

CBEA Efficiency Forum Report

May 23, 2012
Commercial Building Energy Alliances All-Member Meeting

May 24, 2012
Executive Exchange with Commercial Building Stakeholders

National Renewable Energy Laboratory (NREL)
Golden, Colorado




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Sample participant comments:

"These have been two of the most relevant, useful days I have spent this year."

Noah Shlaes
Senior Managing Director, Global Client Services
Newmark Grubb Knight Frank
CREEA Steering Committee member

"Having senior-level people from federal, state, public, and private groups attend and participate illustrated the commitment… to the energy reduction cause. The venue was great."

James R. Moyer, LEED AP
Associate Vice President for Facilities Planning
Grand Valley State University

Introduction

The Commercial Building Energy Alliances (CBEA) are a voluntary collaboration between the Department of Energy (DOE) and building owners and operators in the retailer, commercial real estate, hospital, and higher education sectors that are early adopters of high-performance tools, technologies, and best practices. Collectively, CBEA members represent about 20 percent of the total U.S. floor space in their respective sectors, so their actions represent an important step in achieving large-scale market adoption. CBEA pursues energy-saving opportunities through six Project Teams:

- **Lighting and Electrical**—Indoor and outdoor lighting, including sensors and controls
- **Market Transformation**—Financing mechanisms, incentives, model owner-occupant arrangements, and workforce development
- **Plug and Process Loads**—Plug-in equipment and loads unrelated to general lighting, space conditioning, and water heating
- **Refrigeration and Food Service**—Refrigeration and food preparation equipment and operation
- **Space Conditioning**—Heating, ventilation, and air conditioning systems, including sensors and controls
- **Laboratories**—Laboratory equipment and operation

On May 23 and 24, 2012, DOE hosted the first-ever CBEA Efficiency Forum:

- **May 23** was a **CBEA All-Member Meeting** open to current members. Attendees were challenged to identify the barriers and pathways to maximizing the impact of CBEA resources, report on energy savings in their facilities that can be attributed to these resources, and brainstorm possible 2013 projects.
- **May 24** built upon the findings of the CBEA All-Member Meeting via an **Executive Exchange with Commercial Building Stakeholders**, bringing CBEA members together with senior commercial building stakeholders who have expertise, products, and services directly related to the topics addressed by CBEA Project Teams.

Due to space considerations, attendance at the CBEA Efficiency Forum was limited. CBEA members who were unable to attend the meeting in person were invited to participate in the breakouts via teleconference. The Forum agenda is attached as ***Appendix A***.

Overall, a total of 141 individuals engaged in the CBEA Efficiency Forum—in-person or by teleconference, including 58 CBEA members, 54 industry stakeholders, and 29 DOE technical experts and supporting staff. Attendees and their organizations are listed in ***Appendix B***. All attendees were provided with guidance about how the breakout sessions were to be conducted and the appropriate approach for providing their input, which included a reading of the statement in ***Appendix C***.

Brief overviews of all CBEA projects were sent to all registrants in advance and are included in ***Appendix D***. These overviews describe the main barriers addressed by the project, as well as deliverables, deployment pathways, and metrics for gauging impact.

Key findings from the breakout discussions are summarized in the body of this report. This report and all presentations given at the Forum are available on the DOE Commercial Building Energy Alliances web site on the Past Meetings page.

Public review and comment on the CBEA Efficiency Forum Report is encouraged by submitting input to CBEA@ee.doe.gov through July 31, 2012.

May 23 – All-Member Meeting

Morning Plenary Session – Remarks and Announcements

Welcoming remarks on May 23 were given by Ron Judkoff, Principal Lab Program Manager for Building Energy Technologies at NREL. DOE's CBEA Co-Coordinator Kristen Taddonio provided an overall status update on the Alliance and reflected on its strategic direction. CBEA Co-Coordinator Brian Holuj discussed the intent of the Forum and the approach of using a combination of plenary and breakout sessions to announce important achievements and elicit actionable insights on current and prospective CBEA projects.

Facilitator Doug Brookman reviewed the agenda and indicated that the morning breakout sessions were organized by sector: Hospital, Commercial Real Estate, Higher Education, and Retailer, while the afternoon breakouts were organized by Project Team: Lighting and Electrical, Space Conditioning, Refrigeration and Food Service, Plug and Process Loads, and Market Transformation (note that the Laboratories Team was new at the time of the Forum and was not sufficiently developed to merit a breakout session). Brookman indicated that the findings of the breakout discussions were to be summarized in a verbal report-back during the day's concluding plenary session. Attendees then split up into the morning breakout sessions and later reconvened for the lunch plenary.

Summary of Sector Breakout Sessions – Retailer Energy Alliance

Breakout Session goals articulated by session leads:

- Gauge member satisfaction with their CBEA experience over the past year
- Identify how to deploy CBEA projects at scale in retailer portfolios

Actions for REA members:

- Voluntarily and anonymously submit metrics and criteria used for business cases, which will be consolidated into tiers of cost hurdles
- Review project deliverables and advise DOE on "how to be more actionable and scalable"
- Report the impact of CBEA projects or segments of projects that have been implemented in their portfolios
- Volunteer for Steering Committee – members and Chair needed

Actions for DOE:

- Consider efficiency along with how to make the business case when developing new projects
  - Members need an acceptable ROI, method for determining it, and for making the business case to CFOs in order to get approval to implement projects in their portfolios
- Since DOE must demonstrate the impact of its activities, it relies upon CBEA member reporting on energy savings in their facilities that can be attributed to the CBEA projects
  - Ideal: 100% of members who benefit in any way from any project "report back" to DOE
    - Each project must include clear mechanisms and intervals by which members report on impacts
    - Utilize the CBEA Efficiency Forum, webinar, and other venues to transmit these savings as indicators of success

- Coordinate with Market Transformation Project Team on tailoring future financing and training approaches for retailers so that such considerations are applied to all projects
- For all projects, include deployment pathways for large and small businesses, such as franchisees, who need to make a different business case when they only own/operate a few facilities as opposed to large owners/operators

Making the Business Case for a Company to Implement an Energy Efficiency Measure

- As shown in the RTU Challenge, CBEA project deliverables may need to be more than just a specification
  - Members need to also be able to model it in facilities to help justify the purchase based on costing and models
  - DOE could tweak deliverables for relevance, possibly through a toolbox for creating the business cases, or making alliances with associations on financing
  - Connect with Market Transformation Project Team – looking at issues on financing and training – is there a way to package those tools for retailers
- Building in economic boundaries in relation to specifications is a necessary requirement as part of the deliverable, with boundaries defined for both new construction and retrofit.
- Large buyers have their own economies of scale and will help drive down market costs for later adopters
  - Opportunity: find similar opportunities for early adopters as a group and define that scale process
  - Path Forward: understand economics for retail sector, reflecting differences between new and retrofit, company and franchisee, etc.; determine the metric each company uses
    - Create "simple payback" analysis tool, then "full analysis" tool including depreciation
    - Submit ROI hurdle rates anonymously; collect data collected and determine midpoint for majority of projects (or develop tiers of "what works at which hurdle rate")
- In challenging economic times, looking for opportunities to save energy and improve cash flow with low capital expenditures
  - Consider projects that do not require buying new equipment but could build momentum to show the finance committees a proven track record
  - Re-tuning training is a no-cost example, going beyond specs alone
- Consider uses of budgets already in place; working with previously allocated capital is a good opportunity.
  - 80% of the buildings you will own in 2020 you own today; the collective refresh of the footprint is significant
  - Example: RTU replacement program; justify spending a little more money at the end of life if that will save energy plus reduce size and weight.
    - X capital to replace X RTUs; ask for X differential to get X payback
- Consider bundling to get better rates of return
  - If reducing lighting loads by 30% cuts air conditioning loads by 30%, the new unit you need is smaller
    - Guidance on this from DOE would be helpful

Deployment Pathway for Small Businesses

- What else might CBEA do to better deploy its resources and findings to small businesses?
  - As part of tiered approach, consider that family-owned businesses such as franchisees put capital in expecting a long term return and might be in better position to put technologies in
  - May also have financing opportunities that are not available to larger companies
  - ENERGY STAR® has long-standing program for small businesses

        - Single biggest driver is utility incentives; small businesses are concerned about payroll vs. long-term savings
        - Getting utilities to partner helps drive the curve
        - Utility incentives can bring costs way down; almost uniformly needed to get small businesses to implement
            - ✓ Using third party for rebates can help small organizations deal with the overwhelming amount of paperwork and persistence with utilities that seems to be required
            - ✓ Custom programs are not appealing; programs with very simple implementation seem to work
            - ✓ CBEAs have worked with utilities on lighting side; potential for more
- Partnering with design professionals used by smaller businesses also is part of deployment path
    - If designing projects to work with market leaders, also need to build in a pathway for smaller businesses from project outset

Tax Code and Incentives

- DOE developed a tool for the 179D tax incentive to make it easier to determine if an efficiency improvement qualifies for the incentive
    - 179D for lighting is very easy, but HVAC and envelope are tough; investment to do energy modeling does not make sense for smaller footprints
    - The DOE 179D Calculator is considered a valid tool by IRS
        - CBEA does not engage IRS and/or Congress on the tax code itself, but can assist with tools or other guidance that better enable building owners and operators to achieve the efficiency improvements needed to qualify
            - ✓ Members noted that they could justify a lighting retrofit done on depreciation of existing light fixture but could not justify a new one based on the current economics
            - ✓ Tax codes largely apply to everybody and would help drive deployment of advanced technologies in retrofit and new applications, but other organizations and venues are more appropriate for discussing such opportunities

Field Demonstration Considerations

- Value of field demonstrations in making the business case for energy efficiency
    - Consider cost share by manufacturers, CBEA members and anyone else that has a significant interest and role in pilots
        - If successful, building owner can keep and pay for the equipment; if not, it becomes part of participant's investment in doing evaluations of candidate efficiency measures
    - Value of field demonstrations is showing tangible success that can convince other members to follow suit
- Measurement and verification (M&V) is needed in addition to the specification
    - A simple companion procedure for commissioning the RTU would also be useful
    - If early adopters such as two or three restaurant chains collaborate and do M&V in one; possible to instrument in a way that test results carry weight for others?

