U.S. DEPARTMENT OF ENERGY

PNNL-21310

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Commercial Building Energy Asset Rating Program

Market Research

MJ McCabe
N Wang

April 2012

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle *Since 1965*

DISCLAIMER

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information,
P.O. Box 62, Oak Ridge, TN 37831-0062;
ph: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161
ph: (800) 553-6847
fax: (703) 605-6900
email: orders@ntis.fedworld.gov
online ordering: http://www.ntis.gov/ordering.htm

This document was printed on recycled paper.
(9/2003)

PNNL-21310

Commercial Building Energy Asset Rating Program

Market Research

MJ McCabe[1]
N Wang

April 2012

Prepared for
the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory
Richland, Washington 99352

[1] HaydenTanner, LLC, Bigfork, Montana.

Abstract

Under contract to Pacific Northwest National Laboratory, HaydenTanner, LLC conducted an in-depth analysis of the potential market value of a commercial building energy asset rating program for the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy.

The market research objectives were to

- Evaluate market interest and need for a program and tool to offer asset rating and rapidly identify potential energy efficiency measures for the commercial building sector.
- Identify key input variables and asset rating outputs that would facilitate increased investment in energy efficiency.
- Assess best practices and lessons learned from existing national and international energy rating programs.
- Identify core messaging to motivate owners, investors, financiers, and others in the real estate sector to adopt a voluntary asset rating program and, as a consequence, deploy high-performance strategies and technologies across new and existing buildings.
- Identify leverage factors and incentives that facilitate increased investment in these buildings.

To meet these objectives, work consisted of a review of the relevant literature, examination of existing and emergent asset and operational rating systems, interviews with industry stakeholders, and an evaluation of the value implication of an asset label on asset valuation.

This report documents the analysis methodology and findings, conclusion, and recommendations. Its intent is to support and inform the DOE Office of Energy Efficiency and Renewable Energy on the market need and potential value impacts of an asset labeling and diagnostic tool to encourage high-performance new buildings and building efficiency retrofit projects.

Summary

Over the past several years, there has been a call from pioneers in building energy efficiency to establish a national asset rating standard for comparing energy use in commercial buildings. Currently, the primary standard for comparison is the U.S. Environmental Protection Agency (EPA) ENERGY STAR Portfolio Manager (ESPM). ESPM looks at the whole building "in use" and evaluates a property on the basis of its utility bills (after weather normalization). However, the actual in-use performance of the building is not only related to the as-built system efficiency, but also highly dependent on operations and maintenance as well as plug loads and occupant behavior. The energy performance of a building is subject to wide variation because its occupancy, usage, and management are likely to change. A baseline that gauges the intrinsic energy efficiency of a building from which apples-to-apples comparisons can be made among buildings can be derived only by separating out building characteristics established prior to layering on occupancy and operation.

To address the need for a standard means by which to make such comparisons, the U.S. Department of Energy (DOE) is establishing a voluntary commercial building energy asset rating program and is creating a tool that can help building owners evaluate their buildings. Using a standardized approach to model building energy use, the asset rating system will evaluate the physical characteristics of the building as built and its overall energy efficiency, independent of its occupancy and operational choices. Measured ratings (such as ESPM) alone provide an incomplete picture of the potential energy performance of the building. Energy asset rating, as a complementary system, can provide detailed information that can enable building operators, owners and tenants to identify, prioritize, and justify energy investments and strategies. It also provides a foundation for tracking change in performance over time.

The energy asset rating system is intended to be complementary to the EPA ESPM, which takes into account both the physical assets of the building and its operation, and maintenance. The objective of ENERGY STAR is to provide for ongoing performance measurement via a benchmarking tool for peer-to-peer comparisons or for the building to compare its performance over time. In a complementary fashion, the purpose of an asset rating is to break out the infrastructure piece so that the system efficiency and the operation outcome can be considered separately. Separately evaluating the physical assets of the building eliminates the wide variation due to differences in operation, weather, plug loads, and occupancy, allowing buildings to be compared on an equal footing and providing the means for an owner to determine if the building is performing well because it is a highly efficient building or because it is well managed. Depending on the nature of the occupant, the building owner may have limited control over the usage of the building (e.g., trading floor, data center) and its systems. The ability to disaggregate the energy profile of a building enables the owner to focus on those aspects over which he has control.

> *Our buildings have so many different tenants with different uses that it is difficult to sort out what is occupant vs. the building.* Institutional Investor/Owner

In short, the DOE objectives in undertaking a national building standard creating a commercial building asset rating program are to

- Facilitate cost-effective investment and energy efficiency in commercial buildings.
- Provide a tool that will allow owners to benchmark their building(s) against peers.

