ENERGY PERFORMANCE LABELING FOR COMMERCIAL BUILDINGS

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Objective

This white paper provides an overview of commercial building energy performance indices for energy performance in commercial buildings and the extent to which these initiatives have proven effective at reducing energy use. This work focuses on energy performance, as opposed to features of building design associated with improved performance. As such, it will not address design-oriented rating systems such as Leadership in Energy and Environmental Design (LEED) nor will it address building codes.

The report introduces the concept of building energy performance and the technical basis for labeling programs. The paper proceeds to summarize various programs (such as EPA’s Energy Star Portfolio Manager) and regional initiatives (such as Seattle’s Energy Benchmarking program) and the advantages and critiques of each. The paper notes commercial energy labeling program benefits and critiques and will provide past and present policy implementation throughout the United States supporting benchmarking practices.

It is hoped that this white paper provides a better understanding of present benchmarking and labeling implementations. We conclude the white paper with what this energy performance research means for communities and the future of energy efficiency in commercial buildings for the Northwest United States and the Boise, Idaho, area in particular.

Introduction

Commercial buildings are generally defined as non-residential and non-industrial structures and include office buildings, retail operations, hospitals, schools and university buildings. The direct and indirect burning of natural gas and coal to supply energy to commercial buildings produces the largest share of carbon dioxide emitted in the United States. Commercial buildings have a very high demand for electricity and future energy needs are forecasted to grow.

Commercial buildings are responsible for approximately 20% of energy consumption and electricity usage in the United States. The amount of energy consumed by commercial buildings has increased 70% since 1980 (U.S. Department of Energy, 2008). Of the energy consumption attributed to commercial buildings, near two-thirds goes to education, health, retail and lodging (Day, 2012). 77% of commercial floor space is owned by the private industry, while the remainder 23% of commercial building floor space is owned by government entities (U.S. Department of Energy, 2008).

Various benchmarking and labeling programs have been initiated around the world to decrease energy use and promote energy efficiency in commercial buildings. Proponents of these efforts hope to address a significant market failure in the majority of commercial building use: The fact that commercial buildings are nearly always leased and hence not occupied by the building owners produces a ‘split incentive’ in which the party responsible for energy efficient upgrades (the owner) is not the beneficiary of the energy savings, since the utility bills are nearly always
Building performance efforts take a comprehensive approach to improving energy efficiency, comfort, building systems, operations and maintenance (ACEEE: Commercial Sector Fact Sheet).

**Technical Background**

**Energy Use Index (EUI)**

The most common performance measure for building energy performance is the Energy Use Index (EUI). The EUI is an attempt to normalize energy use data relative to floor space to compare the energy efficiency of various buildings. The EUI is the total annual energy use of the building divided by the conditioned floor space (measured in square feet) of the building. It is usually reported as thousands of BTU per square foot per year (kBTU/ft\(^2\)/yr). Since electricity (which is measured in kWh) is usually a significant portion of building energy use, it is necessary to convert total kWh to kBTUs by multiplying by the conversion factor (3.412 BTU/kWh).

For example, if a 60,000 ft\(^2\) office building uses 65,000 therms of natural gas (a therm is 100 kBTUs) and 425,000 kWh of electricity, the EUI index would be computed as follows.

\[
EUI = \frac{65,000\text{ therms} \times 100\text{kBTU}}{1\text{ therm}} + \frac{425,000\text{kWh} \times 3.412\text{kBTU}}{1\text{kWh}} = 132.5\text{kBTU}/\text{ft}^2\text{ yr}
\]

Note that this is a course measure of building energy performance. While it normalizes for both energy sources and size of the building, it does not take into account the use of the building, nor does it account for the climate and weather of the region. For those reasons, EUI has proven to be most useful for comparing building energy performance to other buildings in the same general category (i.e. office building, K-12 school or hospital) and for buildings in the same general climate.

**Commercial Buildings Energy Consumption Survey (CBECS)**

To better understand commercial energy use nationwide, the United States Energy Information Administration conducted the Commercial Building Energy Consumption Survey (CBECS). CBECS is a national survey on commercial buildings that utilize at least half of their floor space for commercial use and are greater than one thousand square feet (Energy Information...
Administration). CBECS data is a system of energy-related building characteristics of approximately seven thousand commercial buildings in the United States (Sharp, 1996).

The first survey was conducted in 1979, and the eighth and most recent survey was conducted in 2003. A 2007 survey was conducted but not released, as quality standards of the EIA were not met. While the CBECS has historically been conducted every four years, the FY 2011 CBECS survey was not completed due to funding constraints. However, the EIA announced in April that the 2012 CBEC survey was underway, with results likely to be available by mid-2014.

CBECS data is often utilized for baseline comparisons but receives significant criticism regarding its reliability and relative data comparisons. The most recent CBECS data (FY 2003) is approximately 10 years old, yet occasionally applied to make current commercial building energy performance comparisons.

CBECS data was collected through personal interviews with building stakeholders, and are not definitive. For example, some building owners may not know the accurate floor space and/or energy use of their building, therefore, it is generally believed that the CBECS data is open to interpretation (Sharp, 1996).

