# DOE's Commercial Buildings Program: A Market-Based Approach to Zero Energy Performance

*Dru Crawley, U.S. Department of Energy*
*Paul Torcellini, National Renewable Energy Laboratory*
*Linda Sandahl, Sean McDonald, and Andrew Nicholls,*
*Pacific Northwest National Laboratory*

**ABSTRACT**

The United States has approximately 2,665 square miles (6900 square kilometers) of commercial floor space and is projected to add 1,210 square miles (3130 square kilometers) of new floor space between now and 2030. Lighting, space conditioning and other energy service demands in commercial buildings currently require 35% of the nation's electricity and 22% of its natural gas. Projected increases in floor space (and small increases in intensity) by EIA are also projected to add 580 million metric tons of $CO_2$ equivalent gases by 2030.

To help meet these challenges, the DOE Commercial Building Integration Program has embarked on a distinctly new strategy, while still focusing on a goal of marketable net-zero energy buildings (ZEB) by 2025. This paper provides the rationale and an overview of this new strategy as well as progress to date. One key aspect of this strategy is "National Energy Alliances" with commercial building owners and operators in combination with other organizations. This approach is designed to achieve strong market demand-pull for buildings with exemplary energy performance (50% and higher) in large numbers of new buildings. DOE is working collaboratively with both national energy alliances of commercial building subsectors, and with specific national accounts (a company with a portfolio of buildings) willing to take a leading role in designing, constructing, and replicating energy efficient buildings.

The paper also discusses the systematic prioritization of DOE's current and future commercial R&D portfolio to directly support DOE's ZEB goal, and the systematic use of analysis to aid in decision making.

## Background

America's nearly 5 million commercial buildings comprise roughly 75 billion ft$^2$ (7 billion m$^2$) of floor space (or about 2700 square miles). These buildings include schools, offices, warehouses, hospitals, retail and grocery stores, hotels and motels, restaurants, and institutions of religious worship. Energy is needed to provide services in these buildings including lighting, heating, cooling, ventilation, cooking, refrigeration, and water heating, as well as a vast array of miscellaneous electrical equipment including computers, fax machines, and specialized equipments (e.g., medical devices).. In all, the commercial sector requires approximately 18 quadrillion Btu of primary energy per year – about 18% of total U.S. energy use. Associated carbon dioxide ($CO_2$) emissions of 288 MMTCE (million metric tons of carbon equivalent) also represent about 18% of the U.S. anthropogenic emissions. (In comparison, Japan's *total* emissions are 344 MMTCE.) Nationally, commercial buildings use 35% of the nation's electricity and have commensurate impacts of peak system demand (DOE 2007).

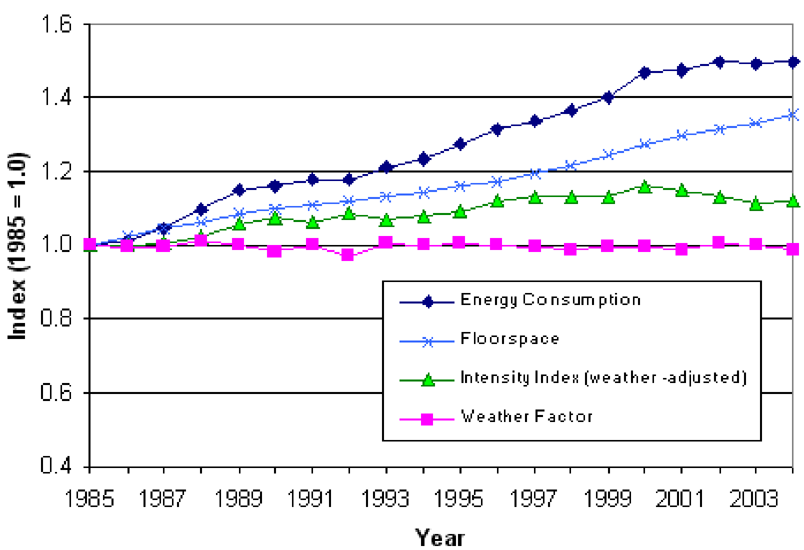
It is well established that stabilizing atmospheric concentrations of greenhouse gases requires sharp absolute declines in annual emissions of GHGs, eventually approaching zero (IPCC 2007). In the commercial sector, total floor space requirements are driven by population growth and economic activity (GDP). Consider that total commercial energy use per year can be represented by multiplying total floor area by stock energy intensity (Btu/ft$^2$·yr or MJ/m$^2$·yr). In order to hold total energy use constant, by no means sufficient to stabilize GHG concentrations, projected growth in floorspace would have to be offset by decreases in intensity.