Summary of Sector Breakout Sessions – Hospital Energy Alliance

Breakout Session goals articulated by session leads:

- Identify one or two replicable energy-savings approaches being pursued by members
- Identify suggestions for DOE role and/or follow-up actions

Actions for HEA members:

- Focus on finance solutions – they are at the heart of moving efficiency programs
- Find, track, and manage champions for energy-efficiency projects; this is a "large-change" management challenge
- Consider joining new Laboratories Project Team and focusing on one of its four strategic areas

Actions for DOE:

- Addressing air change rates and possible requirements/hospital accreditation issues is an opportunity for impact on hospital energy use; in addition to examining adjustments in air change rates, looking at "in use" and "unoccupied" air change settings are an opportunity for additional efficiency and savings
- To overcome resistance to change that all have encountered, consider grass roots "Green Teams" as important promoters of successful energy-efficiency programs
- Provide clarification of Better Building Challenge rules and their intent as to buildings and metering
- Follow up on "Adventist HealthCare approach" webinar idea

Financing Energy Savings Projects/Programs – Four Hospital Case Studies

- Ascension Health – achieved 5.6% reduction in energy use over 30 million sq. ft. (including some MOB's, patient towers, care wings) from FY 08-FY 11
  - $10.1 million in cumulative cost avoidance
    - 168,583 tons of carbon dioxide not emitted into the air
    - $1.95 million in direct medical expenses not incurred by local communities from respiratory, mercury, and related illnesses
  - Focused on good execution of basics, maximizing current resources
    - Application of lighting retrofits (changed out T8's) and central plant efficiency
    - Staff training and readily available resources such as ENERGY STAR® and ASHRAE
  - Partnering in Better Buildings Challenge
    - On track to meet 2020 goal of 203kBTU/sq. ft./year
    - Goal yields $125 million in cumulative cost-avoidance at current utility rates
  - Resources and approach
    - Used outside resources
      - ✓ Some facilities reluctant to embrace energy-saving s process
      - ✓ Management identified outside expert to assess situation and provide objective view of opportunities and challenges
    - Created centralized energy-savings pool to separate capital costs from energy savings
    - Evaluated energy-savings approaches based on "likelihood of failure" model, focusing on infrastructure systems
      - ✓ Compared costs of addressing system replacement as emergent failure vs. cost to plan system replacement

        - ✓ Retained leading engineer to evaluate all proposals and insure consistency and quality were parallel across overall portfolio
    - Challenges
        - Tracking and managing energy-efficiency process; appointed staff to manage overall process
        - Identifying champions – a challenge
            - ✓ Deeper "buy-in" means better results; building engineer is key player

- University of Pittsburgh Medical Center (UPMC) – key factors in "marketing" energy projects
    - Justification Route 1 – Simple ROI analysis with a short payback
        - Example: insulation of primary hydronic valves has a payback in less than a year, with an IRR above 8%; "Just Do It" motto
    - Justification Route 2 – Regulatory Requirements, Incentives, Sustainability
        - Example: UPMC changed out all T12's to T8's, with an IRR just under 8%, payback in less than 6 years, state incentives
    - Justification Route 3 – Aging Infrastructure
        - Example: Old HID parking garage lighting was changed out for new LED lighting
            - ✓ Maintenance savings and lower energy use made payback in 4 years, with modified IRR of 8%
            - ✓ Lamps are dimmable, and now run at a lower light level not due to efficiency but due to better color rendition, allowing security cameras to see details at lower light level
    - Justification Route 4 – Sustainability, Incentive
        - Example: UPMC chose to use geothermal heat pumps for building conditioning
            - ✓ Longest payback period, 8.25 years; baseline typically 6 years
            - ✓ Project undertaken as a demonstration to allow UPMC to understand the system and the operations issues
            - ✓ State development grant helped offset $127,000 in project costs; modified IRR 7.8%

- Adventist HealthCare – resources and approach
    - Savings are assigned to the associated facility and tracked over time
        - To date savings have been 7.2% on BTU reduction, and 12% on spending reduction
        - Deep study at project front end, with group focused on submetering buildings
        - Information on system performance is provided on a daily basis in a one-page easy-to-read format to COO, Facility Director, Building Engineer
            - ✓ Goal – make tracking and using the data a part of daily operations and expectations
            - ✓ Purpose – quickly spot anomalies in operations that indicate systems going out of performance
        - Monthly meetings are held to review the accumulated data, which is delivered in a monthly report; also quarterly reports
    - Outside consultants are used to execute the plan; no in-house staff
        - Lack of staff is a real barrier
    - Savings are created from the O&M budget
        - Not from focus on energy savings per se, more on reduction in operations costs

- Mayo Clinic – approaches
    - Mayo main campus

        - 7-8 million sq. ft. care and clinical space, including MOB's
        - Campus includes two central plants; St. Mary's campus has one plant
    - Mayo currently engaged in the Clinton Initiative
        - Participating in retro-commissioning 37 buildings, targeting a 20% reduction in energy use
            - ✓ Considered BBC program but unsure regarding Mayo composition of buildings
            - ✓ Benchmarking program to start in May, with sub-metering of all buildings
    - Education is biggest hurdle due to constant staff turnover
        - Staffing energy management is a challenge; need 2.5 FTE for current programs
        - Facilities staff focuses more on patient care than energy

New Laboratories Project Team Report

- Paul Mathew, LBNL, seeking 8-10 CBEA members to join new Laboratories Project Team
    - Will pursue four high-impact strategies
        - Fume-hood sash management
        - Optimizing minimum air-change rates
        - Reducing simultaneous heating and cooling
        - Laboratory freezer energy management

Summary of Sector Breakout Sessions – Commercial Real Estate Energy Alliance

Breakout Session goals articulated by session leads:

- Review CREEA-defined goals of recruitment, leadership, individual goals, and Project Team participation
- Identify one or two replicable energy-savings approaches being pursued by members
- Identify suggestions for DOE role and/or follow-up actions

Actions for CREEA members:

- Report experiences, challenges, and successes in working toward energy goals as well as possibilities for case studies
- To achieve recruitment goal, identify companies not yet in CREEA that should be contacted
- Consider expanding membership definition and requirements; engage tenant organizations to explore expanding the role of tenants in membership, whether within the main group or as a special subgroup
- Consider joining a technical project Team; contractors can be designated as member-representatives, upon approval by DOE

Actions for DOE:

- Review CBEA 20% reduction goal and CREEA members' reports of challenges faced in order to disseminate appropriate additional guidance
- Work with the Better Buildings Challenge to develop standards for sharing case studies and provide t his template to CREEA members
- Consider developing a "Building Automation and Controls" Project Team, which might attract CREEA members

CBEA Goal – 20% Reduction by 2020

- Is this goal realistic for all CREEA members?

- Setting the baseline for energy reduction can be challenging
- Many larger companies are dealing with a wide variety of climate zones and building types, along with international locations
- ENERGY STAR® Portfolio Manager is an excellent tool for establishing a baseline and tracking performance

- Focus on "low-hanging fruit" along with behavioral change and technology
  - Idea: to meet your company's goal of net zero greenhouse gas emissions, consider using an internal carbon tax

Recruitment Goal

- Recruitment goal – add 50 new members by the end of 2012
- Current membership is 80
- Identify companies not yet in CREEA that should be considered
- To achieve this goal, consider expanding membership definition and requirements
- Look for those relationships that will add value while *not* introducing marketing from vendors to the alliance
  - Central question: role of tenants within CREEA's membership
    - Tenants play an important role in achieving energy reduction
    - Many larger corporations have a tremendous quantity of leased spaces and deal with a variety of lease, tenant, and landlord issues
    - An effective way of getting the tenant perspective would be to engage with tenant organizations; CoreNet could be a great resource in this respect
  - Vendors and service providers are another major potential member type
    - Engaging with AIA would provide a perspective from those who provide design and architectural services

Leadership Goal

- Current goal is 25% of membership taking a leadership position in working toward industry energy goals
- This goal has been reached and members now need to consider pushing higher to state a more specific leadership goal for the group
- How are members now contributing to the industry?
  - Policy advocacy, pushing for broader and more consistent adoption of energy codes; this is important, but CREEA must remain neutral in regard to voluntary versus regulated initiatives
  - Defining accomplishments; the next step is to gather and then craft the group's leadership story and publicize it

Individual Goals

- Sharing lessons learned with the group is crucial as individual members work toward their energy reduction goals
  - Case studies are key to driving the scale of adoption of energy-efficiency projects, to provide credible strategies to consider
  - Many members only do a one-off project and therefore need a library of strategies to pull from
- Regarding formats for sharing case studies, the Better Buildings Challenge has developed some helpful sharing formats

- Due to concerns over proprietary data, some members may be reluctant to publish and share all data
  - Aggregating data before it is shared will prevent identification with a specific organization
  - Concern over proprietary information is possibly less of an issue than some think, since much data is already well known and published in the industry (CoStar for example)

CBEA Project Team Participation

- Increased participation on Project Teams, in particular technical teams, is a goal
- There are currently six Project Teams including Market Transformation
- A "Building Automation and Controls" Project Team might attract CREEA members

Lunch Plenary Session – Remarks and Announcements

During the lunch plenary, Andrew Thorsen of Kohl's Department Stores provided a presentation entitled "Better Buildings Challenge in Action," which summarized his company's showcase project and collaboration with DOE as a Partner in the Better Buildings Challenge. Michael Deru of the National Renewable Energy Laboratory next gave a brief overview of the 179D DOE Calculator tool. He explained that Section 179D of the Federal Tax Code provides a tax deduction for energy-efficiency improvements to commercial buildings, and the calculator is a DOE-approved tool that provides calculations to determine eligibility for the tax deduction.

Following the lunch plenary, attendees split into the afternoon breakout sessions, and then reconvened for the closing plenary. Summaries of the breakout discussions as presented below were delivered by CBEA representatives and Project Team staff. Holuj noted that a meeting report would be available on the CBEA website in the coming weeks and that attendee feedback was welcome via CBEA@ee.doe.gov.

Summary of Project Team Breakout Sessions – Lighting and Electrical

A key cross-cutting barrier to implementation that covers everything being worked on by this Project Team is the need for greater knowledge and awareness throughout the architectural/engineering firms and the distribution network.

- One solution is to get the DOE resource guide out to more people, perhaps adding a short narrative and bullet points at the front for a CFO or an executive at your property or your building.

Regarding accelerating adoption of the specs for lighting in parking lots and structures, the barriers we identified were **high first cost** and the **need to prove the technology**, especially with claims of product life being five years plus. Has this been demonstrated and how do you explain the extrapolated testing that goes along with that?

- Solutions: We can draw on measurements and studies already being done and the fact that some products have been out there over five years or longer than they are warranted for. The technology is getting better and will continue to get better, particularly as chips improve. They are already being designed for more output, so we are going to see the solutions emerging.

Incentives are a cross-cutting solution, and we need to understand how they apply and possibly improve upon that. Various incentives are available to end users and to the architectural/engineering firms. A good suggestion was to have solutions pre-qualified through the various utilities or jurisdictions.

Another issue is the need for more normalized ROIs, which can range up to 10 years. In most cases, paybacks should be in the range of two to three years and under. Also, in going to top management, the case needs to go beyond KW savings, incorporating maintenance and waste-reduction benefits. Otherwise, the dollar values may be too low to get their attention and lighting projects just get stuck in the middle.

Another potential solution was providing a vetted list of generalized products (not vendor-specific).

Technology-neutral specifications will be an emphasis for us. Initially, the parking lot specification focused on LED technology, but different technologies have evolved and we wanted to be able to bring into the fold technologies like induction or plasma lighting.

Potential New Projects

- **MR16s.** Facilities are going to retrofit with them but manufacturers are not providing much information. We do not want false starts in the marketplace, such as where people use older ballast technology and have problems. We could provide the detailed information that would be helpful. **PAR lamps** present a similar situation.
- **Control systems.** More information and guidance would be valuable here for a variety of applications. For example, some university systems are considering either bi-level or controlled lighting for sidewalks and bike lanes that would sense the movement of a pedestrian or bicyclist. The controls not only could adjust light intensity but also could help in tracking that person, which is particularly beneficial given the paramount importance of safety on campuses. Stairwell lighting is another potential area of interest.

Summary of Project Team Breakout Sessions – Space Conditioning

Current Projects

One of our major activities has been the RTU Challenge, which we will hear more about tomorrow.

First cost remains a barrier. Efficiencies will be there, but the economics must be as well. Proven performance and reliability over time are also barriers to adoption, suggesting the possible need for performance guarantees. Owners looking at these new higher-efficiency units will be weighing all of this, including the increased complexity that usually comes along with high efficiency and what that might mean for operation and maintenance costs and guarantee of ongoing performance.