The 2003 CBECS survey made the following conclusions (Energy Information Administration):

- Since 1979, total EUIs of commercial buildings have declined
- Office buildings account for the largest type of commercial buildings in the United States
- Greater than half of the energy required for commercial buildings is electricity consumption for heating and lighting
- From the first CBECS survey conducted in 1979 to the last in 2003, the number of commercial buildings and their floor space have increased
- The majority of the buildings in the survey (39%) and the majority of the floorspace (37%) were in the South census region.
- Both the West and Northeast regions were under-represented with the Northeast having 16% of the buildings and 20% of the space. The West had 19% of the buildings and 18% of the floor space
- Electricity consumption has exceeded natural gas consumption since 1986

The Energy Information Administration makes CBECS data available to the public

Comprehensive Building Labeling Programs: Beyond EUI

Energy labels promote and encourage excellence in building performance. While only one building code may be established to several buildings within a community, numerous energy labels may be applied within the same community (United Nations Development Programme, 2010).

1 http://www.eia.gov/consumption/commercial/
Energy efficiency labeling programs have been established for consumers to easily understand building energy performance. Prospective tenants are given the opportunity to understand energy performance of potential workspace, financial institutions receive assistance in an area of lesser experience (i.e. energy use), and government agencies are able to decrease costs by supporting efficient buildings (United Nations Development Programme, 2010).

Commercial labeling programs are relatively few, but growing. Voluntary energy performance labeling programs are often complementary and applied in addition to existing building codes or policies.

**Environmental Protection Agency: Energy Star for Buildings**

The Energy Star label is the most acknowledged and used voluntary energy performance label and rating system in the United States. The Environmental Protection Agency (EPA) designated the commercial buildings Energy Star labeling program to be a public-private partnership program in 1999. As of 2011, approximately 200,000 buildings across the United States utilize the Energy Star labeling program (Understanding EPA’s Energy Star, 2011). Public and private building occupants favor the Energy Star benchmarking and labeling program when leasing or purchasing property. More than 20 national, voluntary programs throughout the United States leverage Energy Star tools (McCabe & Wang, 2012).

The purpose of the Energy Star label is to help organizations, private or public, to monitor, understand and reduce energy use in their commercial buildings and compare their energy performance to other buildings. Doing so will not only allow building owners and occupants to be mindful of their use, but supervise financial impacts of improved energy efficiency over time (Katz & Perlman, 2006). Building labeling, such as Energy Star, and building benchmarking, like the Energy Star’s Portfolio Manager (ESPM), has gained more attention in the commercial building sector (ACEEE: Commercial Sector, 2013). Real estate owners, in particular, have established the Energy Star program as a baseline for future evaluations and a year-by-year comparison (McCabe & Wang, 2012). Building owners utilized the Energy Star to regularly record building assets and quality of performance.

In the Energy Star program, users enter actual energy use (electric, gas, district heating/cooling, etc.) for a 12-month period. To be officially registered in the program, a registered professional engineer must certify the data. If eligible, the building receives a grade of 1-100, representing where the building fits within the distribution of performance of the buildings in CBECS with similar characteristics and in similar climate zones. The score is a percentile ranking where 100 means the building is roughly equivalent or better than the best building in the data base. A score of 50 means the building performance is at the median of similar buildings. Since weather and building usage can change from year to year, buildings may be benchmarked periodically (Kats & Perlman, 2006). New energy labels will be assigned to buildings with their associated changes.

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2 ACEEE is the American Council for an Energy Efficient Economy
To qualify for an Energy Star label, a building must receive a score of 75 or greater on a 1-100 scale. A score of 75 of greater denotes a commercial building with an energy performance within the top 25% in the United States (U.S. Department of Energy, 2008).

At its core, the ESPM provides a relative rating. The rating is relative as average scores of comparable buildings are determined. Scores provided by the ESPM provides a rating based off of historical data for specific building types.

All commercial buildings can participate in the ESPM system, but not every building can be given a rating. “Unratable” buildings in the Energy Star system are typically due to the lack of available consecutive utility bills and/or too few building occupants or leases, or the building does not cleanly fit into one of the categories provided in ESPM. (McCabe & Wang, 2012).

The ESPM creates a Statement of Energy Performance (SEP), as shown in Figure 1. The SEP serves to inform building occupants, tenants, owners and visitors of the building’s ESPM rating and performance. The label’s intent is to portray performance details in a clear and understandable manner for use in business transactions (California Energy Commission).

As shown in Figure 1, the location and identity of the building is reported near the top of the statement. The age, size, and performance rating is displayed on the left side of the report with a summary of energy use and greenhouse gas emissions. Space is provided on the right side of the report to ensure accuracy and appropriate certification of this data with a signature of a licensed professional (California Energy Commission).
Figure 1: Sample Energy Performance Certificate for Energy Star. (Source: United States Environmental Protection Agency. Statement of Energy Performance Office Sample Facility.)
Energy Star Criticism

The ESPM benchmarking and labeling system is widely used throughout the United States. Throughout its history, stakeholders have identified various limits of the ESPM system. Much of the criticism of the ESPM system comes from its limited comparison population and its inflexible categorization of building type.

“Ratings are predicated on a relative scale (currently based on non-updated 2003 CBECS data), giving a building’s rating in comparison to only those buildings within the data set. Due to the lack of homogeneity and sample size in the CBECS database, some property types—for example, mixed-use buildings, restaurants, college campuses, libraries, museums, and laboratories—cannot use ESPM to generate a rating. State-level benchmarks (or anything geographically smaller) are also not available” (McCabe & Wang, 2012).

In addition, buildings may score a rating of 75 or greater on their initial assessment. In such cases, Energy Star does not provide further incentive to improve their performance, but only influences buildings to continue to perform at their current level. The system does not provide a straightforward means or influence for improvement once a 75 is obtained.

Finally, as building owners take initiative to perform their own benchmarking scores, discrepancies have occurred as different individuals within a given organization account for space. Some do not account for the space not utilized or frequently occupied, such as closets, restrooms or lobbies, while they should be accounted for in the rating. Such variations can lead to significant errors in the process.