As shown in Figure 1, commercial building sector energy intensity, adjusted for weather, has actually increased by 12% from 1985 through 2004 (DOE 2008b). In a few locations, such as California, energy use intensity remains constant, at least in the recent past. However, with new construction, the total floor area continues to grow, increasing overall energy use. This increase occurred despite a number of countervailing factors:

- Increased building code stringency
- Better technologies (such as T-8 or T-5 lamps and more efficient chillers)
- More stringent standards for equipment
- Increased awareness of efficiency through green building programs (e.g., Green Building Council's LEED™ rating and also GreenGlobes™)

While important, underlying reasons for this increase lie beyond the scope of this paper. What is important is the challenge presented by this intensity trend, the growth of magnitude of this sector, and DOE's strategy to address the increase in energy use.

**Figure 1: Commercial Energy Use, Activity, Weather, & Intensity, 1985-2004 (DOE 2007)**




The Energy Information Administration (EIA) provides the official DOE projection of future energy use. Key economic and commercial building characteristics are summarized in Table 1 for the base year (2006) and for future projections (EIA 2008). Increases in population and greater economic activity (first two rows) together drive growth in the stock of commercial buildings which increases by 26 billion square feet by 2030 (third row). The share of *new* buildings is actually higher as older buildings are demolished over this period. The increase in building area, coupled with EIA's projection of slightly *increasing* energy intensity (row 5), combine to result in an increase an additional 7 quadrillion Btu (Quad) of energy use in 2030 as compared with 2006 (row 4); nearly 90% of which is in the form of electricity.[1] This 7 Quad increase accounts for nearly 40% of the total US energy growth in 2030.[2]

**Table 1: Projections of Key U. S. Energy Drivers and Use (EIA AEO 2008, Early Release)**

| Characteristic | | Units | 2006 | 2030 | Absolute Change | % Increase |
|---|---|---|---|---|---|---|
| Population | | Million | 300.1 | 365.6 | 65.5 | 22% |
| Real GDP | | Billion 2000 $ weighted | 11,319 | 20,832 | 9,513 | 84% |
| Commercial Building | Floor Area | Billion $ft^2$ | 74.8 | 100.9 | 26.1 | 35% |
| | Primary Energy Use | Quadrillion Btu | 18 | 25.1 | 7.1 | 39% |
| | Energy Intensity | Thousand Btu/$ft^2$ | 241.1 | 248.8 | 7.7 | 3% |
| | $CO_2$ Emissions | Million Metric Tons, $CO_2$ | 1046 | 1482 | 436 | 42% |
| Purchased Electricity (Site) | All Sectors | Quadrillion Btu | 12.5 | 16.7 | 4.2 | 34% |
| | Commercial Sector | Quadrillion Btu | 4.4 | 6.7 | 2.2 | 52% |
| Electric Power Sector Net Summer Capacity | | GW | 914.7 | 1114.6 | 199.9 | 22% |

The importance of this sector to total electricity growth is vividly demonstrated by comparing total U.S. use with commercial sector purchased electricity. In all, 53% of the total projected growth in electricity use is due to commercial. The growth in U.S. demand for electricity will require 200 GigaWatts (GW) of new generating capacity by 2030; much met by coal-fired plants. As the commercial sector represents a little more than half of this growth; it is reasonable to assume that half of future capacity growth, or 100 GW, will be due to commercial buildings. For perspective, the Grand Coulee dam, the largest generator in the U.S., is rated at 6.8 GW.

This increased electricity use has implications for $CO_2$ emissions. For the commercial sector, $CO_2$ emissions are projected to increase by 436 million metric tons or about 42%. Much of this increase is tied to electricity production. On the whole, $CO_2$ emissions from the commercial sector are projected to account for over 45% of the increase of US emissions by 2030.[3]

[1] The EIA reference case assumes future improvements in efficiency for commercial equipment and building shells will offset increased demand for energy services such that energy consumption intensity ($\text{Btu/ft}^2\cdot\text{yr}$ or $\text{MJ/m}^2\cdot\text{yr}$ ) shows little change over the forecast period. Growth in total energy consumption is driven by floor space additions, which EIA attributes to the continued transition to a service economy (AEO 2007, pg 75).

[2] When combined with the Residential sector, the building sector in total account for over 60% of US energy growth in 2030 as compared with 2006 (AEO 2008, Table 2.).