Looking at possible solutions, some fault diagnostics are included in the RTU spec, but there may be a need to go beyond that to simplified self-diagnostics for the maintenance people, like those on a copying machine that show you where the paper gets jammed and what doors to open up. We have to get to that point on some of this advanced technology to make sure it keeps running appropriately.

A second project this past year relates to high-efficiency gas unit heaters that go on a lot of different building types. They are maybe 80 % efficient, and the opportunity for efficiency is in the low 90s, using the condensing-type burners that are available for residential and other applications. The concern is, again, the cost. For that extra 10 or 12 % efficiency, will the incremental acquisition and installation costs (to get rid of or neutralize the condensate) be justified? There are also ongoing maintenance costs for neutralizing the acidic

condensate. Participants in the discussion saw it as a rather low-scale opportunity. Few of us use many unit heaters.

A third item was advanced rooftop unit controllers. Testing is being done on retrofitting a controller on a rooftop unit to improve efficiency through fan speed control, damper control for economizing, and possibly ventilation control as well. There is a lot of interest in that application. Barriers to implementation are concerns about proof of performance, cost benefit, and long-term reliability.

Potential New Projects

- **Higher-efficiency gas furnaces.** For the next year, we see an opportunity for research for all types of heating appliances.
- **Improved controls for large air-handling units.** Air-handling units may feed multiple spaces; the most demanding space, such as an operating room, may drive really low-discharge air temperatures and high-energy use in entryways or lobby areas that do not need that. Are there ways to improve energy performance by segmenting in an economical way?
- **Increased use of low-grade waste heat.** How can waste heat from air compressors, condensing units, refrigeration systems, and other sources be used in hot water or other applications?
- **Performance-based versus prescriptive-based ventilation requirements.** We see opportunities, working with ASHRAE for different spaces. Maybe through some training there would be an opportunity for different types of buildings to take advantage of that.
- **Building load analysis.** As rooftop units are replaced, a new unit may be bigger and heavier and may not fit on an existing space. But if the loads on that space went down over time due to lighting retrofits and other internal improvements, maybe you can put a smaller, more efficient unit in place of a bigger, older, heavier unit. Can an application be done to help people understand the existing loads of a building and know where those opportunities might lie?

Summary of Project Team Breakout Sessions – Refrigeration and Food Service

Note: Refrigeration and Food Service projects were treated as two separate breakout tracks.

Refrigeration

Barriers and Potential Solutions

One barrier we identified was energy cost due to equipment not performing as installed. Anti-sweat controls were installed over the years, and we estimate that more than half are currently disabled due to sensor failures. Technicians, instead of replacing the sensors, either turn them full on or disable them. Since anti-sweat controls are standalone and not an integrated part in that system, we do not have control feedback and we do not know whether or how they are running. Anti-sweat control is a fairly low-cost component to the system in general, but with a fairly high return.

Another barrier is energy costs due to inefficient design. Retrofitting cooler doors on open cases is one opportunity. DOE found that adding a door on a case consuming 4.89 kilowatt hours a day takes that down to 2.17 kilowatt hours a day, a 56 % energy reduction. A door retrofit guide is slated as a project. We are also

looking for energy metrics by component – for instance, going from T8 to LED lighting, or retrofitting DC motors.

Another barrier is getting support for commissioning, helping businesses determine who should do the commissioning and what is that commissioning cycle and what returns you get for what you pay. A commissioning guide is currently being worked on, but again, we want to see consistent definitions of value metrics and lots of detail.

Commercial refrigeration is an area that is unique in that there is a need for additional guidance and more boundaries. We do not have any definitions or guides for the controls specifically. We have expensive proprietary systems that are very difficult to support. We would ask for a technology review on what the next systems could be; scanning building controls or the commercial buildings sectors, to see, for instance, what could be done with RFID for better component identification and more simplicity in user feedback.

Food Service

Barriers and Opportunities

In discussing barriers, we began by evaluating obstacles to **the ENERGY STAR® Portfolio Manager** within the food services sector. Restaurants have the distinction of being the only building segment where it was not possible to establish a standard in Portfolio Manager. This would be a useful tool for restaurants because it allows you to compare yourself against your competition and to identify outliers within your own portfolio. The program also provides recognition if you are able to achieve the ENERGY STAR 75th percentile. The last effort was made eight years ago. The challenges include our status as largely franchised organizations, the sheer number of stores, and the diverse types of restaurants—quick serve, fast casual, casual, and fine dining. We are going to discuss how we might overcome those obstacles.

Our second topic was building **energy management systems**. We are constrained by the small size of most restaurants, quick serve in particular, which are typically only 3,000 square feet. Also, individual franchise owners are limited in the capital investments they can make. We need to figure out the economic model that would make sense and also provide a simple guide for franchisees—and even corporations—that do not know where to start in evaluating energy management systems, and then build on energy management 2.0, 3.0 and so forth.

Summary of Project Team Breakout Sessions – Plug and Process Loads

Plug and Process Loads is a new Project Team, and we began by evaluating how the barriers and potential solutions differ somewhat by sector; in particular, for the higher education and commercial real estate sectors.

Higher Education Perspective

Regarding plug loads, which we define as anything that occupants bring in and plug into the wall, the primary challenge is the many points of purchasing decision-making. Anybody from an administrative associate to a procurement staff member can make these decisions, and they may be unaware of energy implications. For example, purchases of voice-over-IP telecommunications equipment may be made based on the speed of connectivity but with no consideration of the increase in electricity costs when it becomes necessary to air condition the telecommunications closet 24/7. Broad-based consumer education will be needed to influence the many different points of decision for all types of things purchased for a campus. DOE can help us develop

specifications or purchasing guidelines, or maybe go as far as labeling, ratings, and rankings to help people make better decisions more quickly.

On the process side, infrastructure-type decisions determine what gets installed in a building. Loads can be significant, especially for research institutions, where a principal investigator may bring in some very heavy-duty equipment, such as ultra-low-temperature freezers, or lasers, or MRIs. The challenge to energy efficiency is bound up in the grant-making and indirect cost recovery process. Researchers make proposals, typically to the government, and when the government selects and funds a proposal, the university actually gets reimbursed for the indirect costs associated with doing that research. So for every dollar that a researcher brings in, they may give back as much as 50 or 60 cents to cover overhead costs. Equipment purchases need to come out of what is left over, so from the researcher's perspective, buying the cheapest thing possible makes sense, but is harmful to the institution as a whole and actually ends up probably costing taxpayers more. We need to address that grant-making and indirect-cost recovery process if we are going to make big inroads into energy efficiency in that area.

Commercial Real Estate Perspective

In commercial real estate, increasingly we deliver concrete, windows, and standard systems, and tenants take over and, within reason, do whatever they want with the space. The space exists for people to occupy and do productive work. That space cost is somewhere between $400 and $1,000 per square foot per year. What is the energy bill? Two to four dollars. We need to remember which is the elephant and the tail here. Nevertheless, how can we affect energy use? As real estate developers and owners, we affect the process loads, meaning the elevators and the other things that are ancillary to the building, but we do not really control the plug loads. The architect and tenants control those and make those decisions.

Potential New Projects

- **Comparative-analysis database.** This could support decision-making efforts, whether it is the architect, the facilities manager, or other people in the company. For instance, when determining what smoke detectors will go into a space, the buyers can compare the options available. What is needed is a comparative analysis that looks at not only the energy side, but also the performance side, with credible, easy-to-access information that people from different disciplines can use to make those decisions.
- **Plug loads need-and-demand analysis**. On the real estate developer side, we would like to get DOE to work with us collaboratively on a plug loads need-and-demand analysis. We are putting far more capacity in buildings and creating a lot less efficient systems than we could because brokers are telling tenants they need 12, 14, 16 watts per square foot. That becomes part of the lease structure.

We did not want to define a lot of initiatives that no one is willing to work on. These ideas pass that bar and we would be more than willing to work on either one of these initiatives with DOE.

Summary of Project Team Breakout Sessions – Market Transformation

As a new project team, we began by discussing and affirming our overall goals:

- One is to collaborate with academia and industry groups to act as a think tank for the energy-efficiency market. Universities share some of the same energy-efficiency objectives and already are performing work on some test sites. Collaboration opportunities can save all of us time and increase deployment of energy-efficiency strategies.

- Second is to pilot and demonstrate new technologies to determine commercial viability. The market is already doing demonstrations, so our challenge is to build case studies for property managers and also for owners, to encourage them to implement on a portfolio-wide basis. These case studies need to be disseminated broadly, reaching groups that may have one or two buildings.
- Our third goal is to work to scale commercially viable technologies at the national portfolio level. Many variables need to be considered to do this effectively, including the structure of the ownership and how tenants are affected. An owner-occupied building requires a different approach than a multi-tenant building managed by a third party.

Priority Activities

We evaluated barriers and potential activities for market transformation for the short, medium, and ongoing timeframes. We considered 26 possible activities and filtered down to 10 that we believed would have the greatest impact, targeted either at owners or property managers.

Green leasing is one opportunity with high potential impact. One of the biggest transformations in the future must be tenant behavior. Once we have retrofitted a building and know that it is running at its top efficiency, control over the remainder of the load goes to the tenant side. We discussed many of the significant challenges in working with tenants and lawyers to implement green leasing. A related opportunity is to give property managers education toolkits for use with tenants. The EPA has a green tenant toolkit that many of us were unaware of, and as a short-term goal, we may put on a webinar about this.

Closing Plenary Session – Project Team Report Back

All attendees reconvened for the closing plenary session. Facilitator Doug Brookman asked representatives from each Project Team to provide brief remarks summarizing the key takeaways from their breakout discussions. Taddonio and Holuj then 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 and nearby facilities.

May 24 – Executive Exchange with Commercial Building Stakeholders

Morning Plenary Session – Remarks and Announcements

Dr. Dan Arvizu, NREL Director, welcomed the attendees with opening remarks that offered context on their surroundings, the work that is pursued by lab staff, and its relevance for the commercial building sector. For the benefit of those unfamiliar with the Commercial Building Energy Alliances, DOE's CBEA Co-Coordinator Kristen Taddonio then provided an overview of CBEA, including growth and membership, current Project Teams, and successes to date. She also briefly discussed a new Lighting Campaign in which BOMA, IFMA, and GPC will champion CBEA lighting specifications within their membership, which is illustrative of the strategy of CBEA members serving as early adopters so that other industry leaders can spur further replication in the broader market.

Next, CBEA members Jim McClendon, Director of Engineering with Walmart, and John Scott, Executive Vice President of Property Management with Colliers International, offered insights from the perspective of members. McClendon discussed Walmart's participation in CBEA lighting specification development and deployment, reporting that the site-lighting (parking lot) specification has now been adopted across the company's new building portfolio and more than 400 member sites have applied the specification, leading to savings of over 50 TWh. Scott discussed his similar depth of engagement with the CBEA Green Leasing Library, which consolidates green-leasing resources and has resulted in seven CBEA member organizations and four other companies implementing green-leasing practices.

Dr. Kathleen Hogan, DOE Deputy Assistant Secretary for Energy Efficiency, then presented on "Maximizing Impact through Public-Private Partnerships." Dr. Hogan noted that, in the Obama Administration's "all of the above" energy strategy, efficiency is a significant and largely untapped resource. She highlighted the vital national importance of energy efficiency in the commercial buildings sector and the manner in which DOE is working with a host of industry stakeholders to pursue high-impact solutions through initiatives like the Better Buildings Challenge. Finding energy-efficiency opportunities and putting them to work requires leadership by both end-users and service providers, Dr. Hogan stated, and DOE engages these through public-private initiatives such as the Better Buildings Challenge and the Commercial Building Energy Alliances.

