
- Actively market the value of DOE resources to the target audiences.

TECHNOLOGY SOLUTIONS TEAM SUMMARIES

Energy Management and Information Systems Team

Energy Management and Information Systems (EMIS) is the focus of a new technology solutions team. Two sessions were held May 29 and 30. Key session discussions included:

- **Background**: The team lead defined several types of EMIS systems and high-level capabilities.
- **Summary of current EMIS Project Team activities**: Current activities address several market barriers, including lack of common terminology in the industry, and lack of information on technology costs and benefits. Activities also involve information gathering to understand the EMIS technologies currently implemented and used by BBA members.
- **User experiences and stakeholder perspectives**: EMIS users, manufacturers and industry stakeholders shared their implementation and development experiences, and challenges preventing wider adoption of performance monitoring and tracking tools. These included: lack of familiarity about what tools are available and their capabilities; the vendor-driven nature of the selection, specification, and implementation process; difficulty and expense to integrate multiple and legacy

systems; and lack of data on cost and effectiveness. Participants shared benefits of using EMIS systems, including that these systems enable users to: participate in revenue-generating demand response programs; conduct continuous commissioning; identify and address performance and reliability issues early; perform remote monitoring; triage buildings in a portfolio to prioritize interventions; identify retrofit and operational improvement opportunities; and in cases where a pilot can be conducted, verify vendor claims.

- **Next steps**: From the discussion, several focus areas emerged that the Better Buildings program could explore in projects during the coming year. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Background

EMIS is defined as a broad family of tools and services used to manage building energy use, including energy information systems (EIS), fault detection and diagnostic (FDD) systems, benchmarking and utility bill tracking tools, and BAS. Energy information systems in particular comprise web-based (usually) tools to collect analyze and display, at a minimum, whole-building electric interval data. Many implementations include additional energy flows (gas, chilled water), and submetered data.

Srinivas Katipamula from Pacific Northwest National Laboratory presents to the group.

II. Summary of current EMIS projects

The primary focus of 2012/2013 EMIS Team activities is on building the business case for adoption of EIS by increasing verified information about technology costs, and benefits of use.

- Several dozen case investigations of current EMIS users will be synthesized to determine energy savings, procurement costs, and practices to maximize achieved savings.
- A second activity involves inventorying the uses of BAS by Project Team members who have not implemented EIS.
- A third activity involves drawing consensus among a broad group of stakeholders on a framework for classifying EMIS technologies. See the Technology and Market Solutions Overviews in Appendix E for more information.

III. User Experiences and Common Themes

The Project Team lead asked the group to share their experiences with EMIS, including goals and technology implemented, energy management practices enabled, and key lessons learned. Some highlights from user experiences include:

- **One size does not fit all**. It's important to have systems designed to the specific needs of the building managers. For example, for a super market, an EMIS system may track kW and refrigerant used. This allows operators to monitor operations of dynamic refrigeration systems within multiple facilities.

- **Request for proposals (RFP) and vendors selection**. It is a challenge defining requirements in an RFP and choosing vendors. Participant lamented that they find that vendors can rarely provide all the services or requests that are in the RFP. Guidance by sector would be useful.
- **Connections between demand response (DR) and energy efficiency**. In several cases members shared their successes in using EMIS automation infrastructures to participate in DR programs, generating incentive payments that could be used for further investment in efficiency measures.
- **Success with central management**. One retailer used a centralized building automation system for lighting and HVAC systems and to monitor RTUs as part of a pilot. Now, all stores now have sub-metering and cameras. Remote monitoring allows central control and performance tracking of the stores, which may not have on-site personnel responsible for energy use.
- **Interoperability**. Participants expressed their preference for, and challenge in, identifying solutions that provide interoperability between multiple systems from a diversity of vendors.
- **Accessibility of data**. It's important that someone is accountable for monitoring the EMIS regularly and dissemination of the information to those who can use it to make recommendations.
- **Utility Incentives.** Utilities receive requests to incent a range of EMIS systems. If there were a set of standards, i.e. minimal data requirements or standards for systems to produce verified savings, it would be easier for them to develop incentive offerings.
- **Vendors and manufacturers** that were present described the aim of their systems: to reduce the amount of data building operators need to analyze in order to identify issues and make improvements. They noted that a system is only useful if it is someone's job to use the tool.
- **Vendor requests**. A vendor described how they plan to expand their particular offering beyond dashboards to provide value added recommendations. The challenge is getting the right data. Vendors would like to know what types of metrics are needed to justify the building owner/operator making an investment in the tool.

IV. EMIS Existing Resources

The session concluded with a discussion of the resources currently available in the public domain, including, for example, instrumentation specifications, guides and handbooks, case studies, and state of the technology evaluations. Information is available on the session slides.

NEXT STEPS FOR FURTHER CONSIDERATION

The Project Team Lead provided a synthesis of suggestions from the discussions that took place over both days of the Forum, and received feedback from participants. Potential projects and topics are described below. Limited feedback from the group is included in these notes; however participants suggested further discussion, and perhaps a poll to prioritize high-impact activities for 2013/2014:

- **Synthesis of existing EMIS resources**: This resource could provide a "Cliff notes" on the existing EMIS resources, describing what audience they are appropriate for and what needs they meet. Feedback from the group was positive and noted that this could be designed to require a relatively low level of effort.
- **Assistance with making- the-case for investment to CFOs**: Getting CFOs and finance personnel to see the value of investing in energy efficiency is important to participants. This could include guides to using EMIS automated project tracking and measurement and verification features to streamline the process of tracking impact to justify further investment.

- **Demonstration of vendor products**: This would include demonstrations of the products of high interest to the membership, including guest access accounts. Vendors' websites, brochures, and canned demos are often insufficient for prospective buyer's needs. Feedback from the group was positive, and there are clear connections to the existing resources and other guidance-based topics.
- **Identification of solutions** for acquiring data, integrating multiple and/or legacy systems, and working with IT departments to facilitate implementation of EMIS; assistance in identifying vendors and third party providers with the right skills set for specific organization/implementation needs.
- **Development of solution packages to streamline procurement**, for example via an EMIS master/guide specification, RFP templates, or vendor selection guides.
- **Overview of utility programs that support EMIS implementation by-region**: various utility regions have offered EMIS pilots and related incentives that support EMIS deployment, and have proved useful to some first adopters in offsetting first costs. A region-by-region guide to this type of support, perhaps combined with demand response information would address members' interest in integrating automation, continuous energy management, and utility support.
- **Deployment assistance, design of continuous energy management and tracking processes**: This topic would address members' questions related to establishing a holistic plan for the use of data and tools in meeting organizational energy management goals. For example site- and portfolio-level practices, EMIS tool selection (type and brand) and implementation, which data points to monitor and display, which analyses to apply at what frequency for which purposes, how to communicate with finance, and which types of software and information systems to use for which activities.

Food Service Team

The Food Service Technology Team held two breakout sessions each day, May 29 and May 30, for a total of four team meetings. The group discussed the status of current team projects, including: Benchmarking (with ENERGY STAR and in general), Energy Management Systems (EMS) in restaurant applications, and activities with utilities.

Several presentations and subsequent discussion by BBA members and stakeholders provided a platform for discussion about best practices and short- and long-term perspectives on industry implementation of energy efficiency measures. The group brainstormed new team projects and activities. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Summary and status of current team projects

- **Benchmarking**: Restaurants are not currently among the building types that can earn ENERGY STAR building certification or benchmark and receive a 1-100 score. The goals of the Team's project are: (1) to work with EPA and the restaurant sector to collect data that could lead to restaurant ENERGY STAR eligibility for certification, and (2) to assist in effective deployment of any Portfolio Manager model developed as a result of the project into the marketplace. If successful, this effort will supplement the metrics already available to restaurants within EPA's ENERGY STAR Portfolio Manager.

- Project status: The industry survey to collect restaurant energy data is very close to completion. The remainder of the fiscal year will be spent deploying the survey and collecting responses. Subsequently, the collected responses will be processed into data files suitable for ENERGY STAR analysis by EPA.

- **Energy management systems (EMS) guidance package**: A four-part Food Service EMS Guidance package: (1) corporate-level guidance document; (2) franchisee/independent-level guidance document; (3) food service EMS case studies; and (4) food service EMS vendor database. The goals of the guidance package are to:
  - Educate users on the benefits, costs, and nature of the technology.
  - Identify the key characteristics of a system that can perform well in food service applications.
  - Guide users through the process of selecting and implementing an EMS.
  - Document best practices for food service EMSs.
  - Compile a database of vendors that offer systems with the key characteristics for food service success.

    Project status: The guidance package is well along in development. Remaining to be determined are specific, experience-based and proven steps for selecting and implementing an EMS in a restaurant. These are being researched over the next 4-6 weeks. DOE is developing an appropriate legal statement for the vendor database.

- **Activities with utilities**: These are informal and do not have a defined structure. During this fiscal year, the team has interacted primarily with the Commercial Kitchens Initiative of the Consortium for Energy Efficiency (CEE), including: co-sponsored Demand Control Ventilation (DCV) webinar (planning for possible joint initiatives); developed measures to encourage and facilitate increased energy efficiency incentive utilization; held several phone and in-person exchanges of information about BBA and utility needs and programs; and kept the team members informed about CEE information on utility incentive programs.

II. Short- and long-term perspectives on industry implementation of energy efficiency measures

The team discussed current and future challenges to implementation of efficiency measures in restaurants, including sharing experiences and lessons learned. Discussion also included "big picture" insights into industry-wide difficulties, possible pathways for improvement, and ways in which DOE might effectively serve as a catalyst for such improvement.

Michael Deru, National Renewable Energy Laboratory, presents to group during technology solutions session.

Four short presentations by participants helped to frame and provide "fuel" to these discussions:

- **CKE Restaurants** (operating the Hardee's, Carl's Jr., La Salsa, and Green Burrito restaurant chains), presented lessons learned from implementing EMS in a number of stores.

- **Pacific Gas and Electric's** (PG&E) Food Service Technology Center (FSTC) gave an overview of DCV technology, focusing on its potential energy and cost savings.
- **Powerhouse Dynamics** (an EMS company) gave a brief overview of various types of data analytics that are useful for restaurants.
- **Manitowoc Foodservice**, a division of The Manitowoc Company, Inc., discussed the potential for including cooking and other kitchen equipment with HVAC and lighting when monitoring, alerting, controlling, reporting, and analyzing restaurant operations.

The large number of constraints on cost, time, expertise, and operations in the food service sector makes it almost certain that progress in energy efficiency will be gradual and will require a long period of time to take hold more universally.

NEXT STEPS FOR FURTHER CONSIDERATION

It was quickly agreed that the benchmarking project must continue in the next fiscal year, as it was conceived as a multi-year project and is about one-third to one-half completed. After discussion of all of the concepts proposed, the resulting list of new project ideas was:

- **Prepare an educational guidance document on DCV**: Guidance will aim to make DCV retrofits easier, more effective, and more common.
- **Compile a list of notable food service member projects (e.g. from member LEED stores) and work with the Better Buildings Challenge to make restaurant chain participation more feasible**. Note that the essential nature of a restaurant is a processing facility, which has product demand constraints that limit the amount of energy load control or load shedding possible in the kitchen/processing portion of the building.
- **Quantify non-energy benefits of EMS technology for food service**. These "soft" benefits help building owners to justify the cost of the energy-saving EMS. They also improve a number of operational, maintenance, and repair aspects of a restaurant that probably have a significant positive secondary impact on energy usage.
- **Study, and perhaps develop a technology specification, for "small-box," high-efficiency walk-in refrigeration for restaurants**. (Note that walk-ins used for restaurants are significantly different from those found in grocery applications.) This would be done in coordination with the Refrigeration Technology Team.
- **Develop a guidance document or technology specification on data analytics software for EMSs used in restaurant applications**. This would involve producing a description of a "toolbox" of data analytic functions and user interface options found to be of high value to restaurants. Such analytics would enable restaurant facilities staff to glean additional opportunities to save energy and money, as well as give them valuable insights into operations and equipment.

Laboratories Team

Two sessions were held on May 29 and 30. Key session discussions included a summary of current projects, Lab Team member "show and tell" where 2 members shared their successes and challenges in laboratory energy management and engaged the group; and development of next steps. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Background

The Laboratories Team is focused on sharing best practices, identifying challenges, and producing guidance and resources to enable efficient and cost-effective laboratory energy management. Lab energy management is important but challenging because labs exhibit high energy intensities, strict building and fire code compliance requirements, and environmental health and safety restrictions.

II. Current Activities

The team identified four high-impact, low-cost activity areas on which its current efforts are focused. These include: fume hood sash management, minimizing air change rates, minimizing simultaneous heating and cooling, freezer energy management. The Laboratories Team is also developing specifications for fume hoods and ultra-low temperature freezers.

III. Lab team member "Show and Tell"

Presentations on the user perspective were given from the University of Colorado Boulder and from the EHS perspective from Exposure Control technologies.

- **Success stories** included effective campaigns and competitions around sash management, engagement and outreach efforts targeted at lab users, implementation of ventilation monitoring paired with demand-based controls, and tailoring ventilation settings to specific lab uses.
- **Challenges** included lack of communication between facilities and EHS staff, lack of control over refrigeration equipment funded by grants, building and fire codes that are not favorable to demand-based ventilation and confusion over codes that do allow it, unnecessary or improper use of ultra-low temperature freezers, and lack of experience with automatic sash positioners.

Some highlights from this discussion include:

- **Need for EHS collaboration**: In many labs, environmental health and safety (EHS) staff do not regularly interface with facilities and energy management staff. Good communication is important for three reasons: (1) energy management activities often have safety implications and should therefore involve EHS experts, (2) tying lab energy management to lab safety is an effective way to improve engagement and buy-in from lab users, and (3) many lab users had heard "urban legends" of facilities staff compromising ventilation quality to improve performance, and involving EHS in communications can help restore confidence.
- **Fume hood sash management campaigns**: Successful campaigns to engage lab users are run at different scales: some were competitions, one appointed individual "eco leaders" in each lab, and one was described as a "bare bones" campaign that only involved low-cost communications to lab users. The amount of reinforcement required to improve performance varies.
- **Sash management vs. performance**: Improving sash management alone doesn't by itself improve performance if the overall ventilation system is not optimized and controlled properly. Monitoring actual fume hood energy performance can verify savings and identify problems.
- **Automatic sash positioners**: Members have only limited experience with automatic sash positioners. They have the advantage of improving performance but the disadvantage of added costs, more complicated maintenance, and the potential for users to bypass them.