[3] These are just projections—the AEO reference case extends current trends based on the best information available today. National and state policies and programs could deliver a very different commercial buildings future.

The Department of Energy's Building Technologies Program seeks to transform the building sector with a goal of net-zero energy consumption. This net-zero focus, is seemingly primarily for new buildings, which is still important in order to avoid increased energy burden. Existing buildings are more difficult to address as compared to opportunities in new construction, but are still within scope of the net-zero goal. That is, technologies and practices pursued toward this net-zero energy performance, while "easier" to implement in new construction, have application to existing buildings.

DOE's long-term goal for Commercial Buildings is to:

*"Develop cost-effective technologies and building practices that will enable the design and construction of net Zero Energy Buildings—commercial buildings that produce as much energy as they use on an annual basis—by 2025."*

DOE is not alone in this effort. The vision of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE 2007) is similar:

*"The building community will produce market viable net zero energy buildings (NZEBs) by the year 2030."*

It is important to determine the feasibility of these levels of performance. DOE commissioned the National Renewable Energy Laboratory (NREL) to examine the technical, not market or economic, feasibility of achieving "net zero" performance. NREL sought to answer two questions:

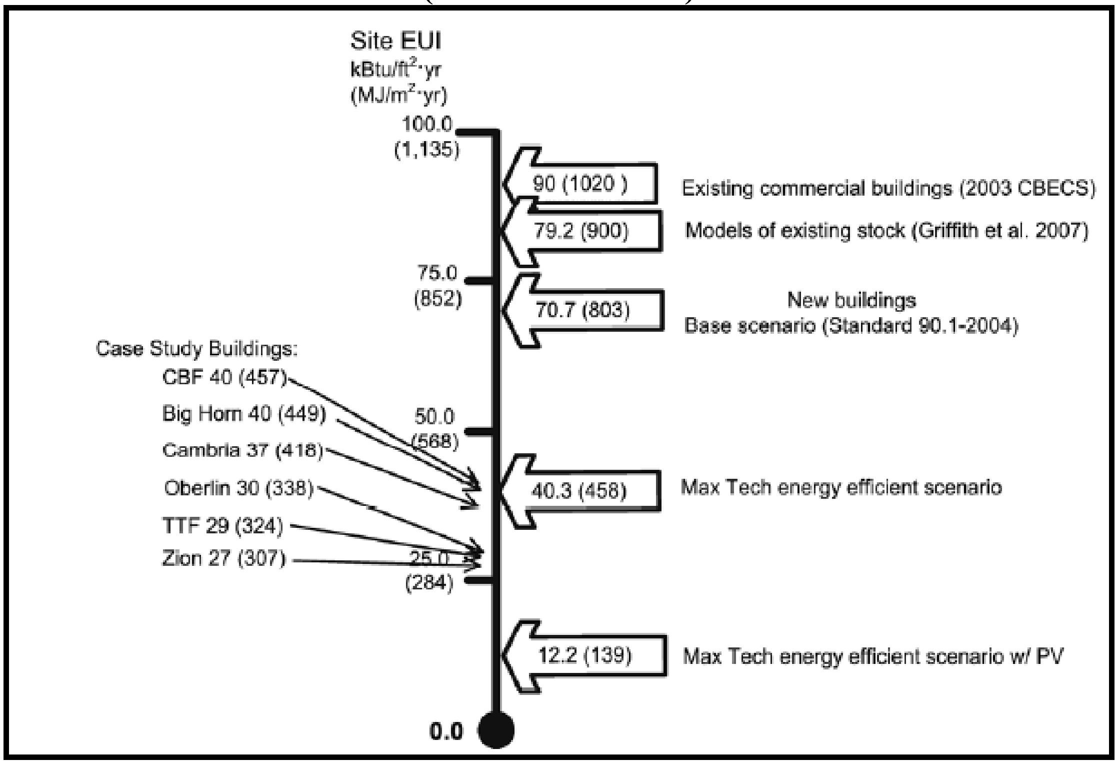
1) "How low can you practically go in terms of energy use?
2) To what extent can rooftop photovoltaics (PV) supply the remaining energy needs of commercial buildings?"

NREL's principal found that 62% of *today's* buildings, representing 47% of today's commercial floorspace could have been net zero if proper technologies and design practices had been deployed.