Energy Star Certified Buildings

In the US, metropolitan areas continue to increase the number of Energy Star-certified buildings, as shown in Table 1. The Environmental Protection Agency (EPA) shows, for example, that the City of Los Angeles had the most certified Energy Star buildings from 2008-2012 (US EPA, 2012). The city of Chicago annually increases the number of Energy Star-certified buildings by 32% (Renew Grid, 2013). Houston, Texas is home to the “Phoenix Tower,” a building earning 14 Energy Star-certifications in the country (Renew Grid, 2013).
Table 1: Top Cities with the Most Energy Star Certified Buildings (Source: Top cities with the most Energy Star certified buildings in 2012 & 2011)

<table>
<thead>
<tr>
<th>2012:</th>
<th>2011:</th>
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<tbody>
<tr>
<td>1. Los Angeles (528)</td>
<td>1. Los Angeles (659)</td>
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<tr>
<td>2. Washington, DC (462)</td>
<td>2. Washington, DC (404)</td>
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<tr>
<td>3. Chicago (353)</td>
<td>3. Atlanta (359)</td>
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<tr>
<td>5. Atlanta (304)</td>
<td>5. San Francisco (270)</td>
</tr>
<tr>
<td>7. Houston (241)</td>
<td>7. Houston (231)</td>
</tr>
<tr>
<td>8. Dallas-Fort Worth (214)</td>
<td>8. Dallas-Fort Worth (178)</td>
</tr>
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**Energy Star Case Studies: Seattle**

*Dexter Horton Building*

The Dexter Horton Building has been an Energy Star labeled building since 2007 and has reduced energy consumption by 34% since its certification. The building owners have improved their energy rating from a 60 in their first year to a 96 (City of Seattle).

“The more aware you are of your building’s energy use and work to rein in energy waste today the better positioned you’ll be in the future as energy costs continue to rise. By benchmarking the Dexter Horton building and making energy efficiency improvements, we are able to compete with buildings that are 60 years younger.”

– CB Richard Ellis, Dexter Horton Building management (City of Seattle)

*Bank of America Fifth Avenue Plaza*

The Bank of America Fifth Avenue Plaza has been an Energy Star labeled building since 2008 and has reduced energy use by 15%. The building has saved approximately $240,000/year for building owners and operators, and presently has the highest rating possible of 100 (City of Seattle).

“Using Energy Star Portfolio Manager is a great way to learn how your building’s energy performance compares to similar buildings, and can serve as a catalyst for making upgrades that improve efficiency and lower energy costs. At Hines, we’re always looking for innovative ways to reduce our operating expenses. Lower operating costs are a benefit that can be passed onto tenants.”

– Anthony Brusco, Hines Engineering Manager (City of Seattle)
DOE’s Building Energy Asset Rating Program – EPA’s Energy Star Program Complement

The Department of Energy (DOE) began piloting a new commercial energy program, the Building Energy Asset Rating Program, to complement the EPA’s Energy Star Portfolio Manager (Stacey, 2012). The asset rating program is established to assist stakeholders to better understand their energy efficiency benchmarking data. Nora Wang, of the Pacific Northwest Laboratory, stated in a DOE webinar in March 2012 that the DOE Building Energy Asset Rating Program is not designed to replace the existing Energy Star Portfolio Manager (Stacey, 2012). Similar to Energy Star, the result of the program is an Energy Asset Score of 0 to 100, but the analysis behind the score is much different. The program requires the user to input a few sheets of data on the building construction and types and sizes of mechanical equipment. It then uses the Energy Plus simulation engine to compute the likely energy performance for that building. The report (first page shown in Figure 2) details not only the “as built” performance but also compares it to a similar building built to the minimum ASHRAE³ energy code.

DOE released a call for participation to pilot the Asset Rating Program in September 2011 (Melton, 2011). Similar to the “miles per gallon” rating for a vehicle, the Commercial Asset Rating Program will measure the “as-built” efficiency and performance of existing commercial buildings. DOE’s program differs in that a comparison among a similar building’s annual energy use and a percentile score will not be given.

The DOE program will allow building owners and operators to understand operations separately, unlike the Energy Star Portfolio Manager, which considers the overall efficiency of a building and denotes system performance as a whole. Because an asset rating system separates the infrastructure influence of a benchmarking score, the DOE Building Energy Asset Rating Program takes two separate factors into account: building operation and physical assets (McCabe & Wang, 2012). Separate operational and physical characteristics allow building owners and stakeholders to determine if their benchmarking score was determined based on occupancy rates or actual energy performance.

According to the DOE, the Building Energy Asset Rating Program will be a cost-effective and easy to use web-based tool (Melton, 2011). The DOE’s Building Energy Asset Rating Program will provide assistance in determining procedures for buildings to undertake to improve energy efficiency and make cost-effective performance upgrades. The DOE’s approach evaluates overall energy efficiency and physical characteristics of the building, independent of operational and occupational uses. DOE believes that an accurate baseline can be utilized in ratings when operational and occupational measurements are separate from physical building characteristics (McCabe & Wang, 2012).

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³ ASHRAE is the American Society of Heating, Refrigeration and Air Conditioning Engineers.
Figure 2: Page from the proposed building energy asset score report (page 1 of 4).
Various states, such as Massachusetts and California, are creating their own initiatives and the national conversation to have a commercial rating program is underway (Eisenbrenner, 2012). The DOE rating is created to provide an entry-level benchmarking system, not to compete with the more extensive ASHRAE Building Energy Quotient, described in the next section (McCabe & Wang, 2012).