Within this context, CBEA Co-Coordinator Brian Holuj then explained the rationale for gathering CBEA members and industry stakeholders for an Executive Exchange at the Forum: to get insights on how to spur much greater market adoption of CBEA-developed efficiency measures that are being demonstrated in member portfolios. He then outlined the approach to be taken during the breakout discussions, and concluded by summarizing a unique CBEA project, the RTU Challenge—which had just achieved two major milestones—and inviting Dr. Hogan back to the podium to reflect on these achievements.

Dr. Hogan recognized five manufacturers that are participating in the RTU Challenge: Daikin McQuay, Carrier, Lennox, 7AC Technologies, and Rheem. She then recognized Daikin McQuay's Rebel™ rooftop unit air-conditioning system for meeting the RTU Challenge, and presented a framed letter of recognition to a Daikin McQuay representative.

Facilitator Doug Brookman concluded the opening plenary by reviewing the breakout session format and protocol and noting that findings were to be summarized in a report-back during the closing plenary session. Attendees split into the morning breakout sessions, then reconvened for lunch.

Lunch Plenary Session – Remarks and Announcements

During lunch, Paul Mathew of Lawrence Berkeley National Laboratory (LBNL) presented an overview of the prototype DOE Buildings Performance Database, which provides empirical energy performance data that is cleansed, validated, and stored in a standard taxonomy for use in portfolio-based analyses of energy-efficiency investments.

Following the lunch plenary, attendees split into the afternoon breakout sessions

Summary of Project Team Breakout Sessions – Lighting and Electrical

Our group especially benefitted from the participation of stakeholder manufacturers, who tempered some of our ideas and also enlightened us about the next generation of technologies. One thing we reaffirmed today is that solid-state lighting is indeed going to be leading the charge into the future. Manufacturers are putting most of their resources into solid-state, so we are definitely on a curve.

The current challenge is that we are in an in-between stage, between existing technologies and the future, which is solid-state, plasma induction, etc.

Three implementation barriers that we identified yesterday were vetted with our stakeholder partners this afternoon.

Barrier one is **lack of A&E design knowledge**. Given that they have been doing incumbent lighting for so long, how do you get them to change and think differently?

- Obviously there are many resources and things that DOE is currently doing, but we did identify additional activities, primarily training-related, that would engage organizations like IES, AIA, and others in making sure information gets disseminated to the end user.
- Another opportunity is to increase utility participation, engaging them to bring incentives, rebates, and programs to the table that can help make customers make the move toward these technologies. We would like to see more utilities at the next Efficiency Forum.
- Development of design guides is not a new idea, but we propose that they be targeted to designers and A&E firms. We would envision simple scenarios for parking structures, office layouts, and other typical applications, helping them through the design process so that solid-state lighting moves its way up in the decision process and provides that necessary education.

Our second barrier is **high first cost**.

- The good news is that solid-state lighting is exceeding projections every year, and even every six months, as light output goes up and cost comes down. So we believe the industry largely will be taking care of that itself. As CBEA, we do have an impact through the technology specifications, which gives us a voice with the industry and the industry has heard and responded accordingly. Another consideration is solid-state lighting does not apply to each and every application. We want to go forth with a tool kit that shows there are other technologies that might work better in some applications.

Our third implementation barrier is that no one wants to be the first to **demonstrate a new technology**.

- Now that we are several years into solid-state lighting, it has gotten better and better, but nonetheless, there is risk associated with doing that first project. Demonstration projects are important. DOE has done many demonstrations through the SSL Gateway Program, but frankly, some reports are three to five years old. So we will suggest to the SSL Program that those be archived and that more current data be made available so that people are not making their decisions based on old data where the technology has raced ahead.
- Alliance members, even competing members, are willing to share data. There might be a three- to six-month lag time to give them that early initiative, but nonetheless we have the opportunity to create short case studies—even three to five pages—that get timely data disseminated more appropriately.
- For the CFO level, getting their attention to empower these decisions is best done with a shorter document, one or two pages that distill the value proposition.

Potential New Projects

We determined that:

- **Control systems** are the single greatest opportunity. Lighting can become more efficacious, but controls will take us the rest of the way. We recommend having this group do something to advance controls, whether it be developing specifications, or requiring control integration into some of our existing technology specs.
  - There was a distinct interest in **bi-level controls** for exterior lighting, street lighting, parking lot lighting, and those types of applications.
- Our second area of interest was **wall packs**. We have three specifications currently out there, one for troffers, one for exterior parking lot lighting, and one for exterior parking structure lighting. We think that adding wall packs to that will fill out that suite of products.
  - A new initiative we are considering—a high-efficiency exterior lighting campaign—will fit well into that.

Summary of Project Team Breakout Sessions – Space Conditioning

We got great feedback from manufacturers on the RTU Challenge. Our initial barrier was first cost and, from the manufacturer's point of view, they need to know there is a market out there. Beyond the Challenge, is there any way we can promote a larger market for these high-efficiency units? Manufacturers also are interested in parameters on what is acceptable for increases in weight and increases in cost. There are many knobs they can tweak with RTUs to increase performance, but what is going to be acceptable from the owners' point of view?

A great lesson learned for any specification moving forward is to make it simple. Do not over specify. Just put out a performance and let the innovation happen in the marketplace to meet those options.

There were several great suggestions on implementing these RTUs. One is to push for more accelerated adoption of 90.1 2010, which does include a two-speed fan control and is one step closer to the RTU Challenge unit. Another was make the units with more options or more revenue potential for owners—for instance, smart controllers that can communicate with the grid in some of these electric markets to create revenue streams in the future.

We also discussed several other ideas, including liquid desiccants in air conditioning for better humidity control and overall system performance; optimal air distribution for RTUs; whole-system performance metrics; whole-building and system performance during peak periods, which opens a potentially big cost savings for building owners; and fan efficiency.

Finally, we discussed how we can get uptake of existing technologies. One idea is a "cash for clunkers" program for replacing the really old technology out there right now—chillers, RTUS—with some of these optimal new products. Incentives could drive mass implementation in the marketplace.

Summary of Project Team Breakout Sessions – Refrigeration and Food Service

Note: Refrigeration and Food Service projects were treated as two separate breakout tracks.

Refrigeration

Developing a guide for **refrigeration commissioning and retro-commissioning** was a central topic for us today. We are working toward a guide that, in cooperation with the ASHRAE special design projects, will standardize and define a refrigeration commissioning process that is measurable, verifiable, and scalable throughout the industry.

The second initiative we are working on is the **cooler door retrofit guide**. Supermarkets are retrofitting open-front coolers with varying degrees of success. We are going to work together, share information, and create a reference guide for successful installation of cooler doors on open cases, while maximizing energy savings and eliminating reliability issues.

Another opportunity discussed was **compressor system specifications**—benchmarking compressor system performance ratings and then moving forward next year with a compressor system store challenge to push what we benchmark to the next level.

We also discussed anti-sweat heater control issues. Many are bypassed currently in existing stores. We will be looking for solutions to eliminate that wasted energy. We will be interested if any of the other groups working on upgrading controls for plug loads or lighting has a solution that might work for controlling a pulse system. That might be useful in the refrigeration industry.

Food Service

Two barriers apply across the board. The first is the very short payback ROI in the food service business, typically less than two years. The second is the predominance of franchisees. We have large portfolios with a very high percentage of what would be considered essentially small business owners. We want to be able to help them as well as our corporations.

Potential New Projects

One project for the short term is benchmarking, enabling development of the ENERGY STAR Portfolio Manager for restaurants. We will be defining metrics differentiated by service type (quick serve , fast casual, casual, and fine dining). Load profiles across those types vary greatly, as well as energy intensity.

The second short-term project relates to **energy management systems**, creating a guidance document for small business owners on what to look for if they are going to be retrofitting a system into their existing stores, including guidance on expected paybacks and on piloting and testing. We also want to identify potential vendors with products applicable to the small footprint and ROI requirements of the industry. A bare-bones specification would identify minimum goals, and then we would create specifications around add-on modules for owners willing to spend a little more for tighter control, including integration of monitoring and control of appliances as well.

In the long-term, we have four projects in the pipeline.

- **New ENERGY STAR appliance categories**. Currently there are only eight within the appliance category. We know there is an opportunity to save energy on plug loads by expanding that category, starting with microwaves and re-thermalizers within restaurants.
- **Heat recovery for water preheating**. This is typical for supermarkets, but restaurants need a small-scale, cost-effective solution with a good ROI. Restaurants may use anywhere from 500 to 1,500 gallons of hot water a day. We want to work with refrigeration manufacturers for potential integration into equipment such as condensing units in walk-in coolers and freezers.
- **Demand control ventilation for hoods.** Products providing variable speeds based on cooking loads are out there, but we need more cost-effective options for the restaurant market, particularly QSR and fast casual. We see the possibility of creating intelligent appliances that handle most of the control for us, as well as integration into energy management systems in lieu of standalone systems. Most current demand control ventilation for hood systems are standalone with very little integration back into an EMS.
- **Motor retrofits.** We see opportunities on condensing units and evaporators for EC motors, driving that marketplace to get more people to retrofit. We do not have a plan yet, but we know there is definitely an opportunity around that.

Summary of Project Team Breakout Sessions – Plug and Process Loads

Barriers

Ownership and accountability for plug and process loads is lacking throughout the building life cycle, starting way back with procurement and design of a new building. Even in an integrated design process, who is the one taking responsibility for making sure that the plug-load design is accounted for, that it is efficient, and that we are planning ahead for being able to cost-effectively meter it, now or later? It extends through 80 % of the building life cycle, where retrofits mess with electrical distribution in your panels. If you are lucky, your lighting circuits were segregated from your plug loads in the beginning, but then you have changes to your building to the point that many different people are making purchasing decisions about plug loads that do not necessarily take energy efficiency into account. That question of ownership and accountability is a key one on the minds of participants today and yesterday.

Another key theme is **metering and its value associated with plug and process loads**. One of several barriers discussed was uncertainty around how much metering should be done, what should be done with the data,

and whether metering is providing the needed value. While it is true that you cannot manage what you do not measure, metering also results in higher maintenance costs as systems go out of calibration. What are the implications of spending labor hours and dollars fixing metering systems?

Varying needs for **consumer purchasing information** is another barrier. What level of detail do different types of buyers want when they are trying to make the purchasing decisions? Some want just the yellow sticker on the device that says, "It will consume this much." If two products cost the same, they pick the one with the lower energy consumption. Other people want to be able to see the assumptions behind those numbers and make sure it works for them.

One of the insights we had is just how differently plug and process loads are viewed by the different sectors. On one end of the spectrum are hospitals, which have a little bit more control over what they are putting into their buildings. On the other end are commercial real estate owners who are heavily constrained by tenants. Solutions that work for hospitals may not work for traditional commercial real estate. Retailers and universities have people working in their spaces who operate equipment that they do not have control over. Where you are working with tenant situations, solutions need to reflect the types of information suited to a brokerage, stakeholders, or perspective occupants.

Potential New Projects

- **Plug load capacity-and-power-requirements analysis**. Hines and GSA—and we hope others in the future—indicate they would be willing to partner with DOE on this effort to get a better sense of realistic capacity requirements for plug and process loads for incorporation into lease language, at the inflection point when needs are being set for a new space. Requirements that are unnecessarily high will affect capital costs as well as energy costs down the line. The project would look at typical spaces and the executive stakeholders thought it would be interesting to choose buildings with influential tenants, to get a better handle on what those capacities should be.
- **Consumer decision-making tools.** To address the obstacle of lack of sufficient consumer decision-making tools, we will start with taking a look at those areas where you can improve the information provided to the various people making those decisions in your organization through better formal policies and procedures for purchasing and selecting equipment. We can lift examples of language and good models where they exist from other programs or from members and try to see what can be applied to others. A future extension of this project would be improving inventory practices. This was something we thought could be done a bit sooner, but we hear from our members and the executive stakeholders today that it would be premature to try to change inventory practices, that the first priority is getting the information request right.