A useful device for gauging energy performance in the commercial sector is the efficiency "thermometer" shown in

Figure 2. This thermometer is stated in terms of descending energy intensity. At the “top” of Figure 2 is the energy use intensity (EUI) for the existing commercial stock which is 90 kBtu/ft$^2$·yr (1020 MJ/m$^2$·yr) as reported by EIA in the Commercial Building Energy Consumption Survey (CBECS). If all buildings were rebuilt to ASHRAE Standard 90.1-2004, the average EUI could drop to 70.7 kBtu/ft$^2$·yr (803 MJ/m$^2$·yr). This is also the national standard for buildings as required in the Energy Policy Act of 2005.

**Figure 2: Average Results for EUI for Current Stock, Minimum Standard (Griffith et al. 2007)**




By applying a comprehensive package of technologies and practices ("Max Tech"), average EUI could be further reduced to as little as 40.3 kBtu/ft$^2$·yr (458 MJ/m$^2$·yr). "Max Tech" is a collection of currently available, though not necessarily currently economic, best practices and technologies. A handful of case study buildings are already *operating* at or below this level. The widespread installation of rooftop PV power systems (with half the roof area covered in PV and unrestricted export of excess electricity) could lead to a net EUI of just 12.2 kBtu/ft$^2$·yr (139 MJ/m$^2$·yr). At this level of energy intensity, many buildings would produce more energy than they consume.

The challenge for DOE, in summary, is to realize exemplary performance not in hundreds of buildings but in the hundreds of thousands, and sooner, not later. Figure 1,

Figure 2, and Table 1 demonstrate the challenge in addressing commercial building energy use. To achieve the goal of net zero energy performance, the intensity trend in Figure 1 must fall to “max tech” levels shown in Figure 2. This is especially true of new floorspace constructed between now and 2030. Designing and constructing buildings with high performance now is especially important, given very long lifetimes of 65-80 years. Buildings cast long carbon dioxide “shadows” into the future.

## The Commercial Marketplace

The literature suggests a number of factors that should be considered to effectively transform the commercial building market. Reed and Johnson (2006) provide an excellent summary of Rogers’ work on the “Diffusion of Innovations.” Diffusion Innovations theory provides a meaningful framework for examining how to analyze, approach, and impact markets.

The obvious implications for program design are to target efforts towards decision makers. But diffusion innovation tells us to further target efforts to decision makers who:

- “Have relatively compact and homogeneous networks of firms and individuals
- Have numerous facilities and extensive linkages within their own firms and/or with other firms
- Are likely to reference each other
- Can be easily addressed through one-to-one contact.”

For commercial buildings, this translates to organizations that centrally manage many facilities. These organizations would have established networks and show a willingness to try new ideas. As an example, just 100 companies sell 80 percent of the groceries in the United States.

Lutzinhiser and Biggart (2001) set out to answer the question, “Why aren’t commercial office buildings more energy efficient?” They empirically examined the dynamics of new commercial building markets with the goal to develop knowledge to support strategic interventions. While the work was focused primarily on new office buildings in California and the Pacific Northwest, the principles have broader applicability. They found “that effective demand-side management (DSM) or market transformation (MT) efforts in such a complex, multi-actor, multi-interest (office construction) system cannot be simple, but need to attack the problem on multiple levels, in concert with the efforts of multiple market and non-market allies.” The authors found that it is insufficient to simply introduce new energy efficient technologies. Instead, the entire building development and design process must be changed to facilitate change. The authors assert that the “change process must occur at three levels:

- Making energy efficiency relevant to the market
- Encouraging demand and institutionalizing energy efficiency in the market place
- Standardization within the development and design process (supplying buildings that are energy efficient).”

On the first level, making efficiency relevant, Lutzinhiser and Biggart identified several trends of relevance. These trends include the movement toward more green and sustainable buildings, the impacts of energy price volatility and requirements for more reliable energy supply, and the growing interest in providing quality work environments to attract and retain employees. With regard to the second level, they identify six factors:

- Working in progressive markets
- Working with build-to-suit projects
- Engaging large institutional users
- Engaging vertically integrated property developers and managers
- Involving institutional investors
- Developing supportive policy and regulatory approaches (e.g., building codes, certifications, and others)

In other energy efficiency market research, Sandahl et al (2006) reviewed efforts to increase market acceptance of CFLs. They sought to identify market barriers and from this historical experience derive lessons learned "in hopes of assisting future market introduction efforts for other promising energy-efficient lighting technologies." Some of the relevant "lessons learned" include:

- Study market structure to see how best to introduce a new technology
- Introduce and focus efforts in niche markets and applications where benefits are clearly defined, and consistent with buyer needs
- Be aggressive in dealing with technology failures that affect stated benefits
- Coordinate manufacturers and advocacy groups efforts to establish performance requirements
- Be specific about benefits: How long do they last? How much do they save?
- Shift focus from product price to product value, and advertise advantages of new technology and disadvantages of old
- Target training and awareness campaigns to market channels such as builders, designers, and retailers

## Strategic Energy Alliances

In the previous sections we established the context, need, and factors for attempting to address energy use in the commercial sector. Energy use in the commercial sector is important, and growing, and the technical potential exists to reduce energy use. Tapping this potential requires a well-constructed and executed strategy. The strategy should consider not only where the opportunities exist, but how, and even more importantly who to work with to capture energy savings. It is insufficient to merely publish research results or suggest certain practices to build design and operate buildings. The strategy must fully engage those organizations which design, build, own, and operate commercial buildings.

Up to the present, DOE's focus was on developing the analytic foundation and technical pathway for achieving low- and zero- energy buildings. The past strategy focused on case studies of low energy buildings and developing feasibility studies of market potential. This past work provides the foundation for current work including ongoing development of design guides focused on 30 to 50% energy reductions. DOE continues to fund modest R&D activities in cross-cutting, integrating technologies such as commissioning, sensors and controls, and indoor environmental quality. These research activities establish the analytical basis and technical pathway for achieving increasing levels of energy efficiency.

Beginning in the current fiscal year, DOE is embarking on a new strategy to directly engage building owners and operators. This is not a simple “extension” of the existing portfolio. Instead, it relies on an entirely new mechanism to test, evaluate, and deploy technologies as well as to shape R&D and technology integration efforts for commercial buildings. This new strategy relies on close alliances with commercial building owners and operators grouped according to building use business models. By working within these alliances, and directly with individual firms or “national accounts” to develop new prototype, highly efficient buildings, DOE is moving beyond design guides and small efforts in research and analysis. DOE seeks to establish, in concrete and mortar, reproducible building types at ever increasing levels of efficiency. The primary goals of this new strategy are:

- Energy improvements in new construction of 50% by 2015 and 70% by 2025 relative to ASHRAE 90.1-2004.
- Improve the stock of existing buildings by providing the technical capability to improve energy performance 30% by 2025 over the CBECS 2003 baseline.
- Establish a strong market focus via national energy alliances in retail and other building subsectors and with “national accounts” as key participants.

In working with the private sector, key guiding watchwords include “flexibility,” “collaborative,” “creative,” and “responsive.” The approach is to plan, develop, demonstrate, test, and evaluate results at increasing levels of efficiency for a variety of building types. All existing DOE efforts, from research to analysis, are now refocused to support these goals. Research elements will be focused on technology options that can be implemented in buildings. Finally, analysis work will be targeted directly to answer questions in support of this new strategy.

The strategy consists of two key components. The first is to establish National Energy Alliances which engage businesses and organizations with similar building types, (for example, “big box” one-story, high ceiling) and business sectors (for example, retail, and office). These building and sectors will likely have similar energy use profiles and potential solution sets.

This aspect of the strategy addresses the first three principles of rapid diffusion: (1) compact and homogeneous networks, (2) with numerous facilities linkages, (3) which are likely to reference each other (Reed and Johnson 2006). The second aspect of the strategy is the use of National Accounts. These National Accounts are companies within the alliances which choose to lead through incorporating changes in design, construction, and building operation. The design is for the National Accounts to share results with Alliance members. This addresses Reed and Johnson’s fourth principle of (4) one-to-one contact.

## National Energy Alliances (NEAs)

The National Energy Alliances (NEAs) are informal associations, with agreements to share information subject to self-imposed limitations. The members share a common goal in reducing energy consumption in their buildings and commit to actively participate and when possible, take the lead as a National Account. The NEA strategy includes tasks which are specifically designed to improve design and operation of new and existing buildings.