- **Demand-based ventilation control**: One member has made extensive use of a ventilation sensing and control system. Real time air quality sensing both improves safety and allows more granular tailoring of ventilation controls. Ventilation should not focus only on improving minimum air change rates (ACRs), but on optimizing ACR overall, often with the benefit of reducing reheating.
- **Tailoring ventilation controls to lab uses**: Members underscored that efficient lab ventilation is not "one size fits all" because of factors specific to each lab: types of chemicals, how they are used, time of use, and type of lab (teaching vs. research). Adjustment of appropriate ACRs should occur not on a set timetable but when the type of lab use changes. Members also noted it can be effective to minimize the need for fume hoods in the first place by changing lab management practices.

Paul Mathew of Lawrence Berkley National Laboratory, speaks to a participant during the Efficiency Forum.

- **Building and fire codes**: Many building and fire codes should be adjusted to allow for newer ventilation control technologies. In some cases, codes can be interpreted to allow for more customized solutions or alternative modes of compliance. Many facility managers are unaware.
- **Ultra-low temperature freezers**: Over and improper use of ultra-low freezers is a significant source of energy waste. Ultra-low freezers are usually purchased as part of a grant (awarded by the National Institute of Health or others) that is outside the control of the institution. Engaging lab users to use standard freezers where possible, building energy performance into the grant process, keeping up-to-date inventories of materials stored in freezers, and encouraging procurement staff to consider efficiency can be effective. A member developed a "cash for clunkers" program to replace old inefficient freezers with new ones.

NEXT STEPS FOR FURTHER CONSIDERATION

The team developed a list of several initiatives and resources that the Better Buildings program could explore in the coming year to support sound lab energy management. Some build on existing activities, while others are new ideas.

Building on existing activities, continuing activities include:

- **Building and fire code guidance**: Model successes interpreting codes differently or finding alternative modes of compliance to reduce ACRs. These codes can be difficult to interpret, so guidance is needed.
- **Case studies on automated sash closure**: Case studies and lessons learned from successful implementation of automatic sash positioners.
- **National "Shut the Sash" Day**: A national day encouraging good sash management could to improve awareness. Participating labs could track improvements in their performance and the overall effect of the initiative (e.g. energy saved or emissions avoided) could be calculated.

New activities include:

- **Guidance on strategies to minimize the use of fume hoods in the first place**: Green chemistry and strategic laboratory management can reduce the need for ventilation, but guidance is needed on how to effectively employ these methods.
- **Greening the grant process**: Energy consumption from freezers can be reduced by building energy performance requirements and smart acquisition into the grant process. The Better Buildings initiative can work with NIH and other groups to facilitate this.
- **Best practices for space and equipment utilization effectiveness**: Energy use can be reduced by simply reducing the amount of equipment and space through more effective utilization (e.g., sharing equipment).
- **Special strategies for teaching labs**: Teaching labs face a different set of requirements than research labs due to the type of timing of their use. Special guidance could be developed to improve energy performance in these labs.
- **Guidance and templates for Lab Ventilation Management Plans**: For compliance with the new ANSI/AIHE Z9.5 rules, labs must complete an LVMP. Tools could be developed to help streamline this process and help build energy management best practices into these plans.
- **Guidance on how to engage and motivate lab users around efficiency**: Lab users ultimately determine whether efficiency measures will be effective, so guidance on how to effectively engage, educate, and motivate them is needed.
- **Case studies and guidance on EHS collaboration**: Collaboration among facilities, EHS, and lab users is important both to maintain safety and improve energy performance, but in many labs it is lacking. Guidance is needed to lay out the benefits and best practices of encouraging such collaboration, including effective collaboration models.

Lighting and Electrical Team

The Lighting and Electrical Team has developed a number of actionable solutions that can deliver significant energy and cost savings in commercial buildings. Key session discussions included:

- Challenges faced by members in adopting high efficiency lighting
- Review of lighting team projects/resources: Troffers; LEEP Campaign
- New resources available soon: Wall Pack specification; Exterior Lighting Controls Guidance
- New areas of interest/possible projects
- Key questions for industry

Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Challenges faced by members in adopting high efficiency lighting

The main challenges identified by the members include:

- Education of tenants, engineers, designers and specifiers, and facility staff. Tenant education includes emphasis on task-specific light levels, versus matching incumbent light levels.
- Split incentives between stakeholders, including triple net lease issues.

- Accuracy of life cycle performance and cost, including long term performance of LED products. impact of maintenance changes, and risks associated with long life LED products.
- Integrating lighting controls (interior/exterior).
- Keeping up with technology advances and knowing when it's the right time to adopt (versus wait).
- Cost factors:
  - Overhead superstructures in older buildings.
  - LED parking lot lighting not currently cost-effective for some owners.
  - Factoring in the long term life of components (specifically drivers).
  - Justifying the ROI – accuracy of the data.
- Perceived risks/aversions to LED designs.

II. Review of Lighting Team projects and resources

Jeff McCullough, PNNL, provided an overview of the Lighting Team resources and led group discussion.

- **High Efficiency Troffer Lighting Specification** – Jeff provided an overview of the specification.
  - Member shared experience with introducing LED troffers in exam rooms, initial resistance turned into appreciation for task-enhancing lighting.
  - Members buying LED troffers directly reported cost of high efficiency LED troffers are now on par and sometimes cheaper than fluorescent counterparts. Those buying through lighting distributors still face significantly higher first cost.
  - Main barriers: education for small facilities lacking trained staff.
- **LEEP Campaign** – Jeff reported significant interest and uptake over the past year, already achieving 100 million sq. ft. goal. Less than 1% of parking in the U.S. uses high efficiency systems like those supported in the LEEP Campaign.
  - A number of members still plan to join.
  - Better Buildings Alliance members are inundated with LED salespeople trying to sell products.
  - Suggestions for use: Use the specifications to vet products, "try before you buy" and see how the products look installed in the application, consider cost of electricity and tell manufacturers how much they can pay in order for the site to meet ROI requirements.
- **Draft Wall Pack specification (new)** – PNNL provided an overview of the draft wall pack specification and guidance document, soliciting feedback from members.
  - Include new wall pack resource with the other exterior lighting resources (LEEP campaign).
  - Aligns with Design Lights Consortium (DLC) specification, beneficial for associated utility incentives, contains excessive requirements related to uplight which precludes a number of products/applications.
- **Draft Exterior Lighting Controls Guidance (new) –** There is strong interest in pursuing a guidance document for exterior lighting controls was discussed in addition to a controls specification.
  - Consensus: the specification is not realistic given the controls market situation (e.g. diverse approaches and protocols, and changing technology).

An overview of the draft exterior controls guidance document was discussed. Key member points included:

- One control scheme does not meet all site owner/operator needs; resource under development catering to individual user needs.
- Site owners concerned about "locking in" with one system, in case they want to expand the site or select different luminaire brands down the road.
- Members prefer generic guidance but need specific examples of lighting control options, general lighting and way finding need to be addressed.

NEXT STEPS FOR FURTHER CONSIDERATION

Participants shared a number of ideas for future efforts including:

- **Better Buildings Alliance volume purchase for high efficiency troffers**, primarily to support smaller buyers. This would improve buying power for small companies. Retail members could offer special pricing to BBA members in other sectors.
- **Member volunteering sites for troffer field tests** and developing case studies with PNNL including no-cost technical assistance.
- **Stretch specifications for parking lot, parking structure**, and wall pack lighting, including "best in class" LED products, and a competition that challenges manufacturers to develop these.
  - This is an opportunity to combine efforts with the Next Generation Luminaires (NGL) competition managed by DOE, with BBA members participating in the judging panel.
  - Team will review wall pack specification for excessive requirements related to uplight.
- **Increasing the number of case studies** of new technologies across the BBA membership.
- **Case study on adaptive exterior lighting at a hospital facility.** Project is underway.
- **Creating standard template for determining ROI** or best practices similar to International Facilities Management Association (IFMA).
- **Developing how-to guides for facility managers** and others on how to apply existing specs with examples (i.e. how to use the specifications in an RFP, and RFP best practices).
- **Conducting a study of safety/security associated with dimming or reduced light levels** including crime rates. It will focus on code changes with respect to light levels and dimming requirements.

Plug and Process Loads Team

The Plug and Process Loads (PPL) Team breakout session was held on May 30. Key session discussions included: a summary of current projects, an overview of the state of the industry in terms of plug load measurement and control, and a brainstorming session for overcoming high-impact barriers that Better Buildings Alliance members are currently facing. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Background

As other building systems (e.g., lighting and HVAC) become more energy efficient, PPLs become one of the biggest pieces of the "energy pie". However, plug and process loads comprise the most diverse set

of equipment compared to other building systems, ranging from laptops to vending machines to elevators; this makes selecting the right efficiency strategy difficult.

II. PPL Capacity Analysis Project

In 2012, the team identified a project to study the capacity and power requirements of plug loads in commercial real estate and higher education buildings, which is currently underway. Preliminary data collected and analyzed by the team suggests actual maximum PPL densities are on the order of 0.5 watt per square foot (W/ft^2) in a set of seven Higher Education buildings (classrooms and offices).

Goal: This project aims to inform tenants and stakeholders that actual PPL capacity needs are typically less than 2 W/ft^2 rather than 5-10 W/ft^2. This over statement of PPL needs in leases can lead to oversizing electrical infrastructure and HVAC systems in multi-tenant buildings.

Materials: This year, the team will create a short brochure, and a longer technical report, that provides evidence of actual capacity and power requirements for PPLs across multiple buildings. This will help members negotiate more realistic PPL power requirements in their leases.

III. State-of-the-Industry: Plug Load Measurement and Control

The team presented on the current state-of-the-industry with respect to plug load measurement and control technologies. NREL introduced the audience to the Advanced Power Strips (APS) and the plug load energy savings that can be achieved with this technology, around 30%. There was then a discussion of the successes and challenges that Members have faced in using APS.

- Success included: large energy savings through controlling PPLs that are normally active on a 24/7 basis with APS; and implementing the built in power management settings on copiers and printers.
- Challenges included the lack of: effective campaigns and competitions around the use of Advanced Power Strips; engagement and outreach efforts targeted at people who procure plug load equipment in buildings; guidance on how to implement plug load monitoring paired with the ability to easily implement controls; and guidance on how to tailor plug load controls to the schedules and behaviors of building occupants.
- The team developed a list of several initiatives and resources, that would comprise an APS campaign, that the Better Buildings program could explore in the coming year to support sound plug load management.

NEXT STEPS FOR FURTHER CONSIDERATION

- **Advanced Power Strip (APS) Campaign**: The APS Campaign would offer one or more of the following: guidance on how to apply APS in buildings across different sectors; better "how-to" installation guidance; sector-specific demonstration cases; connections to utility rebates for APS; clarity on pairing specific plug loads to the most appropriate APS; and tiered options for participation in the Campaign.

Refrigeration Team

The Refrigeration Team held one breakout session on May 29 and two on May 30. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Summary and status of current team projects

- Retrofitting Doors on Refrigerated Medium Temperature Display Cases Guide: The guide for retrofitting doors on refrigerated cases has received widespread distribution. The team is reaching out to utilities via CEE (a utility consortium) to encourage incentivizing the measure. The team discussed:
  - The merits of making the measure prescriptive vs. custom: Prescriptive measures can reduce processing time and uncertainty, however it is often part of a set of case measures (e.g. lighting, fan motors).
  - Encouraging utilities to develop multi-tier measures and adjust for gas vs. electric.
- ASHRAE Commissioning Guide: The team is collaborating with ASHRAE to develop and deploy a guide to best practices for commercial refrigeration system installation and commissioning. Draft will be ready for release summer 2013.
  - The key question is what channels DOE should use in order to facilitate awareness and utilization of the guide and best practices for commissioning.
- Alternative refrigeration system case studies: The team is collaborating with EPA's GreenChill partnership to showcase retail refrigeration systems combining high efficiency and low-GWP performance. Some members expressed interest in being case study subjects.

II. New and Expanded Team Projects and Activities

- Supermarket Compressor Rack Challenge: Participants reviewed the draft specification and generally praised the approach. Goal is to finalize the specification and initiate the challenge within two months.
- Supermarket Rack Standardization: One member presented on the topic of moving toward standardization of supermarket compressor racks. The main takeaways were:
  - A standard would reduce energy use (which can be up to 10x the initial capital cost) and could reduce customization which would save energy by simplifying and ensuring proper maintenance.
  - Standardization of designs and metrics is a long-term effort requiring buy-in from many different constituencies, including supermarkets, suppliers, and service technicians.

NEXT STEPS FOR FURTHER CONSIDERATION

The team agreed on the following continuing projects and activities for the coming year:

- **Retrofitting Open Medium Temperature Cases With Display Doors Guide**: Continue promotion, especially with utility incentive programs, and recommend multi-tier incentives to credit various refrigeration case measures
- **ASHRAE refrigeration system commissioning guide**: Continue to support to ensure publication this fall, and develop approaches for promoting the guide with technicians, supermarkets, utilities and other stakeholders.

- **Alternative refrigeration system case studies**: Prepare and publish alternative refrigeration system case studies, in collaboration with EPA GreenChill where possible, but also with other supermarket chains.
- **Supermarket Compressor Racks Challenge and specification**: Initiate Challenge and finalize specification within two months
- **Market transformation of supermarket compressor racks**: Develop a plan and initiate market transformation activities in order to move the market toward standardization of designs, performance metrics, and diagnostics.

Space Conditioning Team

The Space Conditioning Team held three sessions over May 29 and 30. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Duct Leakage

Building owners and engineers shared experiences about how to find duct leakage problems and the impacts of duct leakage. Several resources were identified to help identify and quantify duct leakage problems and best practices for correcting problems.

- Detection: Full pressure testing of duct systems; comparing testing, adjusting, and balancing (TAB) reports to expected performance (but they are not always available for existing buildings); and testing and proving smoke management systems in high-rise buildings.
- Correction: Duct leakage problems are most often corrected by application of sealants or aerosol sealant that is blown into the ducts.