A related idea is providing calculators for purchasing guidance to help the folks on both sides of the spectrum. Better information will be needed to inform those simpler labels and to provide the underlying assumptions for those who want to be able to tweak some of their assumptions when they are trying to assess the energy consumption of plug loads for themselves.

Summary of Project Team Breakout Sessions – Market Transformation

The Market Transformation team focuses on non-technical barriers. We identify non-technical barriers, work through the national labs and our members to identify solutions, and advance deployment of those solutions throughout the marketplace. For example, barriers can relate to the split-incentive issue, the need for

education of market actors within the commercial real estate value chain, and impediments to adoption of technology specifications.

We began our discussions with stakeholders by focusing on existing solutions that we have already brought to the marketplace and evaluating their effectiveness. We then identified ways to improve those existing solutions and to get members to assist in their deployment, and we also identified additional new opportunities.

Existing Solutions

Re-tuning was the first existing solution we discussed. Re-tuning is a continuous improvement program developed by the Pacific Northwest National Laboratories. It involves a process and tools for ongoing building performance improvement and maintenance. A number of members have already gone through the process of training their engineering staffs on the use of re-tuning. Based on their experience, we came up with a couple of very key issues that still need to be resolved. First is the laborious work effort to gather the data needed to input into the tools. We identified the need for a better process to facilitate the transmission of data from building automation systems into the tool.

Second, we see great promise in developing a technical specification for building automation systems so that they enable that transfer of information into tools, such as the re-tuning tool, which provide a visual interpretation of the data that is very useful to building operators and technicians.

Several new companies at our session agreed to participate in deploying the re-tuning solutions within their organizations.

The Green Lease Library is an existing solution developed to overcome an information barrier that has hindered adoption of green leases in the commercial real estate market. A number of organizations collaborated to create this library, which is managed by the Institute for Market Transformation. The library, at http://www.greenleaselibrary.com/, provides copies of green-lease templates that have been developed, as well as lease clauses that organizations can use in order to overcome the split-incentive issue.

In our discussions, we identified two organizations that have used non-binding green-lease clauses, which they find can be more easily implemented than formal legal ones, and we are reaching out to get their case studies to be added on the green-leasing website.

New Opportunities

The first opportunity we discussed was the High-Efficiency Exterior Lighting Campaign, being created through a partnership of BOMA, IFMA, and the Green Parking Council, with the goal of increasing adoption of the exterior lighting specs that were initially developed through the Retailer Energy Alliance, led by Walmart and Target, and then picked up by CREEA. The goal of the campaign is to increase the number of parking lots and parking structures that deliver attractive lighting while saving energy and money. The split incentive exists in this area as well. It is even more of an issue because of the shorter lease terms for this asset class, which can be two to three years. We also deal with the same issues of multiple decision makers.

We saw market transformation leverage at its best, when three very large commercial real estate services and property management companies in our session agreed to participate in this initiative and potentially deploy this solution through parking fixtures within their portfolios. Those organizations identified additional requirements that they would like to see created before they are able to take these solutions and deploy them

through a portion of their portfolios as a pilot program. We also had ideas for new partnerships to help deploy at a much faster rate. For example, it was suggested that we engage the National Auto Dealership Association, which represents 17,000 car dealerships that likely have parking lot lighting fixtures within their portfolios.

Our second in-depth discussion was on **data access**, which continues to be a consistent problem for all of our commercial real estate members. We learned about a coalition formed to address this that we will likely help to support in some fashion. BOMA's Real Estate Roundtable, the Institute for Market Transformation, and USGBC have begun an initiative at both the state and federal levels to allow for whole-building aggregated information to be passed along to commercial real estate owners. A specific action step is for our team members to engage with utilities and public utility commissions to help facilitate building owners getting access to data. It is a very simple item that, as we all know, has a lot of difficulties and challenges associated with it.

Other ideas raised were beginning a tenant consortium, particularly with very large tenants, like Bank of America, that have huge retail portfolios. We would invite them to come to the table and begin working with us to identify solutions that are meaningful for them. We also talked about using market transformation or collaboration with utilities to affect the curriculum of energy-efficiency education for students. Lastly, CREEA Chair John Scott noted that the "cash for clunkers" idea suggested by the Space Conditioning team might also be a promising potential market transformation opportunity for us.

Closing Plenary Session

All attendees reconvened for the closing plenary session. Facilitator Doug Brookman requested representatives from each Project Team to provide brief remarks summarizing the key takeaways from their breakout discussions. Holuj concluded the closing session by extending his appreciation for everyone's participation and for the staff that helped plan and host the Efficiency Forum. He noted that the CBEA Efficiency Forum Report would be available on the CBEA website in the coming weeks and that feedback was welcome via CBEA@ee.doe.gov. The day concluded with a series of optional tours on the NREL campus.

Appendix A: CBEA Efficiency Forum Agenda

Commercial Building Energy Alliances

CBEA All-Member Meeting

May 23 • National Renewable Energy Laboratory (NREL) • Golden, CO

Identify barriers and pathways to maximizing energy savings from CBEA projects, which will be vetted by stakeholders on day 2

7:30–8:15 MDT	**Security Check-in** (allow 30 minutes to check-in and get to the RSF)	**NREL Visitors Center**
8:15–8:55	**Registration and Coffee**	**RSF 3rd Floor**
8:55–9:50	**Plenary Session**	**Room X344**
	• **Welcome to NREL and Introductions:** Ron Judkoff, Principal Lab Program Manager for Building Energy Technologies, NREL	
	• **Evolution of CBEA and the Inaugural Efficiency Forum:** Kristen Taddonio and Brian Holuj, CBEA Leads, U.S. Department of Energy	
	• **Overview for Breakout Discussions:** Doug Brookman, Facilitator	
9:50–10:05	**Break**	
10:05–11:15	**Sector Breakout Discussions**	
	• **Hospital Energy Alliance:** Daniel Scher, Ascension Health; Kristen Taddonio, DOE	**Rm X324**
	• **Higher Education Energy Alliance:** Ron Judkoff, NREL **(meet in Rm X344 A-B-C San Juan for TTF Tour)**	
	• **Commercial Real Estate Energy Alliance:** John K. Scott, Colliers Int'l; Diane Vrkic, Waypoint	**Rm X320-C**
	• **Retailer Energy Alliance:** Jim McClendon, Walmart; Brian Holuj, DOE	**Rm X320-A**
11:20–12:15	**Project Team Breakout Discussions**	
	• **Lighting and Electrical:** Chris Magee, MGM Resorts Int'l; Jeff McCullough, PNNL	**Rm X320-C**
	• **Space Conditioning:** Scott Williams, Target; Michael Deru, NREL	**Rm X320-A**
	• **Refrigeration:** Richard Royal, Walmart; Bill Goetzler, Navigant	**Rm X403**
	• **Food Service:** Michael Zatz, ENERGY STAR; Rich Shandross, Navigant	**Rm X405**
	• **Plug and Process Loads:** Clayton Ulrich, Hines; Feitau Kung, NREL	**Rm X324**
	• **Market Transformation:** John K. Scott, Colliers Int'l; Diane Vrkic, Waypoint	**Rm X422**
12:15–1:15	**Lunch** (provided)	**Rm X344**
	• **Better Buildings Challenge in Action:** Andrew Thorsen, Kohl's Department Stores	
1:15–3:00	**Project Team Breakout Discussions**	
	• **Lighting and Electrical:** Chris Magee, MGM Resorts Int'l; Jeff McCullough, PNNL	**Rm X320-C**
	• **Space Conditioning:** Scott Williams, Target; Michael Deru, NREL	**Rm X320-A**
	• **Refrigeration:** Richard Royal, Walmart; Bill Goetzler, Navigant	**Rm X403**
	• **Food Service:** Greg Tomsick, Boston Market; Rich Shandross, Navigant	**Rm X405**
	• **Plug and Process Loads:** Clayton Ulrich, Hines; Feitau Kung, NREL	**Rm X324**
	• **Market Transformation:** John K. Scott, Colliers Int'l; Diane Vrkic, Waypoint	**Rm X422**
3:00–3:15	**Break**	
3:15–4:00	**Plenary Session**	**Rm X344**
	• **Breakout Session Report Back:** CBEA Representatives	
	• **Closing Remarks:** Kristen Taddonio and Brian Holuj, DOE	
4:15–5:45	**Optional Tours**	
6:30–TBD	**Optional Dinner** El Rancho Restaurant, 29260 US Hwy 40, Evergreen, CO 80439 (303)526-2300	

Commercial Building
Energy Alliances

CBEA Executive Exchange with Commercial Building Stakeholders

May 24 • National Renewable Energy Laboratory (NREL) in Golden, CO

Collaborate with experts across stakeholder groups to vet approaches for maximizing the energy impacts of CBEA activities

7:30–8:15 MDT	**Security Check-in** (allow 30 minutes to check-in and get to the RSF)	**NREL Visitors Center**
8:15–8:55	**Registration and Coffee**	**RSF 3rd floor**
8:55–10:15	**Opening Plenary Session**	**Room X344**

- **Welcoming Remarks:** Dan Arvizu, Laboratory Director, NREL
- **Maximizing Impact Through Public-Private Partnerships:** Kathleen Hogan, Deputy Assistant Secretary for Energy Efficiency, U.S. Department of Energy
- **CBEA and its Real-World Impacts**: Kristen Taddonio, CBEA Lead, DOE; Jim McClendon, Director of Engineering, Walmart; John K. Scott, Exec VP of Property Management, Colliers Int'l
- **RTU Challenge and Lighting Campaign:** Brian Holuj, CBEA Lead, DOE; Kathleen Hogan, Deputy Assistant Secretary for Energy Efficiency, DOE
- **Overview for Breakout Discussions**: Doug Brookman, Facilitator

10:15–10:30	**Break**	
10:30–12:15	**Project Team Breakout Discussions**	

Review current CBEA projects and assess deployment barriers and opportunities

- **Lighting and Electrical:** Jim McClendon, Walmart; Jeff McCullough, PNNL — **Rm X320-C**
- **Space Conditioning:** Scott Williams, Target; Michael Deru, NREL — **Rm X320-A**
- **Refrigeration:** Richard Royal, Walmart; Bill Goetzler, Navigant — **Rm X403**
- **Food Service:** David Harpring, Yum! Brands; Rich Shandross, Navigant — **Rm X405**
- **Plug and Process Loads:** Clayton Ulrich, Hines; Feitau Kung, NREL — **Rm X324**
- **Market Transformation:** Adam Sledd, IMT; Diane Vrkic, Waypoint — **Rm X422**

12:15–1:15	**Lunch** (provided)	**Rm X344**

- **Introduction of the new Buildings Performance Database**: Paul Mathew, LBNL

1:15–3:00	**Project Team Breakout Discussions**	

- **Lighting and Electrical:** Jim McClendon, Walmart; Jeff McCullough, PNNL — **Rm X320-C**
- **Space Conditioning:** Scott Williams, Target; Michael Deru, NREL — **Rm X320-A**
- **Refrigeration:** Richard Royal, Walmart; Bill Goetzler, Navigant — **Rm X403**
- **Food Service:** Jason Greenberg, McDonald's; Rich Shandross, Navigant — **Rm X405**
- **Plug and Process Loads:** Clayton Ulrich, Hines; Feitau Kung, NREL — **Rm X324**
- **Market Transformation:** Karen Penafiel, BOMA; Paul Wessel, GPC; Diane Vrkic, Waypoint — **Rm X422**