**ASHRAE Building Energy Quotient**

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has been established the Building Energy Quotient, bEQ. The ASHRAE differs from the programs previous discussed, specifically it is designed to move buildings toward net zero energy use as opposed to Energy Star and DOE Energy Asset Score which compare energy consumption against certain standards. The ASHRAE tests buildings twice to determine 1) the building’s energy use (operational rating) and 2) the amount of energy the building is *supposed* to use based upon its design (asset rating) (Will, 2009).

> Whilst Energy Star Portfolio Manager typically bases any energy performance on historical utility billing data and does not take into account when buildings are partially filled and multi-tenanted, it can complicate matters. That’s why the government is promoting an as-built energy performance that is not dependent on occupational behaviour and building operation. Ultimately, as BOMA (Building Owners and Management Association) suggests you need a hybrid solution where you can benchmark one against the other - a methodology prescribed by ASHRAE’s Building EQ system (Eisenbrenner, 2012).

The ASHRAE label, the bEQ, Figure 3, is similar to labels utilized by the European Union. The rating scale utilized by the ASHRAE is tied to median EUI data from CBECS (Commercial Buildings Energy Consumption Survey) (Nall, 2010). The label intends to provide motivation to reduce energy use in commercial buildings. The energy performance of a building is depicted through an energy performance scale. As shown in Figure 3, the left column’s “Net-Zero Energy” to “Unsatisfactory” labeling denotes the “as designed” rating and the right column’s “A+” to “F” denotes operational performance.
Figure 3: Building Energy Quotient Label. (Source: http://www.energycircle.com/blog/2009/08/10/ashrae-building-eq-an-intelligent-energy-measurement-system).
Regional Energy Labeling Programs and Policies

Boise, Idaho: High Performance Building Characteristics

Boise is in the first year of the High Performance Building Characteristics program. This project aims to create public awareness on energy use and is sponsored in part by Idaho Power and is implemented by the Integrated Design Lab in Boise. A label, as shown in Figure 4, has been designed to provide potential tenants with metrics to compare building energy use, much like a sticker on a vehicle designating a mile per gallon assessment.

The first year of this program (2013) is considered a “benchmark year,” to analyze effectiveness of the program over time. Fifty buildings have participated in the first year of the High Performance Building Characteristics program, a larger number than expected. Energy Use Intensity (EUI), an Energy Star rating, Walkability and Access to Daylight measurement will be displayed on the generated building label (see Figure 4 below).

“The overall aim of this project was to stimulate broker and tenant awareness of both energy and non-energy building metrics in the Boise area, and to subsequently develop a metric labeling sheet that could be incorporated into traditional broker leasing sheets to promote energy efficiency at the time of sale or lease. In addition, one of the primary objectives of this project was to document the resources and training needed by real estate professionals to develop the selected metrics on their own. Specific instructions were developed so that the metrics could be consistently calculated and compared among differing buildings” (Day, 2013).

The program proposes the development of a website for building owners and operators to electronically input building energy use data to create portable document formats (pdfs) of labels for each building to attach to lease and purchase agreements, similar to that of Figure 4 (Day, 2013).

The program differs from other energy measuring programs because it incorporates the associated relationship among walkability, daylight access, and the improvement of worker productivity and health, occupancy leasing and reduced employee absenteeism. As an incentive to energy efficient buildings, the building owner receives free help from the Integrated Design Lab with Portfolio Manager if the building is eligible to receive an Energy Star rating.

One of the earliest observations of the implementers of the High Performance Building Characteristic Label program is that different professionals may interpret building characteristics differently. For example, designers measured the entire space when considering square footage, but brokers measured only the space available for rent or lease, potentially neglecting lobbies and restrooms (Day, 2013). The actual building square footage should be utilized for measurements and will be emphasized in the future.

Early response to the program is mixed. Some believe the marketing advantage is that this label could imbue essential, while others believe Boise is not ready for this type of project. The
Integrated Design Lab has stated the ultimate reaction of the program in the Boise area has been well received and that building labeling may be supported if building owners have the opportunity to compare their building performance with others in the community. Figure 4 is an example of the label for this program.

**Figure 4:** High Performance Building Characteristics Label. (Source: Day).
Each metric, such as the EUI, Energy Star rating, Walkability and Access to Daylight, is depicted using a performance scale. The scales are laid out left to right (more desirable to the right) and color coded red (worst) to green (best).

**Arlington, Virginia: Energy Performance Labels**

The Virginian county of Arlington and the Arlington Initiative to Rethink Energy (AIRE) estimated the county’s total annual greenhouse gas emissions attributable to transportations and building operations to be 2.7 million tons and are eager to improve their energy performance. 75% of Arlington County emissions result from building use. According to Virginia’s *Connection to Your Community* in April 2012, “Buildings in Arlington are about to become green with envy” (Pope, 2012).

Arlington County officials wish to curb future “business-as-usual” energy use and have initiated a county program installing performance labels in the lobbies of government buildings and hope to expand to private buildings (Pope, 2012). Their program is entirely voluntary and intended to bring attention to energy performance of buildings.

This program has received mixed reactions. One local information technology professional believes the country is making a mistake and all details regarding energy use should remain private and for county leaders to influence legislators and regulators. The professional stated, “Are they really going to shame them into correcting this thing? Or do you mandate them through legislation to do this thing?” A courthouse employee responded to the county’s initiative, “I think it needs to be visible so people can see it so people know. If it’s behind the scenes, how would I know?” (Pope, 2012).