II. Preliminary Results from RTU Controller Retrofit Demonstrations

Srinivas Katipamula from PNNL presented preliminary results from several demonstrations of RTU controller retrofit demonstrations which include technologies with improved control strategies of integrated economizers, variable speed fans, demand controlled ventilation, and variable or multicapacity control can lead to significant savings.

- Preliminary estimates range from 28% to over 60% savings over the existing RTU. The measured energy savings averaged 40% for heat pump RTUs and 50% for RTUs with gas heating.

III. Advanced RTU Campaign

On the first day of the Efficiency Forum, representative from Walgreens and Target provided summaries of experiences from their RTU replacement programs. The discussions continued on May 30 with the BBA members and key stakeholders on different business models and ideas for reaching a broader market. Advanced RTU Campaign was officially launched at the Efficiency Forum on May 30.

Discussions on ways to improve cost effectiveness revealed several key lessons learned:

- A planned early retirement and replacement program can sometimes be cost justified by the cost savings compared to a premature failure followed by an emergency replacement.

- Replacement RTUs should be resized to meet the current load. Replacement RTUs can be up to 50% smaller than the old RTUs.
- Combining an RTU replacement with other improvements such as a lighting retrofit can improve the return on investment enough to justify the RTU program.
- The 179D federal tax deduction can provide the incremental cost savings to make a high-efficiency replacement program cost effective.

NEXT STEPS FOR FURTHER CONSIDERATION

Several opportunities for improving energy or economic performance of space conditioning equipment were identified during the Efficiency Forum. New initiatives may include:

- **Resources to help facility managers and engineers identify, quantify, and manage duct leakage problems.** Best practice guides, case studies, and a comprehensive design and operation guide for expected fan pressure drop for air-distribution systems for different system and building types.
- **Guidance for evaluating the performance of RTUs.** Evaluation checklist and calculators for determining the payback of replacements and retrofits to help building operators quickly evaluate their inventory of RTUs. Guidance on impacts and savings associated with properly sizing new RTUs.
- **Study on degradation impacts on RTU performance.** This information will help building owners better estimate performance improvement and the savings for retrofit or replacement programs.
- **Educational materials about the value of high-efficiency RTUs.** Reach out to building owners and distribution networks to understand the issues, and offer support for these groups to participate in high-efficiency programs. Partner with ASHRAE, manufacturers, and utilities to deliver materials.
- **Improved Metrics.** The group identified a need to develop improved metrics or rating systems that are intuitive and better reflect operating performance in different climates and building types.
- **"High performance" RTUs in lease agreements.** Work with building owner and tenant groups and the Better Buildings Alliance Market Solutions group to promote. Leased retail spaces often have very poor maintenance programs and very low performance.
- **"Road map" for navigating through the technology options for specific buildings, locations, and applications.** This document can be a series of simple decision trees for different technologies.

New Topics Session

Stakeholders met to discuss new ideas for Project Team topics; illustrative examples included teams focused on renewable energy products like solar and ground source heat pumps, technical assistance, and net zero energy buildings. Members and stakeholders interested in proposing new activities are welcome to share their ideas with DOE by writing to BBA@ee.doe.gov.

MARKET SOLUTIONS TEAM SUMMARIES

Market Solutions: Update on Green and Energy-Aligned Leasing

This session was an opportunity to hear from Better Buildings Alliance members and other industry leaders regarding activities and updates on green leasing and new tools being developed. The goals of the session were to share recent updates, news, and resources on green leasing; introduce and discuss steps to broader adoption of green leasing practices; and to explore issues and opportunities for green leasing in the retail sector.

Fundamentals of green leasing include: creating shared objectives between tenant and landlord; providing sufficient information and motivation for improved energy performance; and supporting current building practices such that tenant behavior doesn't jeopardize current operations and sustainability programs.

Common elements of green leasing include: tenant cost recovery clauses; disclosure of monthly utility consumption data to facilitate whole-building energy benchmarking; tenant improvement specifications; submetering of tenant spaces or separate metering of tenant plug load and equipment; and maximum energy usage dependent on intended usage of space. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Green Leasing Audit – Presented by Marla Thalheimer of Liberty Property Trust

Marla Thalheimer began the discussion by noting some of the challenges and opportunities surrounding Liberty Property Trust's green leasing activities:

- The recession halted new building.
- LPT was forced to look at impact of existing building stock.
- They wanted to reduce tenant operating costs to help struggling tenants.
- They addressed lack of tools or materials, by starting with BOMA Green Lease guide and USGBC materials.

Liberty Property Trust determined that the best approach was to incorporate "green" provisions into the standard lease form, rather than making it a separate section or add-on. Many skeptics initially speculated that these provisions would be edited out by tenant representatives. In 2012, they conducted an audit to determine if this was the case. This audit confirmed that all green provisions were intact in 89% of the leases and that there had been few issues due to the lease language; in the cases where the initial clauses modified, frequently the energy efficiency provisions were not the main issue.

Major lessons learned were:

- Engaging leasing/brokerage staff early in the process is important.
- Leasing/brokerage staff need training/talking points for discussing "win-win" with tenants.
- Lease renewals is a time to focus on overcoming perceived and real barriers.

II. Green Leasing Library – Presented by Adam Sledd of the Institute for Market Transformation (IMT)

New green leasing resources, which define "what is a green lease" and help companies better implement green leasing, are available at www.greenleaselibrary.com. Highlighted activities:

- Green lease recognition program to recognize landlords and tenants already implementing green leases and build awareness of the fundamentals of green lease clauses;
- Implementation roadmap for lease renewals with guidance and talking points.

III. Retail Industry Leaders Association (RILA) – Presented by Adam Siegel of RILA

Retailers and retail owners are trying to improve the energy efficiency and sustainability of retail space. Barriers include but not limited to: landlord approval, lease impediments, split incentives, lack of submetering, complexity of solar installations, and limited access to recycling programs. Issues are further compounded by a dizzying array of people that need to be involved and all require additional education. RILA is coordinating discussions among these stakeholders and is looking for additional opportunities to coordinate and facilitate increased dialog among landlords and tenants.

IV. General Questions and Comments:

- Green Leasing is driven by legislative mandates, voluntary sustainable disclosure and reporting initiatives, availability of more efficient buildings and technologies, and increased demand to control costs.
- Organizations will refine the role that leasing space can contribute to the triple-bottom line.
- Relatively recent development of green leasing tools and resources are helping to define and improve adoption of green leasing into new leases.
- Challenges:
  - Integrating into standard leasing practices exist, including lease renewals, greater awareness and training for leasing professionals, and relatively limited demand for green leases by national tenants.
  - Lack of demand for green leasing by national and large tenants.
- Best practices:
  - New green clauses should be baked into the standard lease and not called out as "green"; in the future a standard lease should incorporate the facets of green and energy-aligned lease practices.
- The next frontier is how to monitor and ensure compliance with green lease clauses.

NEXT STEPS FOR FURTHER CONSIDERATION

- **Identify tenants with green leasing requirements** in order to aggregate potential demand, and quantify for the industry and show the magnitude of the demand.
- **Aggregate and promote potential demand for energy efficiency and green leasing**, quantifying for the industry the magnitude of the market demand.
- **Develop talking points** for leasing staff on the value of energy efficiency.
- **Assist members to incorporate green** leasing into existing lease renewal process.
- **Educate stakeholders** and decision makers throughout the lease renewal process.
- **Connect retailers and retail owners with interested landlords** to expand sustainability programs at retail spaces.

Market Solutions: Tenant Engagement

The session was an opportunity for Better Buildings Alliance members and industry leaders to share innovative tenant engagement initiatives; learn about new ENERGY STAR recognition programs for landlords and tenants; discuss activities to engage the brokerage community to incorporate energy efficiency into their transactions; and to explore potential tools and resources that will further demonstrate the value of energy efficiency to tenants and brokers. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. Hines Occupant Engagement – Presented by Clayton Ulrich of Hines

- Hines GO® provides five base evaluation categories with bonus points available for remodeling and construction, and LEED and ENERGY STAR certifications. Since December 2008 over 200 Hines offices in seventeen countries have achieved the Hines GO® status.
- Hines expanded Hines GO® to office tenants occupying more than 120 million square feet in more than 100 cities. 34% currently are recognized with the Green Office designation.
- Benefits are that Hines can demonstrate leadership, further a positive public relations, provide value-added service to tenants with no or low cost, reduce operating expenses, lower net operating costs, increase asset value, and expand collaboration with tenants.

II. Cushman & Wakefield Environmental Challenge – Presented by Eric Duchon of Cushman & Wakefield

- Tenant engagement strategies for corporate occupier and investor services clients include: Earth Day toolkits, Energy and Sustainability Task Force Newsletters, and an Environmental Challenge with awards for properties in five categories, including Best Tenant Engagement Strategy.
- Innovative programs included tenant councils, tenant events, tenant appreciation holiday parties, Earth Fairs, tenant handbooks, newsletters, and tenant meetings.
- C&W demonstrates the importance of brokers on site selection through a tenant build-out specification to assist tenants to achieve LEED Commercial Interiors for alterations.

III. EPA ENERGY STAR Engagement Activities – Presented by Mike Zatz, US EPA ENERGY STAR

- Tenants (or portions of a whole-building) can now compete for the title of 'greatest loser' as part of the EPA ENERGY STAR National Building Competition (NBC). Allowing tenants to compete will foster partnerships between tenants and landlord.
- EPA developed the ENERGY STAR Guide to Energy Efficiency Competitions for Buildings and Plants (www.energystar.gov/competitionguide) to support other forms of tenant engagement.
- New EPA resource will highlight collaboration between tenant and landlord to overcome the split-incentive barrier; increase energy efficiency at build-out; measure, meter and share data for the purposes of benchmarking whole-building energy use and improve energy performance; and innovative tenant education and engagement strategies. EPA is currently gathering information and producing case studies for planned release in Fall 2013. Contact Cindy Jacobs (Jacobs.cindy@epa.gov) if you have a case study to share.

- EPA is gathering input from senior brokers across the industry, piloting various approaches to educate the brokerage community on the financial value of energy efficient and green buildings, and attempting to build greater demand for energy efficient space.

IV. General Questions and Comments:

- **Challenges**:
  - Tenants arguably control or influence 40% of an office building energy consumption and may represent the most significant opportunity to improve building performance.
  - Brokerage community is a missing link. There is a need to engage them in the discussion regarding the value of energy efficiency.
- **Best Practices**:
  - Tenant engagement is a key aspect of overcoming the split incentive – many innovative programs are underway with opportunities to lift and shift strategies and content from one organization to another.
  - It is most important is to start the discussion, need to engage the tenants in meaningful ways that keep their attention and are reasonable – don't make it too complicated.
  - Pilot approaches to engage the brokerage community are taking place across the country by EPA and industry leaders.

NEXT STEPS FOR FURTHER CONSIDERATION

- **Share lessons learned from pilot programs** to educate the brokerage community.
- **Expand information available on energy efficiency**: Provide information on value of energy efficiency in credible sources brokers already use including CoStar, internal databases, and market reports.
- **Increase broker engagement**: Develop a one-pager or other resources on what matters to brokers. Include broker testimonials and broker talking points for clients based on client needs/drivers, key terms on energy efficiency for brokers, and stats on green and ENERGY STAR certified buildings.
- **Develop standards** to compare like for like property listings with consistent data.
- **Further collaborate** with IREM/RILA/RMI/BOMA/CoreNet and other industry associations to reach brokers and leasing staff. Ask Better Buildings Alliance members to identify "bright lights" to develop broker materials with DOE and EPA.
- **Consider pursuing a broker accreditation or designation**.

Market Solutions: Data Access

Better Buildings Alliance members and other industry leaders shared activities and initiatives underway nation-wide to facilitate greater access to commercial building energy data for owners and managers.

The goals of the session were to:

- Ensure that Better Buildings Alliance members understand the issue of whole-building data access, and how this issue affects benchmarking and analysis of building energy performance.

- Help Better Buildings Alliance members understand the current challenges to data access, as well as the efforts that are being undertaken to overcome these challenges, and resources that are available to support these efforts.
- Provide Better Buildings Alliance members with proven best practices for engaging utilities, regulators, and other policy makers in an effort to make enhanced data access available.
- Obtain feedback from Better Buildings Alliance members regarding future activities that the Market Solutions Team should pursue with respect to the topic of Data Access.

Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. The Importance of Data Access for Building Owners – Presented by Marla Thalheimer of Liberty Property Trust

This presentation offered a property owner's perspective on the importance of readily available, consistent access to utility consumption data. The ability to capture whole-building consumption data is critical for benchmarking commercial properties using tools like EPA's Portfolio Manager, and the difficulty of obtaining such data in multi-tenant and/or triple net leased properties can hinder attempts to fully engage with tenants to drive energy efficiency improvements at these properties. Different strategies have been used at different properties to gain access to this information; however, there is currently no one-size-fits-all approach that can be deployed across Liberty's portfolio.

II. Utility Data Access Programs: A National Overview – Presented by Andrea Krukowski of the Institute for Market Transformation (IMT)

This presentation provided an overview of utility efforts across the United States to deliver data access solutions to customers, with a focus on two key mechanisms: provision of aggregated whole-building energy consumption data; and direct exchange of data into customers' Portfolio Manager accounts via EPA's web services. The presentation touched on considerations that utilities face when seeking to deliver these solutions (including data privacy concerns; cost recovery issues; and technical challenges), as well as the various benefits that may accrue to both utilities and their customers.

III. Putting Data Access into Practice – Presented by Laurie Actman of the Energy Efficient Buildings Hub

This presentation provided a case study of process through which PECO decided to offer direct exchange of energy consumption data into customers' Portfolio Manager accounts, in order to facilitate compliance with Philadelphia's new energy benchmarking and disclosure regulation. A key element of this process involved convening stakeholders – including local government, commercial property owners and managers, utilities, and regulators – through regular meetings and facilitated discussions to explore the benefits of data access. Engaging the public utility commission, in particular, was a critical step in helping utilities and regulators to understand the needs of the commercial real estate community.

IV. General Comments/Questions:

- **"Green" lease language, tenant engagement, and data access**: Property owners can write clauses into standard lease language requiring direct-metered tenants to provide energy consumption data

that will help the property owner to benchmark. This can also be used as a starting point to engage tenants in discussing opportunities for improved energy efficiency.