- Create a basis for valuing and financing energy-efficiency improvements.
- Provide a means to view the relative efficiency of different buildings, explicitly distinct from operations and maintenance, occupant behavior, plug loads, and scheduling.

To meet the above objectives and further understand the market needs, a market research was conducted prior to the program design. Research work consisted of a literature review; examination of existing asset and operational rating schemes and tools; interviews with industry stakeholders (including building owners, facility managers, bankers, investors, tenants); a series of webinars, focus group gatherings, and an in-depth stakeholder meeting; and an analysis of the potential impact of asset and operational rating systems on commercial properties and owner decision making. Relevant findings and factors for success in designing the asset rating program and tool include the following:

- Owners will react more favorably to something that integrates with the EPA ESPM (messaging)—a "complementary system," but one that does not dilute ESPM. Stakeholder feedback consistently highlighted the desire for a strong and meaningful linkage between the asset rating and other rating systems.
- Stakeholders expressed unease over redundancy, conflicting requirements, label "fatigue," and confusion among the existing and proposed rating systems.
- Owners and managers are concerned about cost to implement in terms of actual cash outlay and time impact on staff.
- Owners/investors have built a business model around ESPM. They are facile with the requirements and are used to benchmarking against the tool.
- Owners expressed a desire to recognize buildings "orphaned" by ESPM (those either not meeting the minimum threshold for certification or excluded property types) and a means of recognizing efficiency improvements, even if performance does not meet minimum ENERGY STAR certification threshold (a score of 75).
- Owners pointed out a data gap that exists for large multi-tenant properties and other property types (i.e., restaurants, college campuses, service buildings, convenient stores, assembly buildings, multi-family buildings, mixed-use buildings). Not every building fits "the model."
- Owners desire a benchmark scale that provides both a technical measurement fixed energy use intensity (EUI) per square foot and a relative standard compared to peers (measured against a building's own performance).
- Stakeholders believe the asset rating results would be most useful if they convey information about the existing systems in the building (e.g., system remaining life, comparable to other systems, to support strategic decisions when planning for retrofits).
- Owners noted the asset rating may enable them to identify best performers as well as to separate out the buildings most likely to provide cost-effective return on energy conservation investment.
- Stakeholders indicated that to forge common understanding and shared objectives, language needs to be broadened to incorporate financial and energy metrics in the same medium; for example, cost per kilowatt-hour needs to be translated easily to cost per square foot.

Based on the market research findings, criteria for a successful energy asset rating program have been developed to direct the program design. First, validity of ratings (input and output) must be ensured through accurate and complete data input and output that is relevant to the subject building, actionable, and cost effective. Rigor of the energy analysis must be balanced with cost. Second, the program needs to develop effective quality control measures. Quality assurance issues include competency of rates, simplified inputs, clear reference points (square footage, building type classification, normalization factors), and audits, spot checks, or other means of ensuring rating validity. Third, the energy asset rating program must include integration with operational performance data (e.g., through linkage with ESPM). Linkage with existing systems (ESPM, LEED, ASHRAE bEQ, other third-party applications) must be provided. Fourth, the program must provide actionable strategies for the building owner to make appropriate energy-efficiency improvements. It must reflect incremental improvement. The last but not least important finding is that training, education, and outreach are essential.

The market research has provided useful evidence to assist DOE in making key program design decisions. To address the identified market needs, the energy asset rating system will provide a centralized modeling tool, both reducing cost and increasing standardization allowing for consistent and reliable comparisons. The asset rating tool is the first step in the process by which owners can enter information about their building structure and receive information on the building's modeled performance and recommended efficiency measures.

The model will take into account the building envelope, the mechanical and electrical systems and, other major energy-using equipment (e.g., commercial kitchen appliances in a restaurant)—components built into the building and considered structural in nature. The asset rating system will assess the building's current energy use on a rating scale, identify potential opportunities for cost-effective efficiency improvements, and note what impact those opportunities might have on reducing the building's energy use and its position relative to the scale. The asset rating tool aims to provide added value in the first step of assessment of a building by describing some possible upgrades.

The asset rating is not intended to be a replacement for a full energy audit of a building. The objective of the tool is to give property owners the means of gauging the efficiency of their properties as compared to the potential efficiency, providing information on key action steps, and motivating them to make reasoned and value-conscious investments enabling them to target limited capital resources toward those areas that will produce the most efficiency improvements. Owners of larger properties or portfolio owners may use the tool as a first pass, essentially as a "Phase I" energy report,[1] to assess their buildings and prioritize which buildings should be further assessed using a more detailed energy audit. Owners of smaller properties may be expected to use the tool as a cost-effective means of evaluating energy efficiency and identifying specific actions that may be taken to improve building performance.