DOE has determined an initial priority ordering for target market sectors. This prioritization is based on rank ordering of energy usage in these market sectors and on recent analysis of ZEB potential by the National Renewable Energy Laboratory. This ranking determines the temporal order as to when DOE will establish alliances and commit resources. The current order is:

1) Retail, which includes:
   - Food Sales/General Merchandise (e.g., Wal-Mart, Target, or "Big-Box")
   - Food Only (e.g., Whole Foods, Food Lion)
   - General Merchandise Only (e.g., Home Depot, Petco)
   - Food Service (e.g., McDonalds, Starbucks, Olive Garden)
   - Warehousing and Distribution (e.g., United Parcel Service, Fed Express)
2) Commercial Real Estate (Office Buildings, Leased Property, Lodging)
3) Institutional (including Colleges and Universities, K-12 Schools, Hospitals, Healthcare, and State and Local Government)

The Retail sector was chosen first as it accounts for 18% of energy consumption and 20% of total commercial floor space. It is also the fastest growing subsector. New construction is "key" to the strategy, and growth is a strong selection criterion. The retail sector is very diverse ranging from small corner stores to large retail stores often exceeding 200,000 $ft^2$ (20,000 $m^2$). As such, success in this market may be replicable to other commercial sub-markets. The retail sector is also thought to provide an opportunity for wide-spread adoption of energy efficient and renewable energy strategies as large retail firms build multiple copies of the same design. In addition, there are similarities among retailer building design and operation that may ease transfer of learning to others.

The primary goals of the Alliances are threefold:

- Share knowledge and experience to improve energy efficiency in existing buildings
- Bind together through joint procurements to "pull" equipment to higher levels of efficiency
- Consider new design, construction, and operation approaches provided in "Technology Option Sets" (TOSs) and Building Decision Tools implemented through the National Accounts (and discussed in subsequent sections)

Information sharing takes the form of benchmark data for current operations and best practices. Individual Alliance members submit data to DOE on current buildings such as, size and location, year of construction, energy use by fuel, and energy service equipment (e.g., HVAC, lighting, refrigeration). This baseline data can be summarized and provided back to all Alliance members in an aggregate fashion masking individual stores and owners. Members with buildings that represent energy outliers (very high or very low energy use) will participate in more detailed "Best Practices" studies. Re-benchmarking can take place annually to determine if Alliance members have improved energy use in existing buildings and to determine if DOE, through these Alliances, has been able to "move the market." This baseline analysis forms the primary measure for determining whether DOE is reaching its goal of achieving a 30% improvement in existing buildings by 2025.

Using technology procurements, NEA members will specify and purchase equipment with enhanced energy performance characteristics. This equipment may be beyond current market offerings or these procurements may help bring down the cost of underutilized "cutting-edge" equipment. DOE has used this approach successfully in the past, such as in the introduction of (efficient) compact fluorescent lamps (Hollomon et al 2002). The Retailer alliance has identified a starting list of desired equipment and DOE is developing draft specifications and accompanying energy analysis. This analysis will help inform alliance members as to which equipment procurements will be pursued first. Succeeding rounds of procurements will work down the list or push up levels of key equipment to higher levels of efficiency. An analysis of the market impacts of the procurement process will be undertaken to determine whether the process has increased the number of manufacturers who are offering, as part of their product line, equipment at the higher efficiency levels specified in the procurements.

## National Accounts

By design, "National Accounts" are identified from within each NEA. A National Account is a company or organization that designs, builds, owns, and operates its own stock of buildings (for instance chains such as Wal-Mart, and Home Depot). Companies or organizations take a lead role in designing, constructing, analyzing, retrofitting and replicating energy efficient buildings using their current building construction schedule. Each National Account enters into a formal Memorandum of Understanding (MOU) with DOE that specifies the roles, goals, and commitments by both DOE and the National Account.

In general, it is envisioned that the National Account would agree to:

- Submit current design drawings and specifications for technical analysis
- Work with a technical team to determine an acceptable set of design and operational changes that will save greater than 30% of the energy use over the current design.
- Construct at least one (1) new building according to the new design.
- Contract for third party commissioning of the building.
- Allow long-term monitoring of building operation and energy use.
- Conduct an analysis and retrofit of at least one of their most energy inefficient existing buildings.

In return, it is envisioned that DOE would agree to:

- Analyze the current design to determine current energy usage.
- Provide expertise and consulting services in developing the most energy-efficient building that meets the business needs and cost targets of the National Account.
- Train National Accounts design team on use of the Building Decision tool.
- Monitor and verify energy savings.
- Help the National Account to extend these energy efficiency measures in existing buildings.

And concurrently, the National Account and DOE would agree to:

- Share the results of the re-design with Alliance and potentially more broadly.
- Allow unlimited access to the resulting Building Decision Tool
- Promote the results of the program

The basic process is ideally envisioned to work as follows:

1. DOE enters into an MOU with one or more National Accounts
2. Technical Assistance Teams will be established to work with the National Accounts' design, construction and retrofit teams, to develop an alternative Prototype Design.
3. An alternative prototype design will be developed that meets basic requirements of the current design but with technology offerings that reduce energy consumption by 50% and beyond.
4. National Account selects a level of efficiency (and technology) that meets its business case and incorporate these into the accepted design

5. National Account builds at least one prototype building and agree to third party commissioning and monitoring.
6. Technical Assistance Teams re-simulate the "As Built" building to determine the new energy savings level and fully document the design for recommendation back to the Alliance
7. National Account adopts the new design as the standard for all future buildings.

