

Plenary Session

## **Strategies and Incentives for Retrofitting Commercial Buildings to Reduce Energy Consumption**

**Cory Vandepool<sup>1</sup>**

### **ABSTRACT**

Rising electricity prices, climate change and a sagging economy are driving public and private institutions to focus on energy efficiency in the built environment. According to the Energy Information Administration, buildings today consume 42 percent of the energy generated in the United States, which makes investing in energy efficiency a critical piece of the nation's efforts to reduce our unsustainable demand for energy. Businesses today are anxiously trying to find ways to lower their energy related expenditures.

Aside from making the case for energy efficiency, this paper specifically discusses how building retrofits can utilize building automation and controls as a strategy for reducing energy consumption in buildings. These intelligent building technologies integrate the operational functions of a building for maximum efficiencies. Both power line and wireless technologies will be reviewed and the role these technologies play with LEED, and other green building systems, will also be covered.

For many building owners, capital costs are the primary barrier to investing in a retrofit. Without incentives and financing, especially in the current economy, large-scale adoption of energy conserving technology remains challenging. Many building owners, real estate developers and commercial businesses alike are still not fully aware of the federal and state incentives related to energy efficiency upgrades available for new and existing buildings.

This paper provides information about existing state and federal incentives related to building retrofits. It also analyzes current legislative efforts, like the Energy Bill. The current Energy Policy Act of 2005, for instance, contains the Commercial Building Tax Deduction, which is a viable incentive for new construction projects and retrofits that achieve required energy savings, yet many are still unfamiliar with this existing federal law. The current versions of both the House and Senate Energy Bill also include a provision known as the Retrofit for Energy and Environmental Performance Act (REEP), which would facilitate the retrofitting of existing homes and buildings nationwide through valuable direct cash incentives.

The prevalence of green building programs and the availability of tax incentives and grants helps consumers identify ways to make their buildings sustainable, and more affordable. This paper presents valuable information about both these technological solutions and their associated incentives.

<sup>1</sup> GreenLink Alliance, 800 North Main Street, Mount Crawford, VA 22841

## 1 Executive Summary

Many are in agreement that improving our built environment is the single greatest opportunity to reduce our current energy demand. There are many approaches currently being investigated and employed. Tactics from common sense weatherization to incorporating renewables are all favorable strategies. Although weatherization is essential, it is not an effective strategy in most commercial buildings and incorporating renewables can be very expensive, significantly extending pay back periods. Smarter, greener buildings, where energy efficiency is made a top priority, can result in substantial cost savings for the owner, increased comfort for the occupants and valuable energy saved for the environment.

According to the Department of Energy, it is estimated that buildings today account for 38 percent of all greenhouse gas emissions in the United States, which is about 35 percent of the Continent's total. In the U.S., buildings alone account for 40 percent of total energy use. Furthermore, the Electric Power Research Institute reports energy and energy related expenditures in the U.S. costs companies \$800 billion annually. The unfortunate part is that roughly 42 percent of the energy used to heat and cool a space is wasted.<sup>2</sup>

Building automation and control technologies, referred to herein as “smart building technologies”, have the ability to alleviate energy consumption concerns in existing, and even historic, commercial structures. This paper discusses power line based and wireless technologies, which are both proven solutions for building retrofits because they are considered to be “no new wire” technologies. The ability to retrofit a building without installing new wiring is critical in keeping costs down, yet even with attractive pay back periods, building owners are hesitant to take the first step.

Even though interest in retrofits is increasing, building owners remain challenged by initial “first” costs, which depending on the size of the building, can seem out of reach, particularly since financing has dried up. A simple ROI analysis, however, can demonstrate that the energy saved with a retrofit results in decreased operational costs over the long term. Additionally, as discussed in this paper, state and federal incentives have the ability to further reduce the payback period. Educating building owners about the available off-the-shelf technologies, while at the same time highlighting economic drivers, will hopefully lead to more intelligent buildings.

## 2 Introduction

Over the years, a number of different ideas, concepts and technologies have been introduced that would help building owners conserve energy. Although many building owners are finding it difficult to undertake renovations because of the current recession, now is a good time to start the process of finding ways to

---

<sup>2</sup> <http://my.epri.com/portal/server.pt?>

cut energy related expenses. Budget items like energy costs, once considered a given, are now being reviewed as areas for reductions.

Smart buildings are considered to be intelligent in that they are more electronically enhanced. Elements that work in an intergrated way in a smart building system include sensors, integrated information management, communications infrastructure, controls and energy management devices. Sophisticated systems involve both interior and exterior building components, including parking operations and streetlighting.