[1] Akin to a Phase I Environmental Site Assessment—a report prepared on real property (land and improvements) that identifies potential or existing environmental contamination (ASTM E1527; http://www.astm.org/Standards/E1527.htm). In the commercial real estate markets, the concept of a phase I environmental report has been well understood by the mainstream users.

Acknowledgments

Special thanks must be given to those who gave freely of their time and knowledge, especially Cody Taylor at the U.S. Department of Energy and stakeholders from across the commercial real estate industry who shared their insights through a series of interviews, webinars, focus groups, and written commentary. Many others through the course of this work contributed greatly of their time and expertise—property owners, appraisers, investors, lenders, engineers, architects, those in the private sector, and those in the public sector, nonprofits, and the utility industry. To each of you, we offer our profound gratitude.

Sincere thanks go also to Kim Fowler, Andrew Nicholls, Andrea Currie, and others at Pacific Northwest National Laboratory for their constructive suggestions and thorough review.

Abbreviations and Acronyms

179d	section 179D federal energy tax deduction
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASHRAE bEQ	ASHRAE-developed Building Energy Quotient program
BPIE	Buildings Performance Institute Europe
CBD	Commercial Building Disclosure
CBECS	Commercial Buildings Energy Consumption Survey
CEC	California Energy Commission
CO_2	carbon dioxide
DEC	Display Energy Certificate
DOE	U.S. Department of Energy
EEM	energy efficiency measures
EERE	DOE Office of Energy Efficiency and Renewable Energy
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EPC	Energy Performance Certificate
EPBD	Energy Performance of Buildings Directive
ESCO	energy service company
ESPC	energy services savings performance contract
ESPM	ENERGY STAR Portfolio Manager (building energy efficiency rating program developed by EPA)
EU	European Union
EUI	energy use intensity
ft^2	square foot, feet
GAO	U.S. Government Accountability Office
GRESB	Global Real Estate Sustainability Benchmark
HVAC	heating, ventilating, and air conditioning
kBtu	thousand British thermal units
LEED	Leadership in Energy and Environmental Design
m^2	square meter(s)
MASS DOER	Massachusetts Department of Energy Resources
MPG	miles per gallon
NABERS	National Australian Built Environment Rating System
NBI	The New Buildings Institute
O&M	operations and maintenance
PNNL	Pacific Northwest National Laboratory
REIT	real estate investment trust

RESNET	Residential Energy Services Network
tCO_2e	greenhouse gas emissions equivalent to 1 ton of carbon dioxide
UK	United Kingdom
USGBC	U.S. Green Building Council

Glossary

capitalization rate – The percentage number used to determine the current value of a property based on estimated future operating income. Essentially it is the investors' required rate of return on their investment, based on an assessment of risk. Net operating income divided by the property value = the cap rate. Alternatively, the net operating income divided by the cap rate will provide an estimate of the current value of the property. The higher the cap rate, the greater risk the investor perceives with the property returns.

Class A, B, or C property – Factors that generally affect property classification are 1) age and condition of the building, 2) quality and availability of amenities, and 3) rental rate (often reflecting factors 1 and 2).

competitive (economic) obsolescence – Occurs when the property owner can no longer earn a fair rate of return on the ownership/operation of the subject property

discount rate – The required rate of return as dictated by the most likely set of market rate investors; the rate of return an investor will apply to the cash flows of the property over the anticipated investment hold period. The higher the discount rate, the higher the risk an investor perceives in the cash flows and, consequently, the lower the net present value of the property.

Display Energy Certificate (DEC) – In the UK, a DEC is required to be posted for larger public buildings. The DEC reflects the energy usage of the particular building and should be displayed at all times in a prominent place clearly visible to the public. They are accompanied by an Advisory Report that lists cost-effective measures to improve the energy rating of the building.

Energy Performance Certificate (EPC) – The certificate provides energy efficiency A-G ratings and recommendations for improvement. The ratings—similar to those found on consumer products such as refrigerators—are standardized so the energy efficiency of one building can easily be compared with another building of a similar type. These are required on all property sales and leases.

lease-up – The process of leasing space to full occupancy in a building. The period of time it takes to reach full lease up is called the "absorption period."