3:00–3:15	**Break**	
3:15–4:00	**Closing Plenary Session**	**Rm X344**

- **Report Back from Each Project Team:** CBEA Breakout Session Representatives
- **Closing Remarks:** Brian Holuj and Kristen Taddonio, CBEA Leads, DOE

4:15–5:45	**Optional Tours**	
6:30–TBD	**Optional Dinner** 240 Union Restaurant, 240 Union Blvd, Lakewood, CO 80228 (303)989-3562	

Appendix B: CBEA Efficiency Forum Participants

CBEA Members	
Adventist Healthcare – Jeremy Bedine	Newmark Grubb Knight Frank Global Corporate Services – Noah Shlaes
Ascension Health – Daniel Scher	Newmark Grubb Knight Frank Global Corporate Services – Mike Conner
ASHRAE – Lilas Pratt	Prudential Real Estate Investors – David DeVos
AtSite – Jenna Mikus	Stanford University – Susan Vargas
Boston Market Corporation – Gregory Tomsick	Sustainability Roundtable, Inc. – Jim Ptacek
BOMA – Karen Penafiel	Target Corp. – Neil Monson
CB Richard Ellis Group Inc. – Michael Groppi	Target Corp. – Scott Williams
Colliers International – John K. Scott	The Home Depot – David Oshinski
Cushman & Wakefield – Tim Peters	The Walt Disney Company – Bruce Rauhe
Denver West – David Chasnow	U.S. Department of Veterans Affairs – Lam Vu
Denver West – Ryan Toole	U.S. General Services Administration – Jeffrey Engelstad
Einstein Noah Restaurant Group – Susan Scheurmann	U.S. General Services Administration – Mike Lowell
Energy Efficiency Building Hub – Laurie Actman	U.S. General Services Administration – Doug Rothgeb
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EPA – Stephanie Plummer	University of California, Davis – Siva Gunda
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Glenborough, LLC – Carlos Santamaria	Walgreen Co. – Jason Robbins
Grand Valley State University – James Moyer	Walmart Stores, Inc. – Jim McClendon
Green Parking Council – Paul Wessel	Walmart Stores, Inc. – Richard Royal
Hines – Clayton Ulrich	Walmart Stores, Inc. – David Sheets
IFMA – Dean Stanberry	Walmart Stores, Inc. – Ralph Williams
jcpenney – Kyle Wilkes	Wawa, Inc. – Pat Hagan
Kohl's Department Stores – Andy Thorsen	Wawa, Inc. – Robert Snyder
Legacy Health System – Patrick Lydon	Wendy's Quality Supply Chain Coop – Russell Subjinske
Liberty Property Trust – Maria Thalheimer	Whole Foods Market – Mike Ellinger
Living City Block – Alex Lowenstein	Yum! Brands – David Harpring
Lowe's Companies, Inc. – Charlie Martin	
Mayo Clinic – David Rassel	
McDonald's Corp. – Jason Greenberg	
MGM Resorts International – Chris Magee	

Stakeholders	
7AC Technologies, Inc. – Peter Vandermeulen	Ice Energy – Gregory Tropsa
ABB – Caroline Mason	Institute for Market Transformation – Adam Sledd
ABM Facility Services – Cornel Sneekes	Jetlun Corporation – Elsa Chan
Acuity Brand Lighting – Jeff Quinlan	Legrand North America – Pete Horton
Albeo Technologies Inc. – Jeff Bisberg	Lennox International – Jon Douglas
Alliance to Save Energy – Jeffrey Harris	Manitowoc Ice – Daryl Erbs
American Genius Corporation – Andrew Mongar	Mason Energy + Management – Jack Mason
ASSA ABLOY Door Security Solutions – Aaron Smith	McKinstry – Steve Ruby
Bayer MaterialScience – Timothy Thiel	New Buildings Institute – David Hewitt
Bitzer Compressor Co. Inc. – Kurt Bickler	Osram Sylvania, Inc. – John Zimmerman
Carrier – Mead Rusert	Parker Hannifin – David Dorste
Carrier – David Sabatino	Portland Energy Conservation, Inc. – Scott Moore
Cooper Lighting – Logan Gerhard	PPG Industries – Darijo Babic
Daikin McQuay – Steve Van Peursem	Remis America, LLC – Matthew Pletcher
Danfoss – Peter Dee	REMIS GmbH – Simon Swiderski

Danfoss – Robert Wilkins DC Engineering – Dustin Lilya DuctSox Corporation – Dennis Wilson Efficient Lights – Mark Warwick Emerson Climate Technologies, Inc. – Rajan Rajendran Engineered Mechanical Systems, LLC – Robert Padgett Enmetric Systems – Ryan Bermudez Food Service Technology Center – Don Fisher Food Service Technology Center – David Zabrowski Gas Technology Institute – Larry Brand Heatcraft Worldwide Refrigeration – Ira Richter Hussmann Corporation – Patrick Johanning Hussmann Corporation – Norm Street	Rheem – Erich Bauman Rheem – Sal Brunetto Rocky Mountain Institute – Coreina Chan Rocky Mountain Institute – Robert Hutchinson Sensus Machine Intelligence – Jim Boler The RMH Group, Inc. – Jessie Jones Transformative Wave Technologies, LLC – Danny Miller Twa Panel Systems – Michael O'Rourke UL DQS Inc. – Don Macdonald Weiss Instruments – Steve Weiss Zero Zone, Inc. – Carl Roberts

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Appendix C: Statement from U. S. Department of Energy to Forum Participants

Statement read at the beginning of all Efficiency Forum sessions

"The purpose of today's session is to ask for your input regarding [description of CBEA activity to be discussed]. To that end, it would be most helpful 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."

Appendix D: Commercial Building Energy Alliances Project Overviews

RTU Challenge – Space Conditioning

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

Main Barriers Addressed by the Project:	• *Technological:* Current RTUs do not do not meet the performance potential of the available technology. • *Operational:* Current RTUs do not offer standard communications and on-board fault detection and diagnostic capabilities.
Solutions/ Deliverables:	• *RTU Challenge Specification:* The key performance components of an RTU are specified and the overall cooling performance requirement is 18 IEER. ○ Final specification posted March 2012, cutoffs for manufacturer commitment is May 15, 2012 and product availability by May 1, 2013. • *RTU Lab Test Procedure and lab test results:* A lab test procedure for the first unit was developed in April 2012. Preliminary laboratory test results from the first RTU challenge unit will be announced by May 23, 2012. Test results from other units will be available soon after they are made available for testing. • *RTU Field Test Procedure and field test results:* The field test procedure will be developed by June 2012, and results from demonstrations will be published several months after the demonstrations.
Deployment Pathway:	• *Website*: DOE maintains a website with information updates about the RTU Challenge. • *Webinars*: DOE held a webinar on February 23, 2011 on the benefits of the RTU Challenge. • *Product Demonstrations:* DOE will coordinate product demonstrations with CBEA members and federal facilities in 2012 and 2013. Bonneville Power Administration is also interested in field testing the RTU Challenge units in the Pacific Northwest. • *Performance Calculators:* The RTU Comparison Calculator and the 179D DOE Calculator provide fast savings estimates for interested consumers.
Impact Metrics:	• *Percent of RTUs that meet the RTU Challenge:* DOE will track the number of units sold as a percentage of the total market by working with manufacturers. • *Estimated energy savings per application:* Energy savings over 90.1-2010 minimum efficiency is expected to be between 10% and 50% depending on the location and the application.

References:

RTU Challenge website – http://www1.eere.energy.gov/buildings/alliances/rooftop_specification.html
RTU Challenge webinar – http://www1.eere.energy.gov/buildings/webinar_archives.html#commercial_rtus_20110223
RTU Comparison Calculator – http://www.pnnl.gov/uac/
179D DOE Calculator – http://www.179d.energy.gov/

Gas Unit Heater Specification – Space Conditioning

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

Main Barriers Addressed by the Project:	• *Cost:* The initial cost of a high efficiency gas unit heater can be a barrier to implementation. However, gas unit 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 Unit Heater Technology Specification:* A technical specification outlining the efficiency requirements and design features to be implemented in a high-efficiency gas unit heater. ○ Deliverable Date: 9/1/2012 ○ Status: A working document is currently with CBEA members and industry representatives for preliminary review.
Deployment Pathway:	• *Specification deployment:* Work with the CBEA Space Conditioning Team to get 10 members to implement the specification for new and replacement applications in 2012. Work with other groups such as utilities, the Gas Technology Institute, and the Consortium for Energy Efficiency for deployment beyond the CBEA. • *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.

RTU Advanced Controls Retrofit – Space Conditioning

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

Main Barriers Addressed by the Project:	• *Technological:* Most existing RTUs have constant speed supply air fans and have very rudimentary controls, which limit the energy performance. • *Operational:* Current RTUs do not offer standard on-board communications for performance and control adjustments. • *Data / Awareness:* Limited information is available for owners and engineers on the savings potential and operational characteristics from newly available solutions on the market.
Solutions/ Deliverables:	• *Technical Report:* *Energy Savings and Economics of Advanced Control Strategies for Packaged Air-Conditioning Units with Gas Heat* was published December 2011. The report investigates various control strategies and provides savings estimates for all climate zones in the U.S. • *Technical Report:* *Energy Implications of Retrofitting Retail Sector Rooftop Units with Stepped Speed and Variable Speed Functionality* was published in April 2012. This report shows the savings predicted for implementing variable speed fans in RTU for all U.S. climate zones. • *Field Test Procedure:* An advanced controls field test plan was published in January 2012.
Deployment Pathway:	• *Product Demonstrations:* DOE will conduct product demonstrations with CBEA members and federal facilities in 2012 and 2013. Bonneville Power Administration and the Center of Energy and Environment in Minneapolis, MN are also conducting field demonstrations. • *Performance Calculators:* The 179D DOE Calculator provides fast savings estimates for interested consumers.
Impact Metrics:	• *Total Impact:* 55 trillion Btus annual savings assuming half of RTUs are retrofitted with an average savings of 30%. • *Payback:* Payback for all U.S. locations has been estimated to be less than three years. • *Estimated energy savings per application:* Energy savings are expected to be between 24% and 35% and cost savings are expected to be 38%.