In this report we discuss the benefits of energy efficiency and why this energy resource warrants becoming a national priority. We then identify solutions for retrofitting existing buildings to reduce energy consumption and improve efficiency by streamlining the operational systems in a building. Finally we address the issue of reducing the first costs associated with a retrofit through state and federal incentives so that building owners can take the necessary steps to improve the efficiency of their buildings.

### **3 Green Starts with Energy**

Market trends and other indicators suggest that our demand for energy will rise dramatically in the coming years. As international communities continue to develop, more energy will be needed to feed their desire to grow and industrialize. According to the EPA, global demand for energy sources is forecasted to grow by 57 percent over the next 25 years. By 2030, 56 percent of the world's energy use will be in Asia. Electricity demand in the U.S. will grow by at least 40 percent by 2032. Even more staggering is the fact that nearly 300 new power plants will be needed to meet these electricity demands by 2030.<sup>3</sup>

There are many efforts being undertaken to curb enery consumption in buildings. With the pause in new construction, companies have time to assess their current building stock and contemplate retrofits. For many organizations a desireable first step is have an audit done on their building to determine what areas could benefit from a retrofit. The important next step, which incentives can help with, is moving from understanding to action.

There are various green building rating systems in the U.S. today, the most common one being the U.S. Green Building Council's LEED program. The LEED program includes minimum program requirements and is based on a point system. Program requirements include sustainability at the site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation in operations and a regional priority. Although LEED is a great program for both new construction and retrofits, there are many components and as a result, the path to getting a building LEED certified can be expensive.

Many building owners are concerned primarily with the costs associated with building operation. Although sustainability might be a goal, retrofits in the near

---

<sup>3</sup> [http://www.energystar.gov/index.cfm?c=business.bus\\_energy\\_strategy](http://www.energystar.gov/index.cfm?c=business.bus_energy_strategy)

term are likely to focus on reducing energy consumption. For building owners interested in energy efficiency and conservation, the Energy Star building program offers guidance and easy-to-use tools to assess your building's energy performance. Energy Star developed *Portfolio Manager*, which is an interactive energy management tool that allows you to track and assess energy and water consumption across your entire portfolio of buildings, online. The Energy Star program allows you to rate the energy performance of a building on a scale from 1-100 relative to similar buildings nationwide. Also, as improvements are made to a building, the program allows you to verify and track the progress of the improvements made.

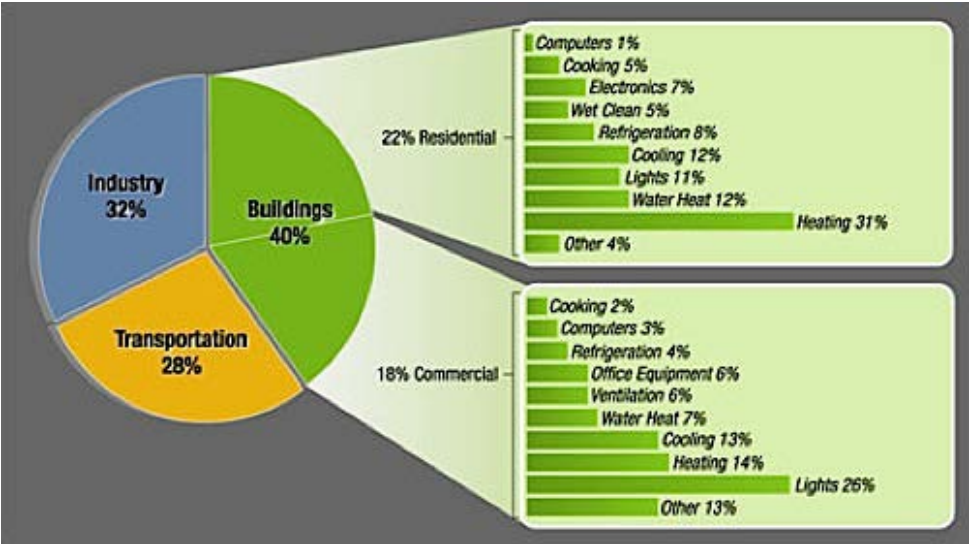


Figure 1 Energy Use in Buildings Courtesy of Lawrence Berkeley National Laboratory

#### 4 Smart Building Technology

As previously stated, both power line carrier and wireless automation and control technologies are appropriate and cost effective for building retrofits. Different buildings have different requirements and each technology offers its own set of benefits and challenges. The point of this paper is not to compare and contrast different technologies, but to present information about the types of technologies in use today to help inform building owners and facility managers of their options for energy efficient retrofits.

Wireless systems are convenient because building operators are able to track building operations from wherever they are. A wireless system can be used for lighting and HVAC as well as fire and security. In the event that offices are moved or walls are added, a building with a wireless automation system won't be limited.