AIRE created a label, shown in Figure 5, reflective of the design similar to a nutrition label on various food products. The header of the label provides: (1) a brief summary of building, (2) its name and location and (3) energy use in a percentage comparison to other buildings throughout the United States. The left side of the label provides a measurement of the Energy Use Index (EUI) in energy units per ft² and the value’s comparison to Arlington county’s year 2050 goals. Unlike most labels in the United States, the Arlington County label provides the building’s carbon footprint in lb/ft² on the right side of the label and a national average comparison. The bottom of the AIRE label notes building information, such as location, year of construction and awards received (Altavilla).
A two to three year pilot program initiated in 2011 in Massachusetts is the first of its kind to determine if a mandatory policy building rating program should be initiated within the state. The pilot program also plans to determine if a building’s asset rating can be computed in a cheap and reliable manner (Mass DOER, 2010). The National Governors Association’s Policy Academy for Building Energy Retrofits (NGA Center) selected the Department of Energy Resources (DOER) to conduct research on building energy labeling in the state of Massachusetts (Mass DOER, 2010). The goal of the program is to require all existing commercial buildings to acquire an energy asset rating before a major renovation, re-finance or sale. A lower energy efficient building will receive a lower grade and will be evaluated based upon a “zero net energy benchmark.”

The Department of Energy Resources (DOER) held a hearing in January 2011 to discuss the Building Energy Asset Labeling Program in Massachusetts. The first phase of the pilot program was completed and determined many factors to a successful building-rating program. Implementers determined that:
• a clear definition of “square foot” is important to building owners
• HVAC sizes should be evaluated and considered to building size,
• comprehensive usage data is imperative to create accurate benchmarks, and
• site visits are advised to ensure data has not become outdated (Webster, 2013).

Initial recommendations to the pilot program determined additional conclusions for the future of the Massachusetts benchmarking and labeling program (Mass DOER, 2010):

• Utilize a technical scale against a “net zero energy” benchmark, rather than relative to the energy consumption of existing buildings
• Use EUI as the fundamental rating with GHG emissions to complement
• Adjust benchmarking scales to building types
• Consider a “minimum-sized” building to participate in the program
• Consider a “letter grade” label reflective of the EUI scores and GHG emissions measures
• Create an “energy leaders” program within the community to highlight buildings achieving energy performance success

The NAIOP, A Commercial Real Estate Development Association, strongly opposed a mandatory energy asset labeling program. A representative testified that their concern that the program will negatively affect gateway cities (midsize cities that support regional economies) and older buildings as vacancy rates are near their highest and property values have decreased. If an energy assessment is done before the aging commercial building is put up for sale, the results may be devastating as poor scores will be assigned to older buildings (Small, 2011). There is additional concern low energy performance scores will decrease property value and cause property abandonment in cities at risk. An additional apprehension is the possibility of increased development as older buildings may be deserted even if renovating older properties saves more carbon dioxide emissions than new construction.

**Minnesota: The B3 Benchmarking Program**

The B3 Benchmarking Plan was created by the University of Minnesota Center for Sustainable Buildings research (CSBR). Minnesota’s B3 program entails “buildings, benchmarking and beyond.” As of spring 2012, approximately 6,500 buildings have been benchmarked (McCabe & Wang, 2012).

Actual energy consumption is compared to the predicted energy consumption of an engineered model of each building in the B3 benchmarking program (McCabe & Wang, 2012). Building portfolios are graded and ranked according to given benchmark scores to identify buildings with the opportunities to improve energy performance. The B3 Benchmarking program allows public sector buildings to utilize the Energy Star rating assigned to their buildings if the building meets Energy Star scoring requirements.

The B3 Benchmarking Program is a web-based tool that allows buildings owners to enter energy performance criteria, such as daily operating hours, fuel resource used, days and months of operation and frequency of temperature control, and building amenities, such as kitchens,
parking spaces, swimming pools, technology rooms.

154 building use types were developed by DOE’s energy simulation tool and are available in the B3 Benchmarking Program tool (McCabe & Wang, 2012). The benchmarking program utilized energy use intensities, EUIs, to describe energy performance in BTU/ft². The EUIs take into consideration Minnesota’s energy code required for lighting, ventilation, heating and cooling.

The B3 benchmarking program allows building owners to have a representation of energy performance without the comparison to other commercial buildings (McCabe & Wang, 2012). Building users are given the opportunity to compare buildings to benchmarks and actual metered energy consumption.

Minnesota’s B3 Benchmarking program found that buildings that have poor energy performance have greater returns on investment on energy efficiency measures as they improve performance measures, compared to those buildings graded as more efficient (McCabe & Wang, 2012).

**International Energy Performance Labeling Programs**

Volunteer and mandatory labeling systems have been in existence for many years within Organization for Economic Cooperation and Development (OECD) countries (United Nations Development Programme, 2010). 30 countries around the world have adopted mandatory energy benchmarking policies. Denmark was the first country to establish an energy performance rating policy in 1997. Labeling systems have been established within the last five years of larger countries, such as Australia, Brazil and China, and smaller local and provincial territories, such as the city of Tokyo and municipalities within Canada (McCabe & Wang, 2012).

Since June of 2007, energy labeling has been required in the European Union (United Nations Development Programme, 2012). The European Union created the most common rating system, the Energy Performance of Buildings Directive (EPBD), in 2002 for commercial properties. New and prevailing buildings must be labeled at the time of sale or lease and public buildings must always be labeled.