If the energy savings level is less than 50% in the new Design Prototype, which is expected early on, DOE will initiate a new design-build cycle. DOE will work with the existing National Account, or other National Accounts, to develop higher levels of efficiency for the next Design prototype. Alternative Building Packages will be developed and analyzed and put forward for consideration.

From DOE's perspective, the ultimate goal is to develop prototype designs for each building type that achieve 50% or greater energy savings as compared to ASHRAE Standard 90.1-2004 and DOE-developed benchmarks. We recognize, however, that the National Account will select the design, and associated efficiency level, that meets its business model including cost constraints and operating needs. However, the full spectrum of choices with 30 to 70% energy savings will be analyzed and documented so that other members of the Alliance have the ability to make alternative choices.

## Decision Tools and Technology Option Sets

To support technical goals for achieving ever high levels of efficiency, DOE is developing both the technologies and the tools for design of new prototype buildings. DOE is developing decision tools that will enable design practitioners to quickly and efficiently evaluate the energy saving contributions of various technology "packages." Conceptually, these tools can be visualized as somewhere in the middle of a continuum that includes full-fledged EnergyPlus simulations on one side, and prescriptive, single-solution (and hard-copy) design guides on the other. By using EnergyPlus as the background calculation engine, the tools will essentially present pre-packaged results tailored for a specific building type and location. They will also feature a menu of technology packages–advanced thermal envelopes, toplighting, daylighting, novel HVAC strategies, reduced plug loads, and so forth. The user will be able to evaluate, for a specific whole building energy savings target, the various pathways to it, and to determine the relative impacts of different approaches. The decision tool will offer the advantage of being much simpler to use while retaining its power to explore various options.

Future DOE research will be focused on development of technology option sets (TOSs) that *directly support* 50% to 70% whole-building energy savings targets in new construction, and where applicable, the 30-50% targets in existing buildings. Technology Option Sets are defined as specific energy efficient solutions for a specific building type or process-specific design. Technology Option Sets may include equipment, strategies, algorithms, methods, and systems. Specific examples of TOS include various approaches to delivering illumination services (and consideration of their impacts on space conditioning), approaches to ventilation and impacts on indoor air quality, and methods for providing space conditioning services.

## Status of the Retailer Energy Alliance

### Development and Goals

In July 2007, representatives of DOE, Wal-Mart, Whole Foods Market, Target, Food Lion, IESNA, and ASHRAE met to discuss collaborative efforts to improve the energy efficiency of retail buildings via the Retailer Energy Alliance (REA). The Alliance was formally inaugurated in February 2008. By March 2008, the REA Steering Committee had grown to 9 retailers plus supporting organizations (Table 2). The Steering Committee defined the purpose and goals, roles of the various parties, activities, and joint projects. Currently more than 15 companies are members of the REA.

**Table 2: Retailer Energy Alliance Steering Committee Members**

| Company/Organization | |
|---|---|
| Wal-Mart | Whole Foods |
| Target | Food Lion |
| Best Buy | Kohl's |
| McDonalds | Home Depot |
| Staples | U.S. Department of Energy |
| American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) | |
| Illuminating Engineering Society of North America (IESNA) | |

Activities identified by the REA include:

- Developing benchmark information on current retail building operations based on information and data contributed by REA members, and subsequently summarized in an aggregate fashion masking individual stores and owners.
- Developing a set of best practice information, terminology, and tools.
- Developing a Web site that provides retail companies with easy access to tools and resources to help them initiate and implement substantial reductions in energy consumption.
- Coordinating a national campaign to encourage retail building owners to conduct energy savings assessments that benchmark their energy consumption and identify process and equipment improvements.
- Training company staff about how to conduct energy savings assessments, including tools for identifying energy efficiency enhancements.
- Defining potential areas of high-impact research and development relating to low-energy retail buildings.
- Identifying technologies that have the potential to save energy and implement these technologies through multiple retail partners.
- Determining how future building products should look–via research–to reduce energy costs.
- Provide a discussion forum to share lessons learned and experiences.
- Engaging in joint development and implementation of technology procurement projects, intended to help pull advanced energy-efficient, competitively-priced technologies into the market using the combined purchasing power of REA members.