Many companies are utilizing self-powered, wireless control systems, which make retrofitting fast and cost effective because they are batteryless, requiring limited maintenance. Wireless solutions have been successfully deployed in

historic buildings as well. This is important since because older buildings are considered energy inefficient, however, they need to be preserved.

In addition to wireless technologies, powerline carrier based automation systems are also appropriate in building retrofits. Power line communications (PLC) is a technique transmitting voice or data at a rapid speed through a power line in a house, office, building or factory. Power line communication systems have become increasingly viewed as an attractive alternative to hard-wired communication systems, which require dedicated communication wiring. A power line carrier based system can monitor and control functions such as energy management in appliances, lighting, HVAC and other building systems.

## **5 Connecting Smart Buildings to the Smart Grid**

The smart grid remains a bit of a mystery and is difficult for many to understand. The truth is that much of the smart grid initiative is focused on utility grids and not necessarily buildings. However, what can be said is that a smart grid without smart buildings would be a lost opportunity. There are many possibilities and applications between buildings and the grid, including energy information to consumers, which is tied into building control systems and devices. One of the functions and advantages of a smart grid would be two way, digital communication between power provide and the power user.

Some energy users, like residential customers, might be happy to let smart appliances and smart meters determine the most efficient way to use energy, but commercial users may want to manage it themselves. The assumption that a smart grid, which provides energy information to building owners and yet still assumes that they will manually turn off lights and equipment themselves, is misguided. To a large extent, the success of the smart grid will depend on control systems within the building.

According to Harry Sim, CEO of Cypress EnviroSystems, a building should know when electricity is expensive and be able to make automation decisions such as changing thermostat setpoints and reducing unnecessary lighting. The concept of auto demand response is important as utilities will be able to introduce dynamic pricing via the smart grid, thereby allowing companies with “smart” buildings to avoid paying more in electricity costs.<sup>4</sup>

## **6 Tax Incentives**

In today’s economy finding money to perform retrofits, even when deemed valuable investments, can be very tough. Many companies today are just barely able to keep the lights on. In order to see a change in the retrofit and smart building market, incentives are needed. Focused incentives that bolster one’s

---

<sup>4</sup> Harry Sim, *Retrofitting Existing Commercial Buildings for the Smart Grid*, <http://www.automatedbuildings.com/news/dec09/articles/cypress/091128020303cypress.htm> (December 2009).

ability retrofit a building and reduce energy consumption costs are key to future energy policy.

In the past, tax incentives have historically not reached all the people who can benefit from them and have mainly subsidized affluent consumers able to purchase the kinds of products and technologies available for credits. Consumers also tend to think that incentives are too cumbersome and not worthwhile and therefore overlook incentives that are in fact valuable. Building owners tend to not utilize incentives available to them and many leave thousands of dollars on the table. Recognizing the human dimension with respect to policy implementation is important. Future energy related legislation has to address these past impediments to adoption if change is going to occur.

In times of strong economic growth and prosperity, tax incentives might not be as necessary as they are today. With economic indicators down and a waning interest in the environment, it is important to point out the various benefits to consumers about energy efficiency. Although green might be a term that comes and goes, energy efficiency is not a trend.

Today there are many incentives related to clean energy, particularly renewables, but for our purposes we have identified incentives related to retrofitting commercial buildings for improved energy efficiency using innovative technologies.

### **6.1 Incentives for Commercial Building Retrofits**

Legislation at the federal level does currently support building retrofits and is augmented by the various state based incentives available all over the country. Some states and their associated utilities have strong, forward thinking incentive and rebate programs focused on energy efficiency, whereas other states have not yet realized the benefits of such programs.

In the essence of time, this paper primarily addresses available and potential legislation related to retrofits. Additional information about state incentives can be found at [www.dsireusa.org](http://www.dsireusa.org). With respect to existing federal legislation, the Energy Policy Act of 2005<sup>5</sup> includes a tax deduction for investments in “energy efficient commercial building property” designed to significantly reduce heating, cooling, water heating and interior lighting energy costs in new and existing buildings.

This tax deduction, referred to as the Commercial Building Tax Deduction<sup>6</sup>, provides up to \$1.80 per square foot for buildings that save at least 50 percent of the heating and cooling energy of a building that meets ASHRAE Standard 90.1-2001. Partial deductions of up to \$0.60 per square foot can be taken for measures affecting: the building envelope, lighting, or heating and cooling systems. This act has been extended through December 31, 2013.

---

<sup>5</sup> [http://thomas.loc.gov/cgi-bin/query/z?c109:H.R.6:](http://thomas.loc.gov/cgi-bin/query/z?c109:H.R.6)

<sup>6</sup> <http://www.efficientbuildings.org/>

This valuable federal incentive has been utilized, but not fully realized by the building community. Multi-level parking garages are the fastest growing EPCa category for lighting and the largest category of commercial property owners capturing EPCa benefits are regional and national retailers, including both stores and distribution centers.