- **Beyond benchmarking**: The ultimate result of receiving improved access to energy data is not just benchmarking, but rather the opportunity to use benchmarking results to identify, prioritize, and implement efficiency improvements that will enhance the energy performance of commercial buildings.
- **Data access engagement**: Many utilities and their regulators do not even realize that data access is a barrier to benchmarking and to subsequent energy efficiency improvements. It is critical that commercial real estate owners and operators work to educate utilities and regulators about this, and to begin constructive discussions.
- **Replicating success through stakeholder engagement:** Session attendees asked whether the Philadelphia example could be translated to other jurisdictions, and whether it was necessary to have a convener like the EEB Hub to succeed in such an initiative. Further discussion suggested that a variety of organizations could play this role, such as local chapters of industry associations. Identification and inclusion of key stakeholders early in the process – including utilities, real estate professionals, and utility regulators – is key.

NEXT STEPS FOR FURTHER CONSIDERATION

Specific opportunities and next steps for the Market Solutions Team include:

- **Drafting a Philadelphia data access case study**: The team drafts case studies on member successes.
- **Engaging with utilities**: The team could develop resources to help building owners/managers understand why and how to engage with utility regulators (e.g., talking points).
- **Tying data access into other Market Solutions activities:** Tie data access issues in with the
- Market Solution Team's ongoing green leasing and tenant engagement activities.
- **Continued engagement with other market actors and initiatives:** Continue to engage with State and Local Energy Efficiency Action Network (SEE Action), Energy Efficient Buildings (EEB) Hub, and National Resource Defense Council/IMT City Energy Project.

Market Solutions: Implementation Models from DOE's Better Buildings Challenge

Better Building Challenge Partners shared proven methods for overcoming barriers. A BBC implementation model is one that:

- Addresses widespread barrier to achieving energy efficiency;
- Innovative but replicable;
- Is related to organizational processes, high-level corporate decision-making and policies, business decisions, or financial and budget structures – not techno-centric; and
- Has led to demonstrated, measurable results.

The goals of the session was to share these proven solutions to market barriers, and also to consider ways these and other solutions can be more broadly disseminated. Members were asked to consider applying one or more Better Buildings Challenge implementation model as an activity, and sharing the results with others. DOE agreed to take action on recommendations from participants on how IMs can be more broadly disseminated. Please see the presentation slides on the 2013 Efficiency Forum page.

KEY SESSION DISCUSSIONS

I. IM presentations and discussions

Energy Finance Strategy – Presented by Marcy Schaefer of Kohl's

- Barriers include: getting and defending sustained corporate funding for energy efficiency projects.
- Solution: Kohl's created a partnership between the Finance and the Energy teams.
- Outcome: The Energy team has an annual "new technology" budget to test emerging technologies and a Financial Analyst liaison to expedite expense requests.

Data Update and Certification Scorecard – Presented by Nick Stolatis of TIAA-CREF

- Barriers include: a lack of visibility into the energy and water usage of the third-party-managed assets.
- Solution: TIAA-CREF added sustainability metrics to the existing property governance scorecard, part of a formal performance assessment of third-party property managers.
- Outcome: TIAA-CREF can better understand resource costs, estimate savings associated with improvement projects, and verify that projected results are achieved.

Good, Better…BEST Standards of Sustainability – Presented by Anne White of Transwestern

- Barriers include: lack of advanced benchmarking system, procedures to identify cost-effective opportunities, and methods to rate and track performance in energy efficiency and sustainability.
- Solution: Transwestern employed Good, Better…BEST Standards of Sustainability.
- Outcome: Transwestern was able to identify individual buildings that excel in energy efficiency and sustainability, and assist properties to achieve goals and promote continuous improvements at Transwestern-managed properties.

NEXT STEPS FOR FURTHER CONSIDERATION

- **Engage stakeholders to increase awareness of models**: The group recommended setting up a DOE webinar series as well as engaging with relevant associations at both the state, regional, national and sector levels. Numerous industry associations were mentioned as potential partnership opportunities.
- **Communicate the value to companies**: The BBC can appeal to companies in a variety of ways. Energy efficiency is a proxy for operational excellence, and can be proven with metrics. Companies want to be seen as socially responsible organizations and at the top of the market.
- **Engage other sectors**: IMs (particularly Kohl's Energy Finance Strategy) could be applicable outside of the retail sector, and might even be a useful strategy for local governments. In general, Better Buildings Alliance members and stakeholders may want to look for opportunities to apply IMs outside of the sector in which the IM was established.

Appendix A: 2013 Efficiency Forum Agenda

Better Buildings
U.S. DEPARTMENT OF ENERGY

2013 Efficiency Forum
All-Member Meeting Agenda

Wednesday May 29 • Better Buildings Alliance Members and Better Buildings Challenge Partners
National Renewable Energy Laboratory (NREL) Research Support Facility (RSF) • Golden, CO

Purpose: Identify pathways to maximize energy savings from activities, outline barriers to implementation, and identify solutions to overcome them. Solutions and strategies will be discussed with additional stakeholders on Day 2.

8:00	**Security Check-In Opens** (*allow 30 minutes*), **NREL East Site Entrance Building**			
9:00–10:00	**Registration, Coffee and Poster Display, RSF 3rd Floor**			
10:00–10:50	**Plenary Session, Rm X344** **Welcome** Mary Werner, Building Technologies Laboratory Program Manager, NREL **Better Buildings Overview and Opportunities** Kristen Taddonio and Holly Carr, U.S. Department of Energy (DOE) **Meeting Goals and Breakout Discussion Guidance** Bill Prindle, Facilitator, ICF International			
10:50–11:00	**Break**			
11:00–12:30 **Sector Breakout I** Choose 1 of 4. See Table 2 on page 4.	**Commercial Real Estate & Hospitality, Rm X320A** Guiding the Way: Setting Our Focus and Sharing Success	**Higher Education, Rm X249** Energy Efficiency in the Higher Education Sector	**Healthcare, Rm X303** Technical Solutions and Employee Engagement Solutions for Hospitals	**Retail, Food Service & Grocery, Rm X305** Driving Energy Reductions: Strategic Management and Innovation
12:30–1:30	**Lunch, Room X344** **Featured Speaker: Tim Stout**, Senior Director, ESource **Joining the Better Buildings Challenge - Discussion Table** *(optional):* Opportunity for informal discussion with DOE.			
1:30-2:45 **Project Team Breakout I** Choose 1 of 5.	**Technology Solutions**		**Market Solutions**	
	Lighting & Electrical, Rm X249 Project Successes and Overcoming Challenges	**Laboratories, Rm X300** Lab team activities and member implementation stories	**Update on "Green" and Energy-Aligned Leasing, Rm X320** Examine latest activity in energy-aligned leasing and discuss new resources	
	Space Conditioning, Rm X305 Better Buildings Alliance Member Discussion	**Food Service, Rm X303** Project Successes and Barriers		
2:45–3:00	**Break**			
3:00-4:15 **Project Team Breakout II** Choose 1 of 5.	**Technology Solutions**		**Market Solutions**	
	Lighting & Electrical, Rm X249 Project Successes, Barriers, and Next Steps, and Key Discussion Items for Industry	**Refrigeration, Rm X300** Moving toward standardization of compressor rack design, operation and maintenance	**Successful Strategies for Engaging Tenants to Improve Energy Efficiency, Rm X320** Engage tenants and the brokerage community to encourage energy efficiency	
	Energy Management & Information Systems, Rm X305 Making the Most of Energy Data	**Food Service, Rm X303** Identify Solutions and Key Discussion Items for Industry		
4:15–4:30	**Break**			
4:30–5:15	**Plenary Session, Rm X344** **Breakout Session Report Back** Technology team representatives inform Forum of progress/accomplishments during Day 2 **Closing Remarks** Kristen Taddonio, Commercial Partnerships Team Lead, U.S. DOE			
5:30–6:30 See Table 1 on page 3.	**Optional Tours, Rm X344** On-site tours available for interested attendees to observe energy efficient and renewable energy technologies in practice and in development. Meet in RSF Room X344.			
7:00–TBD	**Optional Dinner**			

2013 Efficiency Forum
Executive Exchange with Commercial Building Stakeholders Agenda

Thursday May 30 • Better Buildings Alliance Members, Better Buildings Challenge Partners & Commercial Building Stakeholders
National Renewable Energy Laboratory (NREL) Research Support Facility (RSF) • Golden, CO

Purpose: Recognize major milestones and member accomplishments; vet approaches to maximize the energy savings from activities discussed on Day 1 with input from commercial stakeholders and experts.

7:30	**Security Check-In Opens** (*allow 30 minutes*), **NREL East Site Entrance Building**				
8:00–9:00	**Registration, Coffee and Poster Display, RSF 3rd Floor**				
9:10–10:00	**Plenary Session, Rm X344** **Welcome** Bobi Garrett, Deputy Laboratory Director, NREL **Keynote Address** Kathleen Hogan, Deputy Assistant Secretary for Energy Efficiency, U.S. Department of Energy (DOE) **Better Buildings Overview** Maria Vargas, Director, Better Buildings Challenge, U.S. DOE **Announcements and Special Recognition** Kathleen Hogan, U.S. DOE **Meeting Goals and Breakout Discussion Guidance** Bill Prindle, Facilitator, ICF International				
10:00–10:15	**Break**				
10:15–11:45 **Project Team Breakout III** Choose 1 of 7. Review current Alliance activities and assess deployment barriers and opportunities.	**Technology Solutions**				**Market Solutions**
	Lighting & Electrical, Rm X249 Project Successes and Overcoming Challenges	**Laboratories, Rm X324** Strategies for collaboration between facilities staff, lab users and (EHS) personnel	**Plug and Process Loads, Rm X305** State of the Industry as it Applies to PPL Measurement and Control		**Overcoming Obstacles to Data Access: Who, What, Where and How? Rm X424** Identify successful strategies to engage with utilities, regulators, and policy makers to request improved access to energy data
	Space Conditioning, Rm X251 Current Projects Barriers and Opportunities	**Refrigeration, Rm X320** Review current projects and key issues facing the sector	**Food Service, Rm X326** Review of Current Projects and Key Issues Facing Industry		
11:45–1:15	**Lunch and Networking Room X344** **Joining the Better Buildings Challenge - Discussion Table** (*optional*): Opportunity for informal discussion with DOE. **Presentation:** Launch of Wireless Metering Challenge and Advanced RTU Campaign, Update on LEEP Campaign.				
1:15–2:30 **Project Team Breakout IV** Choose 1 of 7. Continuation of morning discussion focused on actionable outcomes.	**Technology Solutions**				**Market Solutions**
	Lighting & Electrical, Rm X249 Project Successes, Overcoming Challenges, and New Ideas	**Energy Management & Information Systems, Rm X324** Making the Most of Energy Data: Existing Resources and Future Activities	**New Topics, Rm X305** Exploring new topic areas: renewables, net-zero facilities, and data centers		**Implementation Models from DOE's Better Buildings Challenge, Rm X424** Discuss processes, implementation/financing strategies, technologies, and services employed by BBC Partners
	Space Conditioning, Rm X251 Manufacturer Solutions and Looking Forward	**Refrigeration, Rm X320** Compressor Rack Standardization (Design, Operation, Maintenance)	**Food Service, Rm X326** New Project Ideas, Impact, and Deployment Path		
2:30–2:45	**Break**				
2:45–3:30 **Sector Breakout II** Choose 1 of 5. See Table 2 on page 4.	**Commercial Real Estate & Hospitality, Rm X320** The Rubber Meets the Road: Bridging Sector Focus Areas with Alliance Activities	**Higher Education, Rm X324** Barriers and Opportunities	**Healthcare, Rm X326** 2013 Efficiency Forum Digest and Priorities for 2014	**Retail, Food Service & Grocery, Rm X305** 2013 Efficiency Forum Wrap-Up Discussion	**Commercial Building Stakeholders, Rm X344** Discussion Session with DOE
3:30–3:45	**Break**				
3:45–4:30	**Closing Plenary Session, Rm X344** **Breakout Session Report Back** Technology team representatives inform Forum of progress/accomplishments during Day 2 **Closing Remarks** Kristen Taddonio, Commercial Partnerships Team Lead, U.S. DOE				
4:45–6:00 See Table 1 on page 3.	**Optional Tours, Rm X344** On-site tours available for interested attendees to observe energy efficient and renewable energy technologies in practice and in development. Meet in RSF Room X344.				
6:30–8:00	**Optional Dinner**				

Table 1. Descriptions of On-site Tours

Tour	Description	Day 1	Day 2
Energy Systems Integration Facility (ESIF)—Technology Research Tour	This tour will focus on the ESIF's unique research and laboratory features, such as megawatt-scale microgrid testing capabilities, which will help industry overcome challenges to greater integration of distributed systems and renewable energy.	5:30 PM, Room X344	4:45 PM, Room X344
Energy Systems Integration Facility (ESIF)—Building Efficiency Tour	This tour will discuss the ESIF's high-performance building systems, with a focus on reducing energy consumption in laboratory, office, and data center spaces.	5:30 PM, Room X344	4:45 PM, Room X344
Research Support Facility (RSF)—Net Zero Energy Office Building	In this 360,000 ft^2 LEED Platinum office building, discussion points will include the procurement process, innovative plug and process load management, daylighting, natural ventilation, a high-efficiency data center, radiant heating and cooling, and on-site photovoltaics (PV).	5:30 PM, Room X320B/C	4:45 PM, X320B/C
Thermal Test Facility (TTF)-Advanced Space Conditioning Research	The TTF is home to NREL's innovative HVAC systems research, and this tour will discuss rooftop unit testing, transpired collectors, and advanced dehumidification and evaporative cooling technologies.	Not offered	4:45 PM, Room X324
LEED Gold-Designed Cafeteria	The cafeteria features best-in-class commercial kitchen equipment; indirect/direct evaporative cooling; greater than 50% kitchen ventilation energy savings over typical design; efficient lighting and daylighting; and a contractual energy performance improvement plan for vendors and operators.	5:30 PM, Room X320	Not offered
High-Efficiency Parking Garage	The low-energy, 1,800-space parking garage features daylighting to reduce lighting loads, occupancy sensors, high-efficiency LED lighting, natural ventilation, and PV panels on the rooftop and south facade.	Not offered	4:45 PM, Room X326
Solar Power R&D, Testing, and Commercialization	This tour will include world-class laboratories where NREL, industry, and universities collaborate on advanced solar technologies and manufacturing methods to accelerate commercialization.	Not offered	4:45 PM, Room X320A