## Accomplishments to Date

The REA's initial goals were to develop an organizational framework, build membership and identify activities that could result in "quick wins" for the alliance. By October 2007, the REA had a strong Steering Committee in place, a Memo of Understanding outlining member roles for participating in the REA, and a web site describing the benefits of membership and partner expectations (DOE 2008c).

A Retail Executive Roundtable on February 21, 2008 signified the organization's official public announcement. Senior staff from REA members discussed their views on a variety of topics including the importance of energy efficiency and sustainability in building operations, and their company's commitment to the REA.

By March 2008, the REA's had identified a menu of project options for collaborative efforts by REA members (see

Table 3). Among the projects is a technology procurement aimed at a large, coordinated purchase of Light Emitting Diode (LED) parking lot lights. The project includes product testing, demonstrations, and development of a LED parking lot light specification and a Request for Proposal. Wal-Mart announced its intentions to illuminate 1,000 of its stores with lighting systems developed as part of this project, and other REA members are likely to participate in project development and purchases.

DOE is working to develop additional alliances. In February 2008, work began to establish a working group for the second Alliance, the Commercial Real Estate Energy Alliance. The activities developed under this alliance may or may not parallel the REA. DOE's watchwords of "flexibility," "collaborative," "creative," and "responsive" will be used in the formation and conduct of future Alliances.

## Conclusion

DOE has developed a new strategy to address the considerable and growing energy use in the commercial building sector. While this strategy is a significant departure from past analytical and technology efforts, it builds upon that analytical base and seeks to incorporate current (and future) R&D. Analysis was used to target markets and approaches. The strategy is based on an expanded understanding of the market—refined after multiple discussions with potential Alliance members.

While this strategy is new, performance measures were developed to assess progress towards goals and will be used to adjust and redirect resources. The strategy will also vary to meet the needs of each Alliance and National Account. While the overarching goals for DOE remain fixed, the path to those goals depends, and in many ways will reflect, the needs of the Alliances. While DOE goals are long-term, Alliance members have already expressed a desire for quick wins. The challenge will be for DOE to maintain the commitment given uncertain resources and to meet Alliance members' expectations for rapid change while moving towards the longer term goal of net-zero commercial buildings.

**Table 3: Candidate REA Projects, March 2008**

| Project Title | Description |
|---|---|
| | **Quick Win Project: Duration of < 1 year** |
| Building Temperature Set Point Reductions | Conduct analysis to determine potential energy savings by reducing building temperatures by one percent degree or more. Develop outreach materials for retailers to use in selling this idea if it makes sense for them. |
| Menu of Retail Operational Strategies | Developed based on confirmed practices by REA members, including a savings matrix. Based on input from a wide set of REA members. |
| Address Local Code Issues | While the National model codes have been well vetted, some local building codes include antiquated requirements for ventilation and other measures. Addressing these issues with a combined voice from REA could lead to improved codes. |
| Equipment sizing | Analysis could help optimally size building equipment, which is often oversized. Data from retailers would help define run times for various equipment could help with the analysis. |
| Web Based Data Collection | Complete a method for collecting data from retailers to assist with benchmarking. |
| | **Innovation Project: Duration 1-2 years** |
| LED Parking Lot Lighting - | Technology procurement project aimed at a large, coordinated purchase, with product testing, demonstrations, and development of a specification and Request for Proposal to be released to industry. |
| 18 EER Equipment | Explore with equipment manufacturers the opportunity to increase the EER on RTUs from 12 to 18 at a small incremental price for large volumes. |
| Pilot Study of CLI Guideline | The DOE Commercial Lighting Initiative has developed whole building lighting solutions that involves ambient, task, and controls lighting. There is a need to pilot it and meter energy use in the various sectors to verify savings from these practices. |
| LED Refrigerated Case Lighting Technology Procurement | Some REA members are already successfully using these, but the first cost is high. This project could refine product features and lower price. |
| Improved Equipment Defrost Cycles | Ideally, defrost cycles should be tied to dew point or some other more robust indicator, versus a timer. This project would explore various options and make recommendations based on store climate zone and operational issues. |
| | **Game Changer: Project duration 2+ years** |
| Open Protocol Controls Specification | REA members develop building controls specification that is open protocol. |
| Utility Rebate Consistency | Work with the utility industry to develop consistent rebate form formats, since inconsistent formats are a barrier to increased utilization of rebates. Others such as NAPEE and CEE may be good partners in this. |

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