These incentives are typically reserved for only tax-exempt organizations, but the Commercial Building Tax Deduction can be utilized by non-profits as well. For publicly owned buildings and non-profit organizations, the tax deduction can be assigned to the designer of the building. In other words, the public agency could assign the credit to the person or company primarily responsible for the retrofit, thereby negotiating a fee reduction, realizing the benefit of the tax deduction in that way. Eligible “designers” may include an architect, engineer, contractor, environmental consultant or energy services provider.

This federal incentive is valuable and can measurably help those contemplating or undergoing a retrofit save some of the initial costs of the retrofit or new construction. There are accounting firms available that will help building owners understand the process of applying for this tax deduction.

The National Electrical Manufacturers Association has sought support from members of Congress to enlarge the Energy Efficient Commercial Building Tax Deduction, described above, from \$1.80 per square foot to \$3.00 per square foot in order to help stimulate immediate job creation. In December 2009, a bipartisan group of House members introduced a comprehensive energy efficiency incentives package, which included the \$3.00 increase.

## 7 Proposed Legislation

In addition to existing incentives, it is important to understand what is currently in the pipeline with respect to building retrofits and energy efficiency. At GreenLink Alliance, we closely follow and monitor the activities of Congress to better understand energy policies. For instance, Section 202 of the American Clean Energy and Security Act of 2009 includes the Retrofit for Energy and Environmental Performance (REEP) Act.<sup>7</sup> The purpose of this act is to facilitate the retrofitting of existing buildings across the United States to achieve cost effective energy efficiency savings of 20 percent or more. The program provides for federal financial assistance to states and local agencies for direct cash incentives.

For commercial buildings, the breakdown of incentives under REEP is as follows:

- A maximum of \$0.15 per square foot of retrofit area for energy use reductions from 20-30 percent
- \$0.75 per square foot for energy use reductions from 30-40 percent
- \$1.60 per square foot for energy reductions from 40-50 percent; and
- \$2.50 per square foot for energy use reductions exceeding 50 percent

<sup>7</sup> <http://www.govtrack.us/congress/bill.xpd?bill=h111-1778>

- These incentives are capped at 50 percent of retrofit costs.

Another initiative called Building STAR<sup>8</sup>, spearheaded by the Energy Future Coalition and supported by Senator Merkley (D-Ore.) and Sen. Mark Pryor (D-Ark.) has been created to promote energy efficiency retrofits of commercial and multi-family residential buildings through upcoming jobs legislation. Building STAR is a package of incentives for building owners who decide to undertake retrofits of their properties. If fully realized, the program would help reduce U.S. emissions by 21 million metric tons. In addition to rebates, the program would also extend low-interest financing options to small businesses and other building owners interested in retrofitting.

## 8 Job Creation

Given the crisis in the commercial real estate market, the introduction of new tax incentives will provide building owners with a substantial impetus to make immediate investments in efficiency. Making these investments will not only spur economic growth but will also create thousands of good jobs across this ailing country. Retrofitting homes and businesses with smart building technology will lower consumer energy costs, increase real estate values and reduce greenhouse gas emissions. Deep deployment of off-the-shelf smart building technologies can cut energy use by at least 30 percent. Outreach, coupled with the help of focused incentives, will allow the building automation and control industry to see the growth that it has been waiting for.

Programs like “cash for caulkers”<sup>9</sup> can provide some much needed, short-term relief but as a nation we need to develop stronger, innovative industries that can support long-term careers, particularly within the new green economy. Widespread utilization and integration of smart building technology would necessitate jobs that blend IT, mechanical, electrical and engineering all into one.

## 9 Conclusion

Energy efficiency and conservation in buildings is a key component of energy policy. This is partly because energy efficiency can be addressed now, with available and proven technologies. Investment in renewable technology is important, but renewables are still very expensive. Nuclear energy, which is the only resource that has the ability to replace the energy generated by coal, is plagued by extremely lengthy approval times. Even nuclear plant applications already in process will likely not go on line for another 10 years.

---

<sup>8</sup><http://www.energyfuturecoalition.org/files/webfmuploads/Building%20STAR%20Proposal%20FINAL.pdf>

<sup>9</sup> <http://www.whitehouse.gov/the-press-office/fact-sheet-homestar-energy-efficiency-retrofit-program>



Energy efficiency is a resource that we can tap into today. Often overlooked as the “first” fuel, energy efficiency and conservation has enormous potential. But like any investment in this economy, energy efficiency retrofits need a push and incentives, both at the federal and state level, can help consumers realize substantial energy and cost savings. Understanding the technology available and the incentives that match is an important piece of the puzzle.