**United Kingdom: Display Energy Certificates (DECs) & Energy Performance Certificates (EPCs)**

The United Kingdom is dedicated to changing energy performance in commercial buildings since nearly half of the country’s carbon emissions and energy consumption results from commercial building use. United Kingdom policy requires commercial buildings to benchmark and display energy consumption as a “Display Energy Certificate” (DECs) or “Performance Energy Certificate” (PECs) (BSRIA, 2009). United Kingdom Legislation hopes the influence of DECs and EPCs will make a future impact in building design.

A “Low Carbon Energy Assessor” (LCEA), a trained energy professional, determines how energy efficient a building is performing with the consideration of total floor space, insulation, gas and electric use, heating and cooling systems and building type. After determining a building’s performance, the LCEA will move forward with assisting building improvements.
A March 2011 article in *The Guardian*, a daily British newspaper, stated, “Getting an A-G rating is all about getting good data” “If you can’t measure it, you can’t manage it” was the phrase used by a local DEC supporter. Commercial building owners have been pushing for DECs to become effective to allow investors to examine energy performance portfolios (King, 2011).

As of January 2013, DECs (Figure 6 below) are *required* to be displayed in public buildings larger than 500 m² (CIBSE). Administrative and technical data are present alongside bar scale graphics that display energy and emission data of a commercial building. Actual energy use is determined and displayed as a data figure on the DEC (see Figure 6). An A-G performance scale is utilized as an “A” denotes more energy efficient and “G” represents less energy efficient. “Total CO₂ Emissions” and “Previous Operational Ratings” are displayed on the right side of the label to complement the operational rating score.
EPCs (Figure 7) are utilized to display and compare energy performance among similar buildings, and any commercial building greater than 50 m² (540 ft²) sold or rented must have an EPC. EPC grades are authorized for 10 years (CertsNI). Any modification to the building will require a renewal of the EPC.

The EPC is composed of a recommendations report and a graphic rating. Building services, such as heating, cooling and lighting, determine an EPC grade, rather than the building appliances.
Therefore, an EPC is an asset rating that considers size, age, and building location. Performance measures to be utilized in order to improve energy efficiency are indicated on the EPC.


**Canada: ecoENERGY Efficiency for Buildings**

The Canadian federal government lacks jurisdiction over energy use in commercial buildings. Regulations of energy use and labeling of products in trans-border trade is the only power held by the Canadian federal government.

Natural Resources Canada’s ecoENERGY Efficiency for Buildings will adopt the Energy Star Portfolio Manager in June of 2013 and encourage new and existing buildings to become Energy Star certified. 4,000 Canadian buildings are utilizing the Portfolio Manager benchmarking tool to date (Natural Resources Canada’s Office of Energy Efficiency, 2012). The report highlights ESPM’s ease of use, cost effectiveness and assistance in energy use decisions. Existing
Canadian Energy Star building data will be transferred to the Canadian system and will include Canadian weather data and bilingual metrics (Natural Resources Canada’s Office of Energy Efficiency, 2012). The Canadian government has noted the opportunity for recognition associated with the Energy Star program in the United States is not available for recognition in Canada.

**Australia: National Australian Built Environment Rating System NABERS**

The New South Wales (NSW) Office of Environment and Heritage administers the National Australian Built Environment Rating System (NABERS) to measure commercial building operational performance (McCabe & Wang, 2012).

The NABERS rating considers waste, water, energy and the indoor environment to assign an operational grade to a commercial building. 12 months of operational data must be available, similar to the Energy Star Portfolio Manager, to be assigned a NABERS grade. Hours of operation, location and mechanical equipment are also considered.

*The Benchmark factor takes the energy use, adjusts to a greenhouse gas emissions figure (kilograms of carbon dioxide per square meter), and then translates it to a value that enables a building to be located on the benchmark rating scale (OEH 2011) (McCabe & Wang, 2012).*

As of 2011, NABERS has rated approximately 60% of Australian office spaces (McCabe & Wang, 2012). 5% of the rated buildings in 2011 Australia are reaching a 5-star benchmark target. The NABERS scale was expanded to 6 stars in 2011 to allow room for the “Market Leading” performance score, as shown in the bottom right of Figure 8. “Market Leading,” a score of 6, denotes a reduction in water use and greenhouse gas emissions by 50% compared to a score of 5, “Excellent” performance. The average score is 2.5 on the NABERS scale. See Figure 8 below.
Stakeholder Perspective

Much of what has been discussed about building performance labeling has been focusing on the impact on the occupant of renter of the commercial space. Less attention has been focused on the owners and buildings of these buildings. Predictably, this group has a different perspective.

Overall, owners have been pleased with the tools available to benchmark energy performance and their associated labeling. Stakeholders appreciated insight into a building value related to occupant behavior and maintenance costs, as well as the opportunity to track their building performance over time in order to make appropriate renovations.

Identifying energy efficiency of a building has given building owners the momentum to make cost-effective and energy performing improvements to their space. When implementing such energy performance tools, an additional stakeholder concern is the cost-benefit analysis associated with implementation benefits, such as staff time required for rating and cost to implement (McCabe & Wang, 2012). Owners and stakeholders have admitted to being more concerned with current replacement and renovation costs, rather than historical energy performance data of a commercial space.

Of particular interest, owners have expressed their preference for a system that complements the EPA’s ESPM, rather than supplements and discards it altogether, as it is already familiar and recognizable. A system that coordinates an asset rating system with another strong, easy-to-understand linkage is preferred. Many building investors have been comfortable with the ESPM and preferred its use in the future. A majority of stakeholders request the utilization of a more technical benchmarking scale, rather than a relative scale, such as the CBECS data used by the ESPM (McCabe & Wang, 2012). A much more technical scale would allow for calibration to a value. A “ratio-scale” has been discussed, but the goal of reaching Net Zero Energy Performance seems too daunting to many building users.