Leadership in Energy and Environmental Design (LEED) – Green building ratings provided by the U.S. Green Building Council (USGBC).

net lease or triple net – A lease requiring the tenant to pay the expenses of the property, such as utilities, taxes, insurance, maintenance, and cleaning, in addition to the fixed rental fee. The tenant is responsible for the payment of these additional costs either, directly or as additional rent. Opposite of a full-service gross lease.

net operating income – Income (in an investment property – rental income) after deducting operating expenses (e.g., utilities, janitorial, supplies, accounting, management, maintenance) for the property but before interest and taxes.

public relations – The art or science of establishing and promoting a positive relationship with the public.

real estate investment trust – A corporation or trust that uses pooled investor capital to buy and manage shares in a real estate portfolio, direct real estate, or real estate loans. A REIT can be one of three types: a listed public REIT, which trades on a public stock exchange; an unlisted/ REIT, not traded on a public exchange; or a private REIT. REITs enjoy certain tax benefits and must distribute out 95% of their annual earnings to shareholders.

stakeholder – A building owner, operator, manager, or agency able to supply data on the building physical details and energy consumption or who has some decision-making authority or influence on decisions made with regard to the building.

Tier 1, Tier 2, Tier 3 – Tier 1 cities are generally defined as major metropolitan areas in a country with populations greater than 4 million people and that attract high levels of investor interest. These cities typically reflect high levels of real estate occupancy. Tier 2 cities are smaller, typically 1–4 million in population, and are considered growth cities. Tier 3 cities have populations under 1 million people and are considered emerging cities. Some examples of Tier 1 metropolitan areas in the United States include New York City, San Francisco, and Washington, D.C.

Contents

Figures

Tables

1.0 Introduction

The state of real estate investments, high-performance building technology, and the interest in energy efficiency, particularly deep efficiency, continues to evolve rapidly. Competing priorities, increased complexity, changing regulations, and the competitive environment mean business practices are constantly changing.

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) is establishing a national commercial building energy asset rating program and developing tools that will enable building stakeholders to directly compare as-built energy performance among similar buildings, irrespective of occupant behavior and building operation. It is likely these comparisons will drive further investment in energy efficiency and thus reduce energy use in the commercial building sector. The asset rating system will consist of an online software tool with which to compute the energy efficiency inherent in a building, taking into account the envelope, mechanical and electrical systems, and other major energy-using equipment. The asset rating system and software (the asset rating tool) will result in an energy certificate and help commercial building owners and operators identify and implement specific actionable strategies to improve efficiency in their buildings. The standard asset rating report will provide a uniform framework and metric yielding consistent, straightforward, and reliable information. The ultimate objectives are to facilitate stakeholder understanding and broadened access to capital and to support quality assurance and increased energy efficiency retrofits.

The asset rating tool will enable owners and operators to compare their buildings to peer buildings. It will enable lenders, potential buyers, and lessees to gain insight into the long-term energy cost of a building, informing their valuation of the building. Building owners and investors can also use the asset rating tool to generate analyses of the potential for cost-effective capital improvements to increase energy efficiency. In addition to awarding buildings an asset rating, the asset rating tool can provide information on specific, actionable, and cost-effective energy retrofit measures to owners, energy managers, purchasers, occupants/tenants, and other stakeholders. Therefore, the commercial building energy asset rating program will support continuous improvement of energy efficiency by allowing the tracking of costs and impacts of energy-efficiency strategies in commercial buildings.

The Pacific Northwest National Laboratory (PNNL) is providing technical assistance to DOE in its development of the asset rating tool and rating system. In support of the effort, PNNL contracted with HaydenTanner, LLC to conduct an in-depth analysis of the potential market value of a commercial building energy asset rating program.

1.1 Objectives

The stated objectives of the commercial building energy asset rating program are as follows:

- Create a tool to help building owners identify and implement actionable strategies to improve commercial building energy efficiency.
- Establish a national standard for commercial building energy asset rating.
- Coordinate with the Environmental Protection Agency's ENERGY STAR Portfolio Manager and create an integrated national building rating system providing asset rating and measured rating.

- Increase the ease of adding new building types to the rating system.
- Reduce reliance of the rating system on the data from the Commercial Buildings Energy Consumption Survey (CBECS). CBECS provide useful data and reference for wide applications. Total reliance on CBECS data to rate buildings has some limitations. The update of the rating systems is dependent on the update of the CBECS database. For some building types, the data set is small and relatively incomplete.
- Differentiate opportunities for improvement in building systems, operation, and maintenance.

To support the development of the energy asset rating and diagnostic tool, the objectives of the market research documented in this report are as follows:

- Identify the need for a commercial building asset rating program
  - to identify the benefits and market value