References:

Technical report – http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20955.pdf
Technical report – http://www.nrel.gov/docs/fy12osti/51102.pdf
179D DOE Calculator – http://www.179d.energy.gov/

Plug and Process Loads Action Plan – Plug and Process Loads

Technical Lead: Feitau Kung, NREL, feitau.kung@nrel.gov, 303-275-4357

Main Barriers Addressed by the Project:	Lack of guidance about how to develop or adapt effective formal policies for purchasing energy-efficient plug and process load equipment Lack of guidance in early design stages about how to plan for cost-effective monitoring of plug and process load energy Lack of understanding about why owners are underutilizing existing resources for plug and process loads that have been produced by DOE, EPA, and others Lack of guidance about how to influence the choices of vendors who select and operate plug and process load equipment in building owners' spaces.
Solutions/ Deliverables:	Example language to help facility managers develop and gain support for improved purchasing policies Sharing of design guidance between project team members Outreach to increase participation in ENERGY STAR's specification review process Assessment of whether any members have strong example language for leases or vendor contracts that can be replicated by peers.
Deployment Pathway:	Recruit a pilot volunteer group of CBEA members to adapt and incorporate example purchasing policy language into their organizations' formal policies. Coordinate with GSA to determine what language in its upcoming revision to its P100 Facilities Standard will support near-term or future monitoring of plug loads through advanced planning during building design. If the language is applicable to others, project team staff will invite GSA to present language from its design standard to other project team members via a webinar. Determine if any members can volunteer example language for leases or vendor contracts that have led to energy savings and can be shared with others publicly. If not, collaborative development of example language can be proposed as a future project.
Impact Metrics:	About 30% of project team members interviewed during the project team launch have a formal energy-efficient purchasing policy for at least some plug and process loads in their organizations. Typical energy savings associated with purchasing a commercial sector ENERGY STAR-qualified product over a baseline product vary by technology category, ranging from 7% for scanners to 65% for commercial hot food holding cabinets. (Source: ENERGY STAR website and calculators, 2012.) Improving inventory practices will improve owners' abilities to assess the efficiency of the installed base of existing equipment and the savings potential of further purchasing policy changes.

Food Service Energy Benchmarking – Refrigeration and Food Service

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

Main Barriers Addressed by the Project:	• 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. • Within-portfolio benchmarking efforts are desirable, but existing tools are not fully developed. 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.
Solutions/ Deliverables:	• *ENERGY STAR coverage of food service buildings:* An ENERGY STAR Portfolio Manager model, and building certification criteria, for food service. • *Upgraded CBEA 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* – o EPA input to CBEA benchmarking tool: [Date TBD] o Portfolio Manager and Building Certification release: [Date TBD] o Provide food service data collection needs to CBECS: For incorporation into the CBECS survey for reference year 2016 [Date TBD] • *CBEA Restaurant Energy Use Benchmarking tools* – o Draft of upgrade: [January 2013] o Early-adopter feedback: [April 2013] o Revision and posting to CBEA website: [June 2013] o Deploy tracking and reporting mechanism(s): [Spring 2013] o Engage industry organizations in publicity and training: [starting Summer 2013]
Impact Metrics:	• *ENERGY STAR building certification* – o Estimated [TBD] food service buildings certified within 2 years of release (16 categories with food service, about 8000 total buildings certified) o Estimated [TBD] food service buildings reduce energy by [TBD%], attempting to achieve label • *CBEA Restaurant Energy Use Benchmarking tools* – o *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 CBEA. o *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 (EMSs) – Refrigeration and Food Service

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

Main Barriers Addressed by the Project:	EMS equipment and software is typically designed for large office environments, and has not been optimized for food service buildings, processes, and operational challenges. High initial cost impedes purchase of 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. 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.
Solutions/ Deliverables:	Food Service EMS technology specification (or guidance): Based on an initial review and benchmarking of existing EMS products, a technology specification or set of guidelines will be developed to identify attributes of EMS technology that are critical for optimal performance and success in food service applications.
Deployment Pathway:	*Market review, benchmarking, and input from CBEA members, industry associations, and Food Service Technology Center (FSTC):* Industry associations to include National Assoc. of Food Equipment Manufacturers (NAFEM) and Restaurant Facilities Management Assoc. (RFMA) [October, 2012] *Draft technology specification (or guidance):* [February 2013] *Final technology specification (or guidance):* [April 2013] *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 3-year simple payback. *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 [5] 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.

Refrigeration Commissioning Guide – Refrigeration and Food Service

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

Main Barriers Addressed by the Project:	• 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. Commissioning can also improve system reliability and temperature control. • 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. • Cost: A standard payback is difficult to calculate because systems and end-users vary widely; however, HVAC commissioning is widely cited as a cost-effective means of conserving energy, but data is lacking for supermarket refrigeration. • Data / Awareness: Supermarket managers have few established methods of measuring performance degradation until equipment fails.
Solutions/ Deliverables:	• Refrigeration Commissioning Guide: The guide will provide instructions for commissioning low and medium temperature refrigeration systems, thus systematizing the process and helping to reduce costs and enhance effectiveness. ○ 8-31-2012 (Preliminary DOE Guide): Initial structure of the guide has been developed and is currently out for comment from stakeholders. ○ Spring 2013 (Official Comprehensive ASHRAE Guide): DOE is coordinating with ASHRAE on the development of this guide. ASHRAE is currently finalizing the development of a project committee dedicated to supporting the guide.
Deployment Pathway:	• CBEA Refrigeration Team: Will utilize the final guide in their commissioning efforts. Expect to perform at least 2 test cases at CBEA members and publish results at ASHRAE or other similar conferences. • ASHRAE: Will vet the 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. • Utilities: Will promote refrigeration commissioning through CEE and utilities, since building commissioning is already incentivized by many utilities. Will present plans and results to California Emerging Technology Coordinating Council (ETCC), which represents all major California utilities.
Impact Metrics:	• Number of Members Affected: Guide is adopted by at least 4 members and >10 other major chains. • Measured energy savings per building: Guide results in a minimum of 15% refrigeration energy savings.

Retrofitting Doors on Cases – Refrigeration and Food Service

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

Main Barriers Addressed by the Project:	• Summary: 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. • Technological: End users have stated that retrofits often do not produce the desired performance results due to improper implementation. • Operational: There are no industry-standard best practices for conducting open case retrofits and properly adjusting the refrigeration system as needed. • Data / Awareness: No successful demonstrations with independent third party validation have been publicized.

Solutions/ Deliverables:	• Open Display Case Retrofit Best Practices Guide: A guide outlining industry best practices for planning, executing, and monitoring open display case retrofits.
	  ○ Deliverable Date: 9/30/2012
	  ○ Status: Working document is currently with CBEA members and industry representatives for preliminary review.

Deployment Pathway:	• CBEA Retailer Refrigeration Team: Will utilize the guide as a source of best practices in performing future open display case retrofit projects. • Industry Conferences: Results will be publicized through ASHRAE and FMI at industry conferences to reach a wider audience. • Utilities: Will explore potential for incentives through CEE and individual utilities like Sempra.
Impact Metrics:	• Number of members affected: Guide will be adopted by at least four members. • Through other channels (e.g. ASHRAE, FMI, CEE), expect at least 10 other chains to adopt this approach. • Estimated energy savings per application: Reduction of energy usage on a per-case basis of at least roughly 40% per retrofitted case.

Compressor Racks Specification – Refrigeration and Food Service

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

Main Barriers Addressed by the Project:	• Technological: System designers can currently choose from a wide array of components and technologies when specifying a rack, making it difficult to select the optimal energy-efficient configuration for their application. • Operational: A rack system which is designed following a high-efficiency specification will offer improved performance and lower operating costs. • Cost: A standard payback is difficult to calculate, as project costs and energy savings will vary greatly as a function of the user and the equipment. However, compressor racks are a major expense and are consumers of electrical energy in a supermarket refrigeration system, and thus the efficiency of the design has a major impact on operating costs. • Data / Awareness: 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.

Solutions/ Deliverables:	• Supermarket Compressor Racks Technology Specification: A technical specification outlining specific design attributes and features to be implemented in a high-efficiency system.
	  ○ Deliverable Date: August 31, 2012.
	  ○ Status: A working document is currently being prepared by CBEA members for future review by the team.

Deployment Pathway:	• CBEA Retail Refrigeration Team: Will utilize the specification as a technical guideline when ordering and specifying new compressor rack equipment. Because of the prominence and purchasing volumes of these lead members, manufacturers will respond by developing appropriate products. • Manufacturers: Will promote products through industry organizations and trade shows such as ASHRAE, FMI. • Utilities: Will promote incentives to be offered through CEE and individual utilities, especially California ETCC (Emerging Technology Coordinating Council) members • Non-members: Once higher efficiency systems are offered by key manufacturers, standardization and higher production volumes will make the costs attractive to many non-members.
Impact Metrics:	• Number of members affected: Guide will be adopted and validated by at least four members. Since these members have hundreds of stores, impact will be very large. • Estimated energy savings per application: Reduction of energy use will vary based on comparison to existing equipment, but could be on the order of 10-20% over currently-installed systems.

Advanced Technology Specifications – Refrigeration and Food Service

Technical Lead: Dan Chwastyk, Navigant Consulting, dan.chwastyk@navigant.com, mailto:jeff.mccullough@pnnl.gov202-481-8491

Main Barriers Addressed by the Project:	• Low market demand for high-efficiency options leads to high first-cost premiums due to low economies of scale for manufacturers, and inefficiencies in sales and service infrastructures. Additional technology-specific barriers are listed below. • Ultra-low temp lab freezers (ULFs): Industry has not yet established a uniform, industry-accepted test procedure for published consumption metrics. End users that wish to differentiate based on efficiency cannot obtain comparable energy-performance information. • Fume Hoods: It is very difficult to understand and quantify the efficiency benefits of "high efficiency" hoods. The hood design is only one component in a complex system. One must understand complex interactions of the hoods, the hood usage patterns, the building ventilation system and the ventilation strategy, and the unique safety issues associated with the specific hazardous material(s) involved. • Electric Water Heaters: Heat Pump Water Heaters (HPWHs) require additional space and their impact on space-conditioning loads is not well understood. While the technology is widely available for residences, product range for commercial applications is very limited and not optimized for many foodservice applications. • Distribution Transformers (DTs): DTs are long-lived, which limits replacement opportunities unless accelerated replacement is considered. Furthermore, awareness of high efficiency options is limited because product visibility is low.
Solutions/ Deliverables:	• Advanced Technology Specifications: Specifications for highly efficient products are being developed for multiple technologies, including: ○ ***Specifications in development:*** ▪ Ultra-low Temperature Laboratory Freezers: Efficiency metric is based on a proposed new test procedure (adapted from industry test procedures for commercial freezers) intended to address the key barrier identified above ▪ Link to ULF draft specification ▪ Laboratory Fume Hoods: Performance requirements are structured to provide efficiency improvements regardless of the complex interactions with other system components ▪ Link to Fume Hood draft specification ▪ Commercial Heat Pump Electric Water Heaters: We will work with end users to help ensure that the space requirements are understood, and that the space-conditioning impacts are leveraged to the end user's benefit to provide useful space cooling and dehumidification • Link to Commercial Water Heater draft specification ▪ Distribution Transformers: We will document the economics of accelerated replacement for a range of common replacement scenarios to help inform

	replacement decisions and will target the most economical applications (e.g. healthcare, foodservice). Link to Distribution Transformers draft specification
Deployment Pathway:	• CBEA Members and Associated Industry Members: CBEA members will be the first adopters of these technologies as they begin to use equipment manufactured in accordance with the technology specifications. Documenting and disseminating early successes by major end users will draw attention to the technologies and encourage purchase by others. • Equipment Manufacturers: The technical specifications will communicate to manufacturers the performance requirements that end users seek, and the accompanying interest pledges from end users will help manufacturers justify the development risk/cost associated with the advanced technologies. • Utilities: Work with the Consortium for Energy Efficiency (CEE) and California's Emerging Technologies Coordinating Council (ETCC) to help communicate the energy benefits and development status of each technology. This will provide utilities with information needed to align incentive programs with the specifications. • Work with DOE/EPA's Labs for the 21st Century (Labs21) to promote high-efficiency ULFs and fume hoods • Work with the National Electrical Manufacturers Association to promote high efficiency DTs, possibly through a "premium" label. • Work with the Building Owners and Managers Association International (BOMA) to promote high efficiency DTs
Impact Metrics:	• ULFs: 30% unit savings compared to typical current ULF, and 10% of market shipments by 2014. • Fume Hoods: 30% reduction in volumetric air flow per hood compared to current typical practice, and 20% of shipments in 2014 • EWHs: 50% unit energy savings compared to conventional electric water heaters, reaching 5% of electric water heater shipments in targeted high usage sectors (e.g. foodservice) by 2014 • DTs: 15% unit energy savings compared to conventional DTs, reaching 10% of shipments in targeted high duty cycle commercial-building applications by 2014.