Table 2. Descriptions of Sector Breakout Sessions

	Commercial Real Estate & Hospitality	Higher Education	Healthcare	Retail, Food Service & Grocery	Commercial Building Stakeholders
Sector Breakout I **Wed. 11:00 AM-12:30 PM**	**Guiding the Way: Setting Our Focus and Sharing Success** The session will frame our collective challenge to optimize the value of Alliance activities from the sector's perspective. Key barriers and potential solutions will be examined, guided by innovative showcase projects from Better Buildings Challenge partners.	**Energy Efficiency in the Higher Education Sector** This session will feature presentations from Better Buildings Challenge Partners on their program showcase projects, and a discussion led by Wendell Brase of UC Irvine on how higher education institutions can realize game-changing energy savings in new and innovative ways.	**Technical Solutions and Employee Engagement Solutions for Hospitals** This session will open with BBA member introductions. We will hear from two members on successful technical and employee engagement approaches: Beaumont Health on the Kaizen methodology to achieve energy savings, and University of Pittsburgh Medical Center on the tie between retro-commissioning and deploying energy information system to help maintain operation.	**Driving Energy Reductions: Strategic Management and Innovation** This session will feature replicable success stories along with cross-cutting barriers and opportunities identified by Better Buildings Alliance members. Session will highlight Staples and Walgreens, two Better Buildings Challenge partners. Session facilitators will review the Challenge opportunity and how the two programs will interact in 2013.	
Sector Breakout II **Thurs. 2:45-3:30 PM**	**The Rubber Meets the Road: Bridging Sector Focus Areas with Alliance Activities** Join a collaborative discussion aimed at coordinating strategies for breaking barriers through project team activities. The session will provide a forum for members to define how Alliance activities can facilitate progress in the sector and beyond.	**Barriers and Opportunities** In this session we will invite representatives of associations working in the higher education sector to discuss some common barriers to energy efficiency facing higher education institutions. We will review available resources, existing programs and proven approaches that directly address these barriers.	**2013 Efficiency Forum Digest and Priorities for 2014** This session will provide an open forum for members to share pertinent items from the Forum and which BBA activities they plan to engage in during the coming year. We aim to get feedback on potential new or enhanced activities that could support the Healthcare sector.	**2013 Efficiency Forum Wrap-Up Discussion** This session will provide retail, grocery, and food service sector organizations with an opportunity to discuss the 2013 Efficiency Forum: highlights, helpful sessions, and ideas for next year's forum. We welcome feedback on session organization and content.	**Commercial Stakeholder Breakout Session** The session will allow time for commercial stakeholders to provide feedback to DOE about their role in the Alliance, ask questions, address concerns, and provide feedback on the project sector team activities that they observed during the day.

Table 3. Day 1 Project Team Breakouts Descriptions

Project Team	Project Team Breakout I Wed. 1:30-2:45 PM	Project Team Breakout II Wed. 3:00-4:15 PM
Lighting & Electrical	**Project Successes, Barriers, and Next Steps** Team will discuss technical progress, member barriers and opportunities related to lighting troffers, LEEP Campaign (exterior lighting), and wall pack projects.	**Project Successes, Barriers, and Next Steps, and Key Discussion Items for Industry** Team will discuss technical progress and member barriers and opportunities related to exterior lighting controls. Members provide feedback on new project ideas and key discussion items for industry stakeholders.
Laboratories	**Lab team activities and member implementation stories** Session will provide an overview of lab team activities, followed by a member "show and tell" on their experiences implementing lab efficiency measures. Group discussion on ongoing lab team activities will follow.	
Space Conditioning	**Better Buildings Alliance Member Discussion** Current and New Projects: Overview and discussion of Advanced RTU Campaign (ARC), project team will propose duct leakage project plan, and brainstorm new project ideas and questions for manufacturers.	
Food Service	**Project Successes and Barriers** Team will discuss progress, plans, and prognosis for ENERGY STAR food service building energy, and Energy Management System guidance package.	**Identify Solutions and Key Discussion Items for Industry** Team will discuss potential further efforts in food service benchmarking, new project on Demand Control Ventilation, new projects on Energy Mgmt. Systems, and will have open discussion of other project ideas.
Refrigeration		**Moving toward standardization of compressor rack design, operation and maintenance** What steps can we take to standardize refrigeration hardware and practices across the sector in order to improve operational performance and simplify maintenance? Team will also discuss ongoing activities and the compressor rack challenge.
EMIS		**Making the Most of Energy Data** Team will discuss operational efficiency and continuous energy management with the goal of understanding member experiences with EMIS, challenges in the proactive use of data, and project team opportunities.
Market Solutions	**Update on "Green" and Energy-Aligned Leasing** Team will discuss latest activity in the energy-aligned leasing arena, including new resources from the DOE and Institute for Market Transformation. Participants will share insights on innovative approaches, green leasing audits, and challenges to implementing these provisions. The discussion will address how interest in energy aligned leasing is taking root in the retail sector.	**Successful Strategies for Engaging Tenants to Improve Energy Efficiency** Tenant engagement provides a powerful opportunity to drive energy efficiency in commercial buildings. Attendees will learn about exciting new initiatives underway to drive coordination between building owners and their tenants in pursuit of improved energy performance, and how the DOE and EPA are helping the industry respond to this challenge.

Table 4. Descriptions of Day 2 Project Team breakouts

Team	Project Team Breakout III Thurs. 10:15–11:45 AM	Project Team Breakout IV Thurs. 1:15–2:30 PM
Lighting & Electrical	**Project Successes and Overcoming Challenges** Team lead will provide takes brief updates on lighting troffers, LEEP Campaign (exterior lighting), exterior controls, and wall pack projects followed by a discussion of challenges and possible solutions identified by BBA members and industry.	**Project Successes, Overcoming Challenges, and New Ideas** Team will continue discussion of lighting project challenges and solutions, and new project ideas.
Laboratories *(Session III)* **EMIS *(Session IV)***	**Strategies for collaboration between facilities staff, lab users and EHS personnel** Session will provide a team introduction, and user and environmental health and safety (EHS) perspectives on implementing efficiency in labs. Safety and usability are not just "non-energy benefits". How to use them as the starting point for strategies and technologies that improve efficiency?	**Making the Most of Energy Data: Existing Resources and Future Activities** Team will discuss operational efficiency and continuous energy management with the goal of understanding member experiences with EMIS, challenges in the proactive use of data, and project team opportunities.
Space Conditioning	**Current Projects Barriers and Opportunities** Session with include preliminary results from the Advanced RTU controller demonstrations and targeted discussions between BBA members and key stakeholders about the barriers and opportunities for promoting the BBA technology specifications, the advanced RTU controllers, and the duct leakage project.	**Manufacturer Solutions and Looking Forward** Session will opportunity to hear new products solutions from manufacturers and targeted discussions between BBA members and key stakeholders about the barriers and opportunities for supporting the Advanced RTU Campaign and new project ideas from Day 1.
Food Service	**Review of Current Projects and Key Issues Facing Industry** Discussion of key issues facing Food Service industry and how BBA can impact solutions, receive stakeholder feedback on FY13 projects and member-identified barriers.	**New project ideas, impacts, and deployment path:** Team will discuss potential further efforts in food service benchmarking, new project on Demand Control Ventilation, new project on Energy Mgmt. Systems, and will have open discussion of other project ideas.
Plug & Process Loads *(Session III)* **New Topics *(Session IV)***	**State of the industry as it applies to PPL measurement and control** Team will discuss industry barriers to controlling PPLs, vet project ideas for FY14 BBA PPL projects focusing on overcoming high-impact barriers, and hear presentations on plug load measurement and verification and from a stakeholder.	**New Topics** Session will provide opportunity for participants to provide feedback on additional topics of interest including renewables integration in commercial buildings, best practices for procuring/constructing net-zero facilities, data center energy efficiency, among others. Session will aim to prioritize potential future efforts.
Refrigeration	**Review current projects and key issues facing the sector** Team will discuss open case retrofits, commissioning guide, compressor rack challenge and identify potential alternative refrigerant case study opportunities. Member feedback is sought about key challenges facing the supermarket refrigeration sector, and how DOE can facilitate solutions.	**Compressor rack standardization (design, operation, maintenance)** Team will discuss how compressor rack design and O&M practices can be standardized across suppliers and end users to achieve better performance and simplified maintenance.
Market Solutions	**Overcoming Obstacles to Data Overcoming Obstacles to Data Access: Who, What, Where and How?** This session will provide an overview of the innovative activities and initiatives underway nation-wide to facilitate greater access to commercial building energy data for owners and managers. A key session goal is to identify successful and replicable strategies for commercial customers to engage with utilities, regulators, and policymakers to request improved access to data.	**Implementation Models from DOE's Better Buildings Challenge** BBC Partners will share information about the implementation models that they have deployed, including: the process, specific tools, documents and steps they used to achieve success; business processes and implementation/financing strategies; and the services, strategies, technologies, and processes Partners are using to achieve their energy savings targets.

Appendix B: Efficiency Forum Attendees and Staff

Attendees

- 7AC Technologies, Inc.- Peter Vandermeulen
- ABB Group - Caroline Mason
- Acuity Brands - Mark Hand
- Aelux - Emily Schapira
- Aircuity, Inc. - Gordon Sharp
- Allegheny College - Eric Pallant
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) - Bert Etheredge
- ASHRAE - Claire Ramspeck
- ASHRAE - Thomas Watson
- Arby's - Frank Inoa
- Architectural Energy Corporation - James Ptacek
- Ascension Health - Gerry Kaiser
- Association for the Advancement of Sustainability in Higher Education (AASHE) - Dave Newport
- Bayer MaterialScience - Gary Gardner
- Beaumont Health System - Kay Winokur
- Boston Market Corporation - Greg Tomsick
- Building Energy - D. Magnus Cheifetz
- Building Owners and Managers Association International - Karen Penafiel
- Callida Energy - Raphael Carty
- Carrier Corporation - Mead Rusert
- CBRE Group, Inc. - Michael Groppi
- CKE Restaurants, Inc.- Juliann Rogers
- Colliers International - John K. Scott
- Consortium for Energy Efficiency - Kim Erickson
- Control Products, Inc. - Paul Carlson
- Coolerado Corporation - Tom Teynor
- Cooper Lighting - Logan Gerhard
- Cox Enterprises - Steve McNair
- Cushman & Wakefield - Eric Duchon
- Daikin McQuay - Angela Scott, Don Winter
- Danfoss - Peter Dee,
- Danfoss -John Galyen
- DC Engineering - Dustin Lilya
- Deloitte - Timothy Thiel
- Denver West Office Park - Dave Clarke
- Denver West Office Park - David Chasnow
- Disney Worldwide Services, Inc. - Bruce Rauhe
- E4E Solution - Walt Taylor
- Emerson Climate Technologies - Mike Saunders
- Energy Efficient Buildings (EEB) Hub - Laurie Actman
- FBO LLC- John Karakash
- Enmetric Results - Bob Larson
- Exposure Control Technologies, Inc. - Thomas Smith
- Fisher-Nickel, Inc. - Donald Fisher
- Focus on Energy - Matthew Matenaer
- Forest City Enterprises - Joyce Mihalik
- Franklin Energy Services - Ross Bennett
- Glenborough, LLC - Carlos Santamaria
- Green Parking Council - Paul Wessel
- Green Parking Council - Trevyr Meade
- Haverty's Furniture - Rawson Haverty
- Healthcare Without Harm - Paul Lipke
- Hines - Clayton Ulrich
- ICAST - Brian Firestone
- IDC Energy Insights - Casey Talon
- IE Technologies - Gregory Tropsa
- Ingersoll Rand - Jordan Doria
- Institute for Market Transformation - Adam Sledd
- Institute for Market Transformation - Andrea Krukowski
- Jones Lang LaSalle- Thomas Miroslaw
- Kohl's Department Store - John Fojut
- Kohl's Department Store - Marcy Schaefer
- Liberty Property Trust - Marla Thalheimer
- Manitowoc Foodservice - Dean Landeche
- Marriott International, Inc.- Douglas Rath
- Mayekawa USA - Mark Tomooka
- McDonald's USA, LLC- Jason Greenberg
- Metrus Energy - Sam Lines
- MGM Resorts International - Chris Magee Michigan State University - Lynda Boomer
- MGM Resorts International - Don Johnson
- Michigan State University - William Lakos
- Mortenson Construction - Jim Bradburn
- NREL - Ron Judkoff
- Navigant Consulting, Inc. - Dustin Bailey
- Navigant Consulting, Inc. - Greg Chung
- New York Presbyterian Hospital - John D'Angelo
- NRG Insulated Block - Marty Walters
- PNNL - Srinivas Katipamula
- Parker Hannifin - Clay Rohrer
- Parker Hannifin - Scott Junkin
- Parmenter Realty - Steve Harrison
- Philips Government and Industry Affairs Office - Kiran Challapali
- Powerhouse Dynamics - Jay Fiske

Attendees (continued)