A large concern to stakeholders is the distinction among building types and their appropriate comparison to other buildings, as not every building type identically matches the benchmark “model.” A stakeholder requested an update and review of benchmarking scales much more frequently to keep up with modern improvements and societal wishes (McCabe & Wang, 2012).

Owners have noted the labels need to be written in plain language. Most stakeholders would prefer a label to be written in financial metrics, such as cost/ft², rather than cost/kWh, or at least complementary to the EUI data provided. Stakeholders have proposed the alteration of the label and rating systems to display current information about the building, such as amount of life remaining in comparison to a similar building.

The building owner who undertakes an energy performance labeling effort has the opportunity to act as a sustainability leader in the community. Their involvement in commercial building energy performance labeling establishes an investment in increasing their building’s value for the long term.
Commercial Energy Labeling Policy and Regulation

Local, county, state and regional governments play a role in commercial energy labeling policy implementation. State or region governments with jurisdiction over approximately forty percent of the United States have established energy labeling policies and regulations.

City and state policies in many regions of the United States enforce benchmark reports and labeling. Cities throughout the United States informally and formally propose policy with various requirements, such as disclosure policies and specific building types (see Figure 10). Various benchmarking policy requirements, such as mandatory public disclosure and benchmarking time frames are applied to commercial buildings. Local and state governments apply energy benchmarking labels to particular buildings, new commercial buildings, government-government owned and recently renovated (Buildingrating.org).

Ratings and labels of commercial buildings are developed according to voluntary guidelines developed by the United States Department of Energy. All federal agencies must lease commercial space with Energy Star Ratings according to the Energy Independence and Security Act of 2007.

Various state tasks forces are establishing benchmarking policies. Washington state’s policies require public ratings at the time of lease, sale or financing of a commercial building. The Oregon Department of Energy has created a task force under Senate Bill 79. Under the Oklahoma State Facilities Energy Conservation Program, the state of Oklahoma obtains the Energy Star rating in commercial buildings whenever possible to reduce the state’s energy use by 20%. Energy Star Portfolio Manager has been required by Alabama’s state departments and agencies in order to reduce state energy consumption by 30% in 2015 relative to 2005 utilization (Buildingrating.org).

Figure 10 shows the geographic and regional distribution of programs to date.
Figure 10: U.S. Building Benchmarking and Disclosure Policies. (Source: http://www.buildingrating.org/sites/default/files/documents/US_Rating_Map.pdf)

Commercial Energy Labeling Benefits & Efficacy

The benefits of commercial energy labeling can be seen at local, county, state and regional levels. Policies implementing energy labeling in commercial buildings are beneficial catalysts influencing the local economy, culture and environment. The potential impacts of a successful labeling campaign can be far-reaching and summarized below.

Improve community self-reliance
At all levels of government, there is increasing concern about the source of energy and the goal of energy independence. Experts agree that the most important first step toward great self-reliance on outside energy sources is to simply use less. Making consumers aware of building energy use can bring market forces to bear and encourage the development of more energy efficient buildings.
Save consumers and taxpayers money
The recent depression of natural gas prices notwithstanding, the cost of energy is forecasted to rise into the foreseeable future. Efficient buildings save money.

Create local “main street” jobs
Unlike manufacturing, jobs related to construction and remodeling cannot be outsourced. In addition, many US companies are doing well manufacturing energy efficient equipment and building components. Encourage energy efficient buildings directly supports the local economy and is rapidly becoming a significant portion of the construction sector in many regions.

Catalyze local economic investment
Like all construction, the investment on buildings stays within the community and can have positive impacts for years to come. In urban regions, success often breeds further success. Cities with aggressive green building policies have seen strong synergistic activity that pays great dividends down the road.

Help protect the environment
In addition to the argument that lower energy consumption is directly related to reduced GHG emissions, other potential damaging activities are avoided when energy consumption is reduced. Nationwide, approximately 50% of electricity comes from coal fired power plants, which are, in turn, responsible for a significant portion of mercury and sulfur dioxide emissions.

Energy Star Efficacy
In spite of the criticisms aimed at Energy Star and ESPM, evidence is mounting that the program is having a positive impact on energy efficiency in commercial buildings. Buildings under ESP have improved occupancy use, reduced costs due to reduced energy use and improved energy performance, and increased building value (Katz & Perlman, 2006). Energy Star labeling results will continue to be recognized with improved building assessments. Stakeholders have stated Energy Star buildings have lowered building costs with reduced needs for energy resources and provided the opportunity to invest in energy efficiency (McCabe & Wang, 2012).

“And a recent study of the U.S. market supports previous conclusions showing that buildings rated by ESPM as more efficient reflect rental premiums of 3.5% and value premiums of 4.9% per dollar of energy savings (Eichholtz et al. 2011, p. 19).

Performance:
Data analyzing Energy Star labels efficacy have identified operation and maintenance improvements due to periodic maintenance procedures and active energy management. Commercial buildings with Energy Star labels utilize 35% to 40% less energy than comparable buildings (U.S. Department of Energy, 2008). Six consecutive years of Energy Star labeled
buildings are approximately 20% more efficient the sixth evaluation year than the first (Katz & Perlman, 2006). The Environmental Protection Agency discovered buildings with multiple years of Energy Star labeling improve building performance over time and outperform comparable buildings that are not Energy Star labeled (Kats & Perlman, 2006).