LED Site (Parking Lot) Lighting Project – Lighting and Electrical

Technical Lead: Michael Myer, PNNL, michael.myer@pnnl.gov, 781-862-2321

Main Barriers Addressed by the Project:	A variety of resources have been developed by CBEA to address barriers to increased use of LED site lighting, yet adoption remains fairly low. Resources include:
	• Specification: CBEA LED Site Lighting Specification Version 1.3 with savings of about 50% ; 75% or more with controls was developed by CBEA members and vetted with manufacturers to address the following barriers:
	  ○ Building owners unsure of what to require in parking lots using LEDs (product and performance/design requirements).
	  ○ No specification to reference in RFP materials.
	• Case studies including Gateway Demonstration Assessment of LED Parking Lot Lighting: Walmart, Leavenworth, KS and a Fact Sheet Application Considerations for LED Site Lighting Projects Using the CBEA Performance Specification: A Review of DOE GATEWAY Demonstrations address the following barriers:
	  a. Unfamiliarity with the technology and need to better understand its performance in actual parking lots, and the inherent challenges/lessons learned from demonstration projects.
	• The report: Exterior Lighting for Energy Savings, Security, and Safety was completed to address security and image concerns related to lower light levels (made possible due to improved LED uniformity).
	• The report: Standard Measurement and Verification Plan for Lighting Retrofit Projects for Buildings and Building Sites was developed to address challenges related to measuring performance.
	• Google Map: Identifying sites that have used LEDs, for those who have not seen one.
	• Webinars reached >1000 since 2011, to address lack of awareness beyond the CBEA.
	• Lack of or where to find utility incentives. (NEW barrier being addressed)
	• ROI is around 5 years but is improving. Financing is especially challenging for those with leased sites. (NEW barrier being addressed)
	• Lack of guidance for building the business case. (NEW barrier being addressed)

Solutions/ Deliverables:	• High Efficiency Exterior Lighting Campaign – DOE, IFMA, BOMA, GPC partner to increase adoption of high efficiency parking lot and parking structure lighting by encouraging their membership to adopt lighting performance levels consistent with CBEA Specifications and by offering new resources that address the financial and business case barriers.
	  ○ Ongoing: Providing technical assistance on the Specification
	  ○ TBD: Financial and Business Case resources
	  ○ 8/28/2012: Campaign web site complete
	  ○ 9/28/2012: Partners announce Launch of Campaign (press releases, etc.)
	  ○ 11/28/2012: Partners release participant names; recognize accomplishments
	  ○ Quarterly: Announce key accomplishments

Deployment Pathway:	• CBEA Members: Walmart uses the specification portfolio wide for all new buildings and retrofits when applicable. Regency Centers, Lowe's, and PNC Financial Services Group have sites in the design stage. 19 others are investigating it. • Press: Numerous articles, presentations, and webinars. • Focus on the Campaign to encourage greater application of the technology.
Impact Metrics:	• The total energy savings against company standard practice or energy use before renovation for the 421 CBEA member sites (3 organizations) that have applied the CBEA specs (design or completed construction) is estimated at 551,234,475 kWh. • Campaign partners will develop impact targets.

High-Efficiency Parking Structure Lighting Project – Lighting and Electrical

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Main Barriers Addressed by the Project:	A variety of resources have been developed by CBEA to address barriers to increased use of high efficiency (induction, fluorescent, LED) parking structure lighting, yet adoption remains fairly low. Resources include: • Specification: CBEA High-Efficiency Parking Structure Lighting Version 1.1 with lighting energy savings of about 40%, and even greater savings if lighting controls and daylighting are applied, address the following barriers: a. Building owners unsure of what to require in parking lots using LEDs (product and performance/design requirements). b. No specification to reference in RFP materials. • A Fact Sheet Application Considerations for LED Site Lighting Projects Using the CBEA Performance Specification: A Review of DOE GATEWAY Demonstrations address the following barriers: a. Unfamiliarity with the technology and need to better understand its performance in actual parking lots, and the inherent challenges/lessons learned from demonstration projects. • The report: Exterior Lighting for Energy Savings, Security, and Safety was completed to address security and image concerns related to lower light levels (made possible due to improved LED uniformity). • The report: Standard Measurement and Verification Plan for Lighting Retrofit Projects for Buildings and Building Sites was developed to address challenges related to measuring performance. • Google Map: To pinpoint locations where the technologies are used. • Webinars reached >1000 since 2011, to address lack of awareness beyond the CBEA. • Lack of or where to find utility incentives. (NEW barrier being addressed) • ROI is around 5 years but is improving. Financing is especially challenging for those with leased sites. (NEW barrier being addressed) Lack of guidance for building the business case. (NEW barrier being addressed)
Solutions/ Deliverables:	• High Efficiency Exterior Lighting Campaign – DOE, IFMA, BOMA, GPC partner to increase adoption of high efficiency parking lot and parking structure lighting by encouraging their membership to adopt lighting performance levels consistent with CBEA Specifications and by offering new resources that address the financial and business case barriers. ○ Ongoing: Providing technical assistance on the Specification ○ TBD: Financial and Business Case resources ○ 8/28/2012: Campaign web site complete ○ 9/28/2012: Partners announce Launch of Campaign (press releases, etc.) ○ 11/28/2012: Partners release participant names; recognize accomplishments a. Quarterly: Announce key accomplishments
Deployment Pathway:	• CBEA Members: Cleveland Clinic and NREL each have completed sites. USAA Real Estate and Walmart have sites in the design stage, and 20 others are at various stages of pursuing site(s). • Press: Numerous articles, presentations, and webinars. • Focus on the Campaign to encourage greater application of the technology.
Impact Metrics:	• The total energy savings against company standard practice or energy use before renovation for the 2 CBEA member sites (2 organizations) that have applied the CBEA specs (design or completed construction) is estimated at 1,735,540 kWh. • Campaign partners will develop impact targets.

High-Efficiency Troffer Lighting – Lighting and Electrical

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Main Barriers Addressed by the Project:	The project has developed a specification, and the current focus is on increasing adoption of the specification by CBEA members. • Specification: CBEA High-Efficiency Troffer Lighting Version 3.0 (completed 2/15/12) and Fact Sheet: CBEA High-Efficiency Troffer Lighting Specification. Potential savings from applying the specification range from 15–45% on a one-for-one basis and up to 75% with the use of controls. Fifty percent of all commercial fluorescent lighting fixtures are recessed troffers in 2'x4', 2'x2' and 1'x4' configurations, in operation for more than 10 hours a day on average and collectively consuming more than 87 terawatt-hours of electricity annually. . Lack of guidance on what to require from vendors in high efficiency LED troffer luminaires. a. Unfamiliarity with LED technology and need to better understand its performance in actual applications, and the inherent challenges/lessons learned from demonstration projects. • Lack of awareness of the specification beyond the CBEAs. (Not addressed currently) • Tracking utility incentives is difficult. • Initial cost differential is high relative to incumbents. (Not addressed currently)
Solutions/ Deliverables:	• Outreach to date: ○ Webinar: High-Efficiency Troffer Specification [616 attendees]. ○ Webinar: High-Efficiency Troffer Specification [531 attendees]. • Project Team meetings to discuss specification application at specific sites and to share information on where to find utility incentives. • Assistance with the GSA demonstration. • Technical assistance to CBEA members interested in adopting the specification.
Deployment Pathway:	• CBEA Members: ○ GSA applied the spec in a demonstration site in San Francisco, [12/12 completion]. Colliers and HealthSouth are considering the spec. ○ U.S. General Services Administration (Project Chair), Cleveland Clinic, Wendy's/Arby's Group Inc., Cushman & Wakefield Inc., USAA Real Estate Co., CB Richard Ellis Group, Inc., Sinai Health System, IMCOM, IES, SUPERVALU INC., Target Corp., The Home Depot, Inc. and Macy's Inc. are members of the project team. • Press: ○ A number of articles were run after DOE released the specification on 2/15/2012, including: Optronic Laboratories article links to LEDs Magazine: DOE updates energy-saving specifications for troffers, parking luminaires; Facilities Management News article DOE releases energy-saving specifications for commercial lighting;Green Energy article Energy Department Announces Market-Driven Energy-Saving Specifications for Commercial Lighting; LEDs Magazine news release DOE updates energy-saving specifications for troffers, parking-lot luminaires. ○ On Green Business article Energy Department Announces Market-Driven Energy-Saving Specifications for Commercial Lighting.
Impact Metrics:	• Number of members and others applying the specification. • Number of utilities offering incentives for troffers that meet the specification.

Commercial Building Re-Tuning – Market Transformation

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Main Barriers Addressed by the Project:	• Commissioning is not standard in buildings operations training, yet the energy savings potential is significant (estimated at $30 billion per year by 2030 by one study)[1] • Organizations must pay for additional training or hire service providers to implement commissioning, and few organizations are systematically implementing this practice across their portfolio
Solutions/ Deliverables:	• Deliverable Name: Building Re-Tuning • Status: In progress, recruiting CBEA members to participate • Description: Building re-tuning is a scaled down version of retro-commissioning that leverages data from a building's existing building automation system (BAS) and a systematic process to identify operational inefficiencies. This methodology 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. DOE PNNL is offering free building re-tuning train-the-trainer sessions for CBEA 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
Deployment Pathway:	• DOE and PNNL will host up to 3 commercial building re-tuning train-the-trainer sessions for organizations willing to implement across their portfolios • Participating CBEA members will 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 (%)

[1] Evan Mills. 2009. "Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-gas Emissions"

Green Leasing – Market Transformation

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Main Barriers Addressed by the Project:	• 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 of green leasing or how they can implement this practice to the benefit of both parties • There are many existing resources for implementing green leasing, but they are spread out across multiple organization websites. These resources are intended for a variety of audience types with differing scope, making it difficult to find the resources that will be most helpful in a specific situation
Solutions / Deliverables:	• Deliverable Name: Green Lease Library • Status: Completed, drafting additional resources to post on the website • Description: The Market Transformation team collaborated with 7 outside organizations (e.g., BOMA International, Institute for Market Transformation, and the Rocky Mountain Institute), to consolidate resources and categorize them according to audience. Next, the team created a one-stop-shop website to serve as a hub for green leasing resources, which will be kept updated as new resources are created. The green lease library categorizes and organizes resources into type and audience. DOE hosted a green leasing webinar to debut the Green Lease Library and to provide expert insight into the current state of green leasing in the market. Currently, the market transformation team is coordinating with outside stakeholders to increase adoption of green leasing by promoting this practice through case studies that illustrate successful implementation
Deployment Pathway:	• DOE partnered with stakeholder organizations to identify gaps in deployment of green leasing best practices • CBEA members are utilizing the resources in the green lease library and the DOE webinar to evaluate and implement green leasing practices in their organization • The market transformation team is working with CBEA members to promote green leasing adoption by identifying successful implementation and additional barriers. These successes will be published into case studies and posted onto the green lease library
Impact Metrics:	• Number of CBEA members implementing green leasing practices and participating in DOE green leasing case studies • Energy savings reported in green leasing case studies (kWh per year)