- Professional Retail Store Maintenance (PRSM) Association - Amruta Vantipalli
- PRSM - Joshua Witte
- Prudential Real Estate Investors - David DeVos
- Red Robins - Donna Trovalli
- Regency Centers - Liz Miskelly
- Regency Centers - Mark Peternell
- Retail Industry Leaders Association (RILA) - Erin Hiatt
- RILA - Adam Siegel
- RMH Group, Inc. - Jessie Jones
- Rocky Mountain Institute - Cara Carmichael
- Rocky Mountain Institute - Elaine Adams
- Safeway, Inc. - Michael Crockett
- Solar Art - Matthew Darienzo
- Source Refrigeration - Richard Heath
- Southwest Energy Efficiency Project - Curtis Framel
- Sprint - John Holmes
- Stanford University - Susan Vargas
- Staples Inc. - Patrick Maher
- Sunoptics - Eric Huffman
- Sustainable Endowments - Stephanie Gripne
- Sustainable Values - Theddi Wright-Chappell
- Target Corporation - Neil Munson
- Target Corporation - Scott Williams
- The Home Depot - David Oshinski
- The Home Depot - Terry Snowden
- TIAA-CREF - Nicholas Stolatis
- Transformative Wave Technologies - Danny Miller
- Transwestern - Dorothy Schwarz
- U.S. Environmental Protection Agency (EPA) - Stephanie Plummer
- U.S. EPA - Michael Zatz
- U.S. General Services Administration (GSA) - Michael Bloom
- U.S. GSA - Doug Rothgeb
- U.S. GSA - Jeffrey Engelstad
- U.S. GSA - Kinga Porst
- U.S. GSA - Michael Lowell
- U.S. Green Building Council - Kristin Ferguson
- University of California, Irvine - Wendell Brase
- University of Colorado, Boulder - Susan Beckett
- University of Colorado, Boulder - Kathryn Ramirez-Aguilar
- University of Maryland - Robert Hermstein
- University of Maryland Medical Center - Richie Stever
- University of Utah - Jeff Wrigley
- University of Utah - Michael Perez
- Walgreens - Jamie Meyers
- Walgreens - Jason Robbins
- Wawa - Pat Hagan
- Wendy's - Russ Subjinske
- Whole Foods Market - Kathleen Loftus
- Whole Foods Market - Mike Ellinger
- Whole Foods Market - Mike Guldenstern
- Yum! Brands - Adam Jarboe
- Zero Zone, Inc. - Carl Roberts

Staff

- E Source - Tim Stout
- ICF International - Zachary Abrams
- ICF International - Natalie Chadwick
- ICF International - Leigh-Golding DeSantis
- ICF International - Joe Indvik
- ICF International - Nyla Khan
- ICF International - William Prindle
- ICF International - Andrew Schulte
- ICF International - Jen Singer
- JDM Associates - Deborah Cloutier
- JDM Associates - Paul Coraggio
- JDM Associates - Jacob Dowling
- Lawrence Berkley National Laboratory (LBNL) - Paul Mathew
- LBNL - Jessica Granderson
- Navigant Consulting, Inc. - Richard Shandross
- Navigant Consulting, Inc. - William Goetzler
- National Renewable Energy Laboratory (NREL) - Michael Deru
- NREL - Bobbi Garrett
- NREL - Feitau Kung
- NREL - Michael Sheppy
- NREL - Paul Torcellini
- NREL - Mary Werner
- Pacific Northwest National Laboratory (PNNL) - Linda Sandahl
- PNNL - Jeff McCullough
- U.S. Department of Energy (DOE) - Holly Carr
- U.S. DOE - Kathleen Hogan
- U.S. DOE - Jason Koman
- U.S. DOE - Kristen Taddonio
- U.S. DOE - Maria Vargas
- Waypoint Building Group - Patrick Finch,
- Waypoint Building Group - Andres Potes,
- Waypoint Building Group - Diane Vrkic

Appendix C: Better Buildings Contacts

Program	Lead	Email Address	Phone
Better Buildings Alliance	Kristen Taddonio	kristen.taddonio@ee.doe.gov	202-287-1432
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Technology	**Lead**	**Email Address**	**Phone**
Food Service	Rich Shandross, Navigant	richard.shandross@navigant.com	781-270-8391
Energy Management and Information Systems	Jessica Granderson, LBNL	jgranderson@lbl.gov	510-486-6792
Laboratories	Paul Mathew, LBNL	pamathew@lbl.gov	510-486-5116
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Plug and Process Loads	Michael Sheppy, NREL	michael.sheppy@nrel.gov	303-275-4327
Space Conditioning	Michael Deru, NREL	michael.deru@nrel.gov	303-384-7503
Refrigeration	Bill Goetzler, Navigant	wgoetzler@navigant.com	781-270-8351
Market Solutions	**Lead**	**Email Address**	**Phone**
Appraisals and Valuation	Elena Alschuler	elena.alschuler@ee.doe.gov	202-287-1561
Data Access	Andrew Schulte	andrew.schulte@icfi.com	919-293-1671
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Sector Team	Lead	Email Address	Phone
Commercial Real Estate and Hospitality	Jennifer Singer	jen.singer@icfi.com	301-244-5894
	Jacob Dowling	jdowling@jdmgmt.com	703-639-4257
Healthcare	Leigh-Golding (LG) DeSantis	leigh-golding.deSantis@icfi.com	202-862-1202
Higher Education	Joe Indvik	joe.indvik@icfi.com	202-862-1252
Retail, Food Service and Grocery	Zach Abrams (former higher education lead)	zach.abrams@icfi.com	646-334-1174
	Natalie Chadwick	natalie.chadwick@icfi.com	202-862-1261

Appendix D: 2013-2014 Steering Committee Members

2013-2014 Steering Committee Members – Better Buildings Alliance	
COMMERCIAL REAL ESTATE AND HOSPITALITY	**RETAIL, FOOD SERVICE AND GROCERY**
• **Carlos Santamaria, Glenborough (Co-Chair)** • **Chris Magee, MGM Resorts International (Co-Chair)** • Bert Etheredge, ASHRAE (Ex-Officio delegate) • Brenna Walraven, USAA Real Estate Co. • Bruce Rauhe, Disney Worldwide Services, Inc. • Christine Dorgan, Disney Worldwide Services, Inc. • Douglas Rath, Marriott International • Eric Duchon, Cushman & Wakefield • John Scott, Colliers International • Jon Flaherty, Tishman-Speyer • Karen Penafiel, BOMA International • Kinga Porst, GSA • Laurie Actman, EEB Hub (Ex-Officio delegate) • Marla Thalheimer, Liberty Property Trust • Michael Groppi, CB Richard Ellis Group • Noah Shales, Newmark Grubb Knight Frank Global Corporate Services • Will Teichman, Kimco Realty	• **Kyle Wilkes, jcpenney (Chair)** • Bert Etheredge, ASHRAE (Ex-Officio delegate) • David Harpring, Yum! Brands • Jason Greenburg, McDonald's Corporation • Mike Ellinger, Whole Foods Market • Jim McClendon, Walmart Stores Inc. • David Oshinski, The Home Depot • Andy Thorsen, Kohl's Corporation • Bob Valair, Staples Inc. • Scott Williams, Target Corporation
HEALTHCARE	**HIGHER EDUCATION**
• **Drew Chidester, University of Pittsburgh Medical Center (Chair)** • Corey Zarecki, Gundersen Lutheran Health System • Bert Etheredge, ASHRAE (Ex-Officio delegate) • Gerry Kaiser, Ascension Health • John D'Angelo, New York-Presbyterian Hospital • John P. Krolicki, University of Pittsburgh Medical Center • Rob Haddix, TRICARE Management Activity • Tom Riley, Hospital Corporation of America	• Bert Etheredge, ASHRAE • Elizabeth Davey, Tulane University • Lanny Joyce, Cornell University • Susan Corry, University of Maryland • Susan Vargas, Stanford University • Vakili Faramarz, University of Wisconsin • Wendell Brase, University of California

Appendix E: Technical and Market Solutions Overviews

2013 Efficiency Forum
May 29 - 30

Contents

U.S. DEPARTMENT OF ENERGY

Energy Efficiency & Renewable Energy

Building the Business Case for Adoption of Energy Information Systems

Energy Management and Information Systems Team

Technical Lead: Jessica Granderson, LBNL, JGranderson@lbl.gov, 510-486-6792

Main Barriers Addressed by the Project	Few building technologies are currently as heavily marketed or publicized as energy information systems (EIS). Although EIS can enable whole-building energy savings of up to 20%, adoption remains low due to 3 critical barriers. • **Technical**: Lack of information on technology costs and associated energy and cost savings. • **Awareness:** Limited understanding of how the technology can be used for maximum benefit. Also, the lack of standard terminology and the broad diversity in the number and type of solutions make it difficult to distinguish one technology from another.
Solutions/ Deliverables	3 key resources will be produced for members, utilities seeking to build the case for whole-building pilots and programs, and vendors looking to grow their customer base. • Consensus among a broad group of stakeholder on a framework for classifying EMIS technologies (using the CEE Whole Building Performance committee framework as a starting point). • Identification of technology costs; energy and cost saving benefits (effectiveness). • Best practice technology uses (including sub-metering and aggregated whole-building data) for realizing energy efficiency that can be applied by adopters to achieve maximum value.
Deployment Pathway	• **Website:** The EMIS team website contains team information, updates, and activity outcomes. • **Webinars:** A webinar will be held in Fall 2013, disseminating the team's findings on EIS costs and benefits as well as best practice uses. • **White paper:** Highlights of findings will be published in Fall 2013. • **Technical report:** Full technical findings will be published in Fall 2013. Presentations on project outcomes will be presented at industry efficiency conferences and other stakeholder venues, such as CEE Meetings and facilities management forums.
Impact Metrics	Number of members participating in the EMIS team • Number of downloads of project outcome documents • Number of members who choose to adopt EIS based on the information generated from this activity

Wireless Metering Challenge

Energy Management and Information Systems Team

Technical Leads: George Hernandez, PNNL, George.Hernandez@EE.Doe.Gov; Anne Wagner, PNNL, anne.wagner@pnnl.gov

Main Barriers Addressed by the Project	• **Technological:** Energy measurement devices in today's market either have more features than needed for basic measurement of building energy use and have a high cost, or, have a low price but are not robust enough for commercial applications. • **Operational:** Energy use must be measured to most effectively improve a building's energy efficiency. • **Data:** Due to the current high cost of metering and gathering data, energy use data is not available for many buildings. • **Awareness:** Raising industry awareness of the need for cost-effective metering systems using wireless communication will increase the visibility of the need and will positively impact both the market supply side and demand side.
Solutions/ Deliverables	• **Wireless Energy Meter Specification:** An aspirational specification outlining the basic requirements and design features for a cost effective metering system including panel level sub-meters with wireless data transmission to an onsite collection point. • **Webinar:** An informational overview providing the scope and intent of the Wireless Meter Challenge as well as a review and clarification of key technical requirements. • **Compliance Review:** DOE will be provided a summary of the compliance review results. • **In-Building Test Results:** DOE will receive a report on the in-building test analysis findings.
Deployment Pathway	• Name challenge compliant entries • Work with building owners, private and federal, to deploy technology.
Impact Metrics	• Using metering systems to enable energy efficiency actions is estimated to deliver minimum electricity energy savings of at least 2%. • For all commercial buildings this corresponds to annual primary electricity energy and cost savings of 71 trillion BTU/yr. and $1.7 billion/year.

Food Service Energy Benchmarking

Food Service Team

Tech Lead: Rich Shandross, Navigant Consulting, richard.shandross@navigant.com, 781-270-8391

Main Barriers Addressed by the Project	• **Technological:** Within-portfolio benchmarking efforts are desirable, but existing tools are not fully developed. • **Data:** Lack of energy consumption benchmarks inhibits identification of retrofit priorities, getting a high-level view of energy use for all stores, identifying stores with high and low energy use, and tracking changes in energy use. • **Awareness:** ENERGY STAR Portfolio Manager does not model food service, so there is no opportunity for food service building certification. Building certifications are major motivators for energy efficiency upgrades.
Solutions/ Deliverables	• **ENERGY STAR Coverage of Food Service Buildings:** An ENERGY STAR Portfolio Manager model, and building certification criteria, for food service. • **Upgraded Restaurant Energy Use Benchmarking Tools:** Improved guidelines, spreadsheet, and user-friendly tools for performing benchmarking and energy management within a food service organization's building portfolio.
Deployment Pathway	• **ENERGY STAR building certification:** – Better Buildings Alliance-led development of Food Service Building Energy Survey. – Deployment of Food Service Building Energy Survey. – Portfolio Manager and Building Certification release. – Provide food service data collection needs to CBECS, for incorporation into the CBECS survey for reference year 2016. • **Upgraded Restaurant Energy Use Benchmarking tools:** – In light of the significant insight that ENERGY STAR and DOE Asset Rating results will shed on restaurant energy usage, this part of the project will be re-evaluated when those results become available.
Impact Metrics	• **ENERGY STAR building certification:** – Estimated [TBD] food service buildings certified within 2 years of release (16 categories with food service, about 8000 total buildings certified). – Estimated [TBD] food service buildings reduce energy by [TBD%], attempting to achieve label. • **Restaurant Energy Use Benchmarking tools:** – Number of members using the tools: Initially, [2-4] early-adopting members use tools. After successes publicized, usage rises to [75%] of member organizations and steadily-rising use outside of the Better Buildings Alliance. – Measured energy savings per building: Benchmarking to result in an average energy savings of [10% or more] for buildings improved by the operator.

Energy Management Systems (EMS)

Food Service Team

Tech Lead: Rich Shandross, Navigant Consulting, richard.shandross@navigant.com, 781-270-8391

Main Barriers Addressed by the Project	• **Technological:** EMS equipment and software is typically designed for large office environments, and has not been optimized for food service buildings, processes, and operational challenges. • **Operational:** High initial cost impedes purchase of typical EMSs for food service buildings, especially relevant for franchised organizations. Optimized, proven technology for restaurant applications will increase sales of EMSs to food service, lower cost and raising organizational/ franchisee acceptance. • **Data:** Clearing restaurant Return on Investment (ROI) hurdles would be made easier if EMSs can be used to prevent catastrophic breakdowns of food equipment, which lead to spoilage, extra energy use, and loss of sales. • **Awareness:** Most restaurant owners are not knowledgeable about EMS technology.
Solutions/ Deliverables	• **Food Service EMS Guidance Package:** An ENERGY STAR Portfolio Manager model, and building certification criteria, for food service. Based on an initial review and benchmarking of existing EMS products, a set of guidelines is under development, intended to: (1) educate users on the benefits, costs, and nature of the technology; (2) identify attributes of EMS technology that are critical for optimal performance and success in food service applications; (3) compile a database of vendors that offer systems meeting the desired attributes, (4) guide users through the process of selecting and implementing an EMS; and (4) document best practices for food service EMSs. • **Measured energy savings per building:** Benchmarking to result in an average energy savings of [10% or more] for buildings improved by the operator. • **Wireless Metering Challenge**: Supports development and delivery of low cost wireless energy meters, which would reduce installation and capital costs and would simplify food service EMSs.
Deployment Pathway	• **Stakeholder Feedback**: Market review, benchmarking of practices, and input from BBA members, industry experts, and Food Service Technology Center (FSTC): March, 2013 • **Materials**: Draft and final guidance packages. • **Implementation** – *Members:* Deploy EMSs to a test group of stores (est. ≤15), evaluate results, then roll out to the portfolio if ROI will meet typical 2-year simple payback. Support Wireless Metering Challenge. – *FSTC:* Demonstrate technology, monitor an implementation(s), or similar. – *Trade associations*: RFMA, NAFEM, and National Restaurant Assoc. (NRA) to publicize, promote, and train members regarding new technology.
Impact Metrics	• Initial adoption goal: New EMSs to initially be deployed by at least 4 members. • Follow-on adoption goals: Deployment to increase by 10-20 large food service chains and 2-5% of other NRA members over 5 years. • Energy savings goal: Average energy savings of 10% per year per building, within one year of deployment. • Ancillary benefits goal: Deploying organizations to avoid 1-3 breakdowns of food equipment per year, with associated reductions in waste, extra energy use, and loss of sales.