**Occupancy:**
Financial impacts related to occupancy flux are felt by building owners and managers. Occupancy trends have been noticed among managers of Real Estate Investment Trusts (REITs). REITs managers have confirmed buildings with large Energy Star portfolios are character of high occupancy and high tenant comfort (Katz & Perlman, 2006).

Energy Star labeled buildings are more likely than non-labeled buildings to have efficient ventilation and lighting systems that increase tenant comfort. Satisfactory tenant comfort provides the opportunity for occupancy and financial profitability. “Energy Star labeled buildings with the highest occupancy also have higher reported use of EMCS (Energy Management and Control Systems)” (Katz & Perlman, 2006).

**Asset Value:**
Realtors are also recognizing the link between Energy Star labeling and the asset value. Two major factors increasing asset values of commercial buildings due to Energy Star labeling are higher occupancy rates and the related lower operating costs.

**Economic:**
A building with predictable energy performance due to the implementation of an Energy Star label is linked with a building’s increased value trend. Buildings with consistent energy performance correlate a building’s higher net operating income due to energy savings.


The Equity Office Properties, a large United States company owning, operating and managing over 70 million square feet of commercial office building space throughout the country, commented on the Energy Star label, “The ENERGY STAR label signals to its tenants and investors that it has capitalized on an extraordinary opportunity to make its buildings environmentally and fiscally sound” (Katz & Perlman, 2006).

**Efficacy Testimonials:**

David Downey, Managing Director of Transwestern Commercial Services, states, “When we sell buildings that are Energy Star, purchasers are more likely to recognize and pay the increased building value resulting from the decreased energy use and increased net operating income” (Katz & Perlman, 2006).

“Through their partnership with EPA, the owners and managers of Energy Star-certified buildings are helping reduce greenhouse gas emissions while saving on utility bills,”
says EPA Acting Administrator Bob Perciasepe. “With Energy Star, cities across America are helping achieve President Obama’s goal to cut in half the energy wasted by our businesses over the next 20 years.” (Renew Grid, 2013)

“Over the past 20 years, with help from Energy Star, American families and businesses have saved more than $230 billion on utility bills and prevented more than 1.8 billion metric tons of greenhouse gas emissions, according to the EPA” (Renew Grid, 2013).

“ESPM does provide the means to prospectively analyze a building via a tool called ENERGY STAR Target Finder. Target Finder provides an estimate of what ESPM rating a building might obtain upon completion and 12 months of operation, if managed to achieve the estimated EUI. Industry stakeholders indicate they find the tool insufficiently robust, requiring additional work to Target Finder to make it useful from an asset analysis perspective. To achieve replicable and reliable results, the entire analysis of “as-built” conditions needs a systematic approach” (McCabe & Wang, 2012).

“The persistence of energy performance in ENERGY STAR labeled buildings documented in this study helps ensure future energy savings and a higher NOI (net operating income), which can contribute to increased asset value” (Katz & Perlman, 2006).

“The ENERGY STAR energy performance scale is based on existing buildings because this approach supports informed investment decisions that unlock the tremendous energy and carbon emissions reduction potential that exist in the commercial buildings market” (Understanding EPA’s Energy Star, 2011).

Future

Commercial buildings are a major component of a municipality’s economic environment and significant consumers of energy. New and existing commercial buildings hold the potential for energy performance savings. Various economic benefits rest with the adoption of commercial building energy performance labeling. Local energy savings can result in considerable financial benefits and reach local, communal ambitions (ACEEE: Energy efficiency policies).

The premium for green buildings tends to be larger in smaller markets and outlying metropolitan areas where rents are lower. A green label, such as Energy Star or LEED, adds proportionately less in value at a prime location, in part because land rents are higher and utility costs a smaller component of rent (McCabe & Wang, 2012).

Policy and decision makers, state energy offices included, have the ability to make a large impact on the energy efficiency of commercial buildings. Implemented labeling programs could provide an incentive component aimed at energy efficiency growth (U.S. Department of Energy, 2012). Efforts to improve energy efficiency in commercial buildings should be directed toward decision-makers and their interests. Decision makers may or may not be occupants of buildings.
“Communities in states taking little action on efficiency can set examples for the rest of the state in efficiency service delivery or in developing policies to improve access to information on energy-saving opportunities for the community as a whole. Every community can take action by improving energy efficiency in their own government operations and public investments” (ACEEE: Energy efficiency policies, 2013).

Although local governments own a small percentage of the commercial buildings in the United States, local administrations can lead with a public and private influence. Public organizations and have the opportunity to lead by example, implement and execute energy labeling in commercial buildings within the community, and require new and renovated buildings to implement energy benchmarking programs. Local governments can make decisions that influence private actions in building investments.

Building owners and companies investing in commercial buildings space, small to large, are likely to invest in asset rating systems and labeling programs differently. Owners large in size will utilize such initiatives as the ESPM to designate opportunities for improvement and to compare their performance to others. Smaller building owners are likely to use the tool to designate and understand the necessary steps to take to save costs and improve energy performance.

Local governments should keep in mind that commercial buildings with effective labeling programs appeal to utilities and the opportunity for energy efficiency and demand-side management utility programs to provide incentives to commercial building owners (U.S. Department of Energy, 2012).

Priorities and community values should be at the forefront of energy efficiency decisions in each community. Commercial energy labeling may not be appropriate for every community, but every community can make some measure to become more energy efficient. Most programs or policies, commercial energy labeling included, require very little or no cost. Slowly incorporating energy efficiency labeling into existing plans, services, or activities is the best place to start.
Resources