Low-cost High-Impact Operational Strategies for Labs

Laboratories Team

Technical Lead: Paul Mathew, Lawrence Berkeley National Laboratory, pamathew@lbl.gov, 510-486-5116

Main Barriers Addressed by the Project	• **Operational:** Several lab efficiency measures require a persistent operational effort to ensure savings – most notably fume hood sash management. • **Awareness:** Many lab users are not aware of the energy intensity of fume hoods and freezers and the impact that they can have on reducing energy use. Similarly some lab EHS personnel are not aware of best practices on optimizing minimum air change rates. • **Data:** There is a lack of quantitative data on some high impact efficiency measures, including reheat energy use and freezer energy use.
Solutions / Deliverables	The current focus is on four low-cost, high impact strategies: • Fume hood sash management • Optimizing minimum air change rates • Minimizing simultaneous heating and cooling • Freezer energy management For each of the four strategies, DOE worked with members to develop the following guides and resources to facilitate implementation by members (all of which are available on the Labs Team website): • Fume hood Sash Management Guide: Provides step-by-step guidance on how to run a sash management campaign or competition. • Fume hood Sash Management Resource Kit: Includes member examples of campaign posters and sash stickers • Getting below Six Air Changes: Highlights 3 members who optimized air changes rates to below 6 air changes per hour. • Minimizing Reheat Guide: How to identify, quantify and minimize reheat in existing labs • Freezer Energy Management Guide: Strategies to reduce energy use of Ultra low temperature freezers, including specification and procurement, operations, maintenance, etc.
Deployment Pathway	• **Webinars:** Discuss best practices for each solution option. • **Website:** Labs team guides and related resources are available on the Labs team website. • **Member implementation:** Members are currently implementing these measures. As results come in, they will be shared with other members. • **Conference presentations:** Resources will be presented and shared with key stakeholder organizations, such as the International Institute for Sustainable Laboratories.
Impact Metrics	• Number of members participating in Labs team (currently 14). • Energy savings from member implementation of lab strategies. Initial results are being compiled as members provide them and a summary will be available in September 2013.

Lighting Projects

Lighting and Electrical Team

Technical Lead: Linda Sandahl, PNNL, linda.sandahl@pnnl.gov, 503-417-7554

Main Barriers Addressed by the Projects	The Lighting and Electrical Team is addressing a number of real and perceived barriers to wider adoption of high-efficiency lighting in exterior (parking lot, structure, wall pack, and exterior controls) and interior (lighting troffer) applications. Barriers addressed include: • **Technological:** – Uncertainty regarding what to require when using new or unfamiliar technologies such as LEDs (product and performance/design requirements). – Unfamiliarity with the technology and need to better understand its performance in real world applications, and the inherent challenges/lessons learned from demonstration projects. – Lack of guidance on how to apply the different control technologies to different luminaires in parking lots, parking structures, area lighting, and building-mounted lighting. • **Operational:** – Uncertainty about what to require from vendors, and what performance parameters to specify in RFP materials. – Lack of knowledge of the questions to ask from the early stages to the end stages of commissioning a high-efficiency parking facility. – ROI for high-efficiency lighting is generally 3+ years but is improving. – Commercial sector often faces the challenge of split incentives. • **Data:** Lack of knowledge where to find utility incentives; lack of site level performance data for troffer lighting. • **Awareness:** – Lack of guidance for building the business case. – Perception that Initial cost differential of high-efficiency solutions is very high relative to incumbents, yet in many cases costs have come down rapidly. – Wall packs are typically deployed on site, often without any thought to the lighting quality provided by the luminaires.
Solutions/ Deliverables	• **Lighting Energy Efficiency in Parking (LEEP)** Campaign – Partnering with DOE, IFMA, BOMA, GPC to encourage utilizing high-efficiency lighting solutions. Resources include: – **Technical Assistance:** Provided on specifications by PNNL lighting experts upon request. – **Specifications**: With savings of 40% or more (when using controls),

developed by members and vetted with manufacturers.

- LED Site Lighting Specification Version 1.3 [Feb 2012]
- High-Efficiency Parking Structure Specification Version 1.1 [Feb 2012]

– **Key events:**

- Campaign webinar to provide overview and progress [Feb 2013]
- Campaign reaches 100 million sq. ft. Goal [April 2013]
- Awards event – IFMA Spring Conference and Expo [Apr 2014]

– **Resources:**

- Case studies, including: Cleveland Clinic Goes LED in Parking Garages [Sep 2012], Walmart Parking Lot Goes LED [June 2012], Gateway Parking Lot Lighting with LEDs: T.J.Maxx Plaza [Jan 2011], Gateway Demonstration Report on Walmart Parking Lot Lighting [May 2011]
- Fact Sheets, including: LED Site (Parking Lot) Lighting [Feb 2012] Specification, High-Efficiency Parking Structure Lighting Specification [Feb 2012], Application Considerations for LED Site Lighting Projects [Feb 2012]
- Report on Exterior Lighting for Energy Savings, Security, and Safety [Nov 2009], completed to address security and image concerns related to lower light levels (made possible due to improved LED uniformity).
- Report on Standard Measurement and Verification Plan for Lighting Retrofit Projects for Buildings and Building Sites [Oct 2012], developed to address challenges related to measuring performance.

- **Wall Pack Specification and Guidance:** The team is currently working on guidance that will be complimentary to wall pack specifications sponsored by the DesignLights Consortium or FEMP. Users will be able to select minimum efficiency levels.
- **Exterior Lighting Controls Guidance:** The team is currently working on example language to help designers, owners, and facility managers achieved desired effects from lighting controls.
- **High-Efficiency Troffer Lighting Specification, Fact Sheet, and more:**
  - High-Efficiency Troffer Lighting Specification, Version 4.0 [Apr 2013]. Potential savings range from 15–45% on a one-for-one basis and up to 75% with the use of controls.
  - High-Efficiency Troffer Lighting Fact Sheet [Apr 2013].
  - Outreach to date: Webinar: High-Efficiency Troffer Specification [616 attendees]; Webinar: High-Efficiency Troffer Specification [531 attendees]; Webinar: FEMP First Thursday [Feb 2012; 1,745 attendees]; Webinar: FEMP First Thursday [Apr 2013; 1,000+ attendees]
  - Technical assistance to members in applying specification or in conducting field test(s).
  - Case study of field test results will be completed.

Deployment	• **LEEP Campaign (high-efficiency parking)**: – Commercial building community: Since the formal launch in the fall of 2012, the LEEP campaign has grown to include over 127 organizations, including 67 Participants and 55 Supporters in over 25 states. – Better Buildings Alliance Members: 19 members representing 67 sites have joined since May 2013. – Press: Numerous articles, presentations, and webinars. • **Wall Packs Specification and Guidance Project** – Early interest expressed by MGM Resorts International, Wells Fargo, Kohl's, Home Depot, Safeway, and Kimco Realty. – Materials available for download from the Internet, including the Better Buildings Alliance and LEEP Campaign websites. • **Exterior Lighting Controls Guidance Project** – Early interest expressed by Safeway, Walmart, and Kimco Realty. – Materials available for Internet download, including the Better Buildings Alliance and LEEP Campaign websites. – Coordinate with the Lighting Controls Association (LCA) for use with other programs and dissemination in their education modules. • **High-Efficiency Troffer Lighting** – GSA applied the spec in a demonstration site in San Francisco. – Members are encouraged to participate in a field test. Interest in field tests expressed by Petco, Lamey-Wellehan Shoes, and HealthSouth. – Possible inclusion of resources in an Interior Lighting Project sponsored by FEMP [2014].
Lighting and Electrical team Impact Metrics	• Number of members participating in Lighting and Electrical Team (currently 47). • The LEEP Campaign goal is to achieve 100 million sq. ft. of parking space that exceeds ASHRAE Standard 90.1-2010 by at least 1/3. Energy savings associated with meeting this goal are estimated to equal about 46 million kWh. This goal was achieved in April 2013, and we expect to far exceed it. • Number of members that have reported using the various specifications or guidance resources. • Attendance at webinars and other presentations. • Media coverage of lighting specifications and other resources. • Number of utilities offering incentives that meet the specification levels.

Green Leasing

Market Solutions Team

Technical Lead: Deborah Cloutier, JDM Associates, dcloutier@jdmgmt.com, 703-639-4266

Main Barriers Addressed by the Project	• **Awareness:** Green leasing practices (specifically energy efficiency lease clauses) are not widely implemented in the commercial building sector. Often, tenants and landlords are not aware of the benefits or how they can implement this practice to the benefit of both parties. • **Operational:** With the development of the Green Lease Library, there is now a centralized resource containing descriptive information about green leases. However, further effort is still need to get tenants and landlords to actively incorporate energy-aligned lease clauses into leasing activities. To date the majority of resources developed describe the barriers to green leasing but additional resources are needed to demonstrate the growing adoption of green leasing and to provide specific and replicable examples.
Solutions / Deliverables	• **Case Studies:** Two case studies completed in October 2012. The Market Solutions Team collaborated with the Brandywine Realty Trust, The Pyramid Company, the Institute for Market Transformation, and the Energy Efficient Buildings Hub to develop two green leasing case studies (Brandywine – office; Pyramid – retail), now available on the Better Buildings Alliance website. • **Green Leasing Recognition Program:** In process. The team is currently developing a recognition program for commercial real estate landlords and tenants who have successfully implemented energy-aligned lease provisions into leasing practices. The recognition program will help to: (1) highlight organizations that have implemented green leasing; (2) demonstrate the growing adoption of green leasing practices; (3) further awareness of the critical components of green leasing; and (4) increase transparency of the process, tools and resources available to the market. • **Implementation Roadmap:** In process. This roadmap is intended to provide process-oriented guidance for landlords, property managers and leasing agents on how to conduct discussions and negotiations with tenants that will result in the incorporation of energy-aligned language into lease renewals and new leasing activities. This resource will provide specific and replicable examples of how commercial real estate landlords, property managers, and leasing agents have successfully engaged with tenants to deploy green leases based on several representative scenarios.
Deployment Pathway	• Working with a steering committee comprised of members and industry leaders to provide successful strategies, as well as feedback on program design and resource development. The steering committee will also provide a deployment/promotional channel for final materials. • The team is seeking additional support from industry leaders to co-brand the recognition program and to assist in promotion of the selected organizations. IMT will maintain a list of all recognized organizations and develop industry best practices case studies to further awareness and share lessons learned. • The implementation roadmap will be available via the www.greenleaselibrary.com and jointly promoted by IMT, DOE, and other industry stakeholders.
Impact Metrics	• Number of members implementing green leasing practices and number of members being recognized by the industry. • Energy savings reported in green leasing case studies (kWh per year).

Data Access

Market Solutions Team

Technical Lead: Andrew Schulte, ICF International, andrew.schulte@icfi.com, 703-934-3201

Main Barriers Addressed by the Project	• **Data/Awareness:** Easy access to whole-building energy consumption data is a prerequisite for benchmarking and other analyses of building energy performance – which, in turn, is the foundation for effective energy performance improvements across portfolios of commercial buildings. Most frequently, commercial building owners and operators look to their local utilities for this information. However, the process for obtaining this information – as well as the format in which this information is provided – is not consistent across the country, and has been cited as a barrier for organizations seeking to benchmark their energy performance across large, national portfolios. • **Operational:** This issue can be further compounded in the case of multi-tenant properties, where the building owner/operator is responsible for benchmarking, but the tenant spaces are metered directly, and so bills are sent to and paid by the individual tenants. In this scenario, it can be difficult for the building owner/operator to obtain and aggregate multiple billing records in order to benchmark the building as a whole. While some utilities have agreed to provide building owners with aggregated whole-building data in the absence of explicit tenant authorization, this approach has not been universally accepted, due to customer privacy considerations.
Solutions/ Deliverables	• **Data Access Case Studies:** To be developed following the Data Access breakout session at Efficiency Forum. These resources will highlight examples of commercial building owners and operators that were able to successfully engage with utilities, regulators, and/or policymakers to obtain a workable data access solution. The purpose of these case studies will be to highlight productive and replicable approaches that building owners and managers can employ in order to proactively address this barrier. Where possible, these case studies will also highlight linkages with the ongoing Green Leasing efforts. In particular, requiring tenants to provide the landlord with energy usage data as part of a lease agreement is a strategy that has already shown promise • **Coordination of activities and resources across DOE:** Ongoing. Across DOE, there are currently a number of overlapping initiatives and deliverables focused on the issue of data access for commercial buildings, including Better Buildings Alliance, Better Buildings Challenge (forthcoming Implementation Model focused on data access) , and the State and Local Energy Efficiency Action Network (A Utility Regulator's Guide to Data Access for Commercial Building Energy Performance Benchmarking). A key goal of the Market Solutions Team is to ensure that these efforts are effectively presented as a toolkit to BBA members.
Deployment Pathway	• Regular coordination between DOE program leads (Better Buildings Alliance, Better Buildings Challenge, SEE Action), as well as third party organizations such as the Institute for Market Transformation and the EEB Hub. • Engagement with key associations participating on the Market Solutions Team (BOMA, RILA), whose members are most affected by data access barriers. • DOE "Product Alerts" as new resources are developed.
Impact Metrics	• Number of members submitting information for case studies. • Number of utilities offering enhanced data access solutions.

Commercial Building Re-Tuning

Market Solutions Team

Technical Lead: Andres Potes, Waypoint Building Group, andrespotes@waypointbuilding.com, 919-943-7291

Main Barriers Addressed by the Project	• **Operational:** Building facility managers are not trained to analyze their BAS data and they are missing opportunities to save energy by optimizing building operations. • **Awareness:** Making the business case to senior management for training is a barrier to deploying and scaling re-tuning across an organization and in the market.
Solutions/ Deliverables	• **Building Re-Tuning Training:** Building re-tuning is an approach for utilizing BAS to save energy by identifying and correcting operational problems, such as inefficient scheduling, temperature set points, and static pressure set points. Re-tuning focuses on identifying operational problems, correcting them, and reporting savings. The training comes with a Microsoft Excel tool that uses output from a BAS to identify problems. Re-tuning minimizes energy consumption and improves occupant comfort. This process can reduce building energy use between 5% and 20%. DOE and PNNL are offering free building re-tuning train-the-trainer sessions for Better Buildings Alliance members. The market transformation team will coordinate with interested members to implement the trainings and to identify how to increase adoption of this practice in the market. Two trainings were held in October 2012. These trainings were attended by 24 members from 11 organizations. The market solution team produced a case study detailing how Vornado Realty Trust implemented re-tuning to save 27% on its heating bill and 3% on its electricity bill (3-month averages). The market solution team is recruiting members interested in building re-tuning to participate in future trainings.
Deployment Pathway	• DOE and PNNL will recruit members to attend free train-the-trainer commercial building re-tuning sessions. • Participating members commit to piloting the training and providing feedback on how they have implemented it, barriers that they have encountered, and results (see below). • The market transformation team will work with members to increase adoption of this best practice in the buildings sector through promotional materials, case studies, and / or webinars.
Impact Metrics	• Number of trainings implemented. • Number of buildings deploying re-tuning. • Annual energy savings (kWh per year). • Return on Investment (ROI). • Tenant complaint reduction (%).

Financing

Market Solutions Team

Technical Lead: Patrick Finch, Waypoint Building Group, patrickfinch@waypointbuilding.com, 415-738-4730

Main Barriers Addressed by the Project	• **Operational:** – **High First Cost / Access to Capital**: High price disqualifies many energy efficiency investments, and companies have difficulty accessing capital. – **Short Payback Requirements:** Many businesses have short internal payback requirements that an investment must meet for consideration. This requirement disqualifies energy efficiency measures with longer operating lives, and with significant benefits over this time. – **Cost Pass-Through Resistance:** Higher rent costs may drive away tenants in Class CandD buildings. If the lease allows cost pass through for energy efficiency improvements, the tenant may be subject to undue or unnecessary increases in rent. • **Awareness (Complicated / Unavailable Incentives):** Financial incentives such as utility programs, subsidies, rebates, and tax breaks are often unavailable and difficult to use to improve the cost of energy-efficiency investments, whole building efficiency, modeling and commissioning. • **Data (Lender Restrictions):** Lenders face uncertainty in energy efficiency deals due to inconsistencies in predicting energy savings. Additionally, most commercial buildings have existing mortgages that restrict the owner's ability to take out additional debt for items such as efficiency improvements.
Solutions/ Deliverables	• **Financing Solution Web Pages**: Descriptions for and solutions to financing barriers. Financing solutions include resources that address access to the solution, guidance implementing the solution, or case studies of companies that have successfully deployed the solution. The solution overviews also present pro's and con's to each financing solution that help building stakeholders gauge its relevance to their particular situation and business model. Web pages went live in May 2013 and the team welcomes feedback from members.
Deployment Pathway	• This website was developed with feedback from members that expressed interest in financing. • The website is available to the public and is presented through a new and easily accessible web format.
Impact Metrics	• Number of implementation models developed using demonstrating application of financing methods. • Number of Better Buildings Alliance members working with Better Buildings Challenge Financial Allies. • Number of downloads of solution overviews. • Additional resources added to solution sheets.

Plug and Process Loads Capacity and Power Requirements Analysis

Plug and Process Loads Team

Technical Lead: Michael Sheppy, NREL, michael.sheppy@nrel.gov, 303-275-4327

Main Barriers Addressed by the Project	• **Data:** Commercial building occupants and real estate brokers need better information about realistic plug and process load (PPL) capacities when they set infrastructure needs. Oversizing a building's electrical infrastructure increases upfront capital costs and energy consumption; it may also increase cooling system sizing and subsequently increase HVAC system costs. • **Operational:** Industry partners have reported that tenants typically request a PPL capacity of 5–10 W/ft^2 in their lease agreements. Limited initial data suggest that actual PPL densities in leased buildings are substantially lower. • **Awareness:** DOE has the capabilities necessary to provide industry with reliable, third-party guidance to address the current information gap.
Solutions/ Deliverables	• **Technical Report:** A technical report that shows the range of PPL densities in typical commercial office building spaces. The technical report will document actual PPL densities of the metered spaces and the energy savings potential of right-sizing systems; its target audience will be engineers. • **Brochure:** A simple brochure that will include steps for readers to estimate right-sized PPL densities for their spaces; its target audience will be facility managers, energy managers, and designers who interact with prospective occupants or real estate brokers.
Deployment Pathway	• **Solicit Volunteer Feedback:** Impact will be measured through volunteer team member feedback, such as: number of organizations implementing results in their practices; estimates of square footage impacted by modified practices; and energy savings. • **Quantify Energy Savings:** Energy savings could be quantified if (1) a volunteer implements a retrofit where pre- and post-retrofit energy consumption is measured; or (2) a volunteer implements a design in a new building with sufficient energy metering and normalization data to compare the new design to typical practice.
Impact Metrics	• **Develop Accurate References:** Prospective occupants lack accurate references for plug load power requirements, so they often overestimate these values, leading designers to oversize electrical infrastructure and cooling systems. Better plug load capacity guidance would enable more optimal sizing and design of electrical and cooling systems, allowing them to operate at more energy-efficient loading levels. • **Enable Right Sizing:** According to the EPA "actual savings from right-sizing have not been widely documented," though one case study by CRC Construction Innovation found that right-sizing of chillers in two buildings reduced whole building energy by 3-4%. • **Enable an Integrated Design Approach:** If an integrated design approach could enable 3% whole building energy savings in all U.S. office buildings, it would save 34 TBtu of site energy per year.

Refrigeration System Commissioning, Open Case Retrofits, and Compressor Racks Challenge Specification
Refrigeration Team

Technical Lead: Bill Goetzler, Navigant Consulting, wgoetzler@navigant.com, 781-270-8351

Main Barriers Addressed by the Project	• **Refrigeration System Commissioning:** – **Technological:** Refrigeration systems often fail to operate at optimal efficiency due to lack of proper maintenance and tuning of system parameters. This amounts to a substantial, invisible loss of energy that can be avoided with proper commissioning. – **Operational:** There are no industry wide comprehensive standards or best practices for commissioning the equipment and conducting regular maintenance, so most efforts are ad-hoc. – **Data:** Supermarket managers have few established methods of measuring performance degradation until equipment fails. – **Awareness:** Lack of a uniform methodology has restricted awareness and acceptance of commissioning practices. • **Open Case Retrofits:** – **Technological:** Many retailers wish to retrofit open display cases with transparent doors to save energy. However, if the retrofit is not performed properly, it can adversely impact system operation, leading to poor reliability and system performance. End users have stated that retrofits often do not produce the desired performance results due to improper implementation. – **Operational:** Lack of industry-standard best practices existed for conducting open case retrofits and properly adjusting the refrigeration system as needed. – **Data:** Lack of publicized demonstrations with independent third party validation. – **Awareness:** Promotion of this technology has been limited to manufacturer efforts and a few utility channels. Concerns about performance have limited acceptance. • **Compressor Racks Challenge Specification** – **Technological:** System designers can currently choose from a wide array of components and technologies when specifying a compressor rack, making it difficult to select an optimal energy-efficient configuration for their application. Few standard solutions with known performance levels are available. – **Operational:** A rack system which is designed following a high-efficiency challenge specification will offer improved performance and lower operating costs. – **Data:** Due to the wide variety of system designs and custom nature of the equipment, it has, to date, been difficult for system operators to compare the performance of different compressor rack configurations. – **Awareness:** Unavailability of standard high-performance options has resulted in limited awareness of technologies and designs holding high energy-savings potential.

Solutions/ Deliverables	– **Refrigeration Commissioning Guide:** Provides instructions for commissioning commercial refrigeration systems, with a focus on supermarket refrigeration. The goal is to systematize the commissioning process to reduce costs and enhance effectiveness. DOE is coordinating with an ASHRAE project committee on the development of this guide, which will include the process for commissioning, technical procedures, and example commissioning documents. • **Open Display Case Retrofit Best Practices Guide:** Outlines industry best practices for planning, executing, and monitoring open display case retrofits. Developed in collaboration with retailers, equipment manufacturers, engineering firms, and retrofit suppliers/installers, the guide was published in November 2012. • **Supermarket Compressor Racks Challenge Specification:** Outlines specific design attributes and features to be implemented in a high-efficiency system. A working document was prepared by members and support staff, and discussed with key stakeholders to solicit feedback on technical provisions of the spec. An updated draft has been circulated for discussion at the Efficiency Forum.
Deployment Pathway	• **Refrigeration Team:** Team members will utilize the deliverables in their efforts when commissioning refrigeration systems, retrofitting open cases with doors, or purchasing new compressor rack equipment. The team will also seek to perform several demonstration projects with members. • **Trade organizations:** ASHRAE will vet the commissioning guide and distribute the final version to their membership in Q1 2013. ASHRAE's market reach is unmatched in this industry since most technical staff are members. The team is collaborating with ACHR News and the Refrigeration Service Engineers Society to promote open case retrofits through trade publications and training materials. • **Utilities:** Measures will be promoted through CEE and individual utilities. The team has already discussed open case retrofits with CEE and a number of utilities, and has received a positive response. Plans and results of commissioning efforts will be presented to California Emerging Technology Coordinating Council (ETCC), which represents all major California utilities. • **Manufacturers:** High-efficiency compressor racks will be promoted through industry organizations and trade shows such as ASHRAE and FMI.
Impact Metrics	• Number of members affected: – Deliverables should each be adopted by at least 4 members. – Through other channels (e.g. ASHRAE, FMI, CEE), BBA expects at least 10 other chains to adopt each deliverable. • Measured energy savings: – Commissioning guide should result in a minimum of 15% refrigeration energy savings. – Retrofits should result in a minimum of 40% energy savings per retrofitted case. – Racks meeting challenge spec could save 10-20% over standard designs.

Encouraging High-Efficiency Rooftop Units

Space Conditioning Team

Technical Lead: Michael Deru, NREL, michael.deru@nrel.gov, 303-384-7503

Main Barriers Addressed by the Project	• **Technological:** Most existing rooftop units (RTUs) are low efficiency, have constant speed fans, and have very rudimentary controls, which limit the energy performance. • **Operational:** Current RTUs often suffer from a lack of maintenance and are only repaired or replaced after failure with a like unit. This cycle perpetuates low performance and missus opportunities for long-term energy efficient operation. • **Data / Awareness:** Very high-efficiency RTUs are available for replacement of older units (>10 years) and advanced controllers are available for retrofit of younger RTUs. Both solutions offer energy savings of 20% to 50%; however, limited information is available for owners, engineers, and contractors on the energy, economic and operational benefits available from these high-efficiency solutions.
Solutions/ Deliverables	• **Advanced RTU Campaign (ARC):** ARC is a partnership between DOE, organizing partners, ASHRAE and RILA, and several supporting partners to encourage a wide-scale adoption of high-efficiency solutions for RTUs for retrofits and replacements. The campaign brings together the technical, installation, maintenance, and financial resources to support this process. • **RTU Challenge Specification:** A high-performance challenge specification was developed with BBA members to catalyze the market introduction of cost-effective, energy-saving RTUs. Key performance components of RTUs are specified and the overall cooling performance requirement is 18 IEER. • **Advanced RTU Controller Demonstrations:** Several demonstrations are underway and results will be published in a technical report. Preliminary estimates of the savings and best applications are published in an April 2012 technical report Energy Implications of Retrofitting Retail Sector Rooftop Units with Stepped Speed and Variable Speed Functionality.
Deployment Pathway	• **Campaign:** The Advanced RTU Campaign is a broad reaching partnership with owner, manufacturers, utilities, efficiency organizations, and installers to coordinate resources and promote best practices. The campaign will be launched on May 30 at the BBA Efficiency Forum and will continue through two cooling seasons. • **Websites:** – The ARC website is the central point for resources, communication, and tracking progress. – The RTU Challenge website provides resources and updated information • **Webinars:** Several webinars through the Better Buildings Alliance and the organizing and supporting partners will be delivered to reach a broad range of interested parties. Information on the webinars will be posted on the campaign website. • **Performance Calculators:** The RTU Comparison Calculator and the 179D DOE Calculator provide fast savings estimates for interested consumers.
Impact Metrics:	• **Total Impact:** 0.5 Quads of annual savings assuming half of RTUs are replaced or retrofitted. • **Payback:** Payback for most U.S. locations has been estimated to be less than four years. • **Estimated energy savings per application:** Energy savings are expected to be between 20% and 50%.

Encouraging High-Efficiency Gas Heaters

Space Conditioning Team

Technical Lead: Michael Deru, NREL, michael.deru@nrel.gov, 303-384-7503

Main Barriers Addressed by the Project	• **Cost:** The initial cost of high-efficiency gas heaters can be a barrier to implementation. However, gas heaters with high use can have attractive energy savings and payback periods less than two years. • **Data / Awareness:** Limited information is available for engineers on the operating characteristics and best practices for sizing and locating high-efficiency gas unit heaters.
Solutions/ Deliverables	• **Gas Heater Technology Specification:** Outlines the efficiency requirements and design features to be implemented in a high-efficiency gas heater was completed in October 2012.
Deployment Pathway	• **Website:** The Space Conditioning Team website features an energy savings calculator, links to incentives, manufacturers, and guidance on how to use the specification. • **Specification deployment:** Work with the BBA Space Conditioning Team and other groups such as utilities, the Gas Technology Institute, and the Consortium for Energy Efficiency for deployment beyond the Better Buildings alliance. • **Technology demonstrations**: Demonstrations will be carried out in 2013 and lessons learned will be gathered and used to develop design and implementation guidance.
Impact Metrics	• **Estimated energy savings per application:** Energy savings are expected to be 10% for equipment meeting current standards, and over 20% for older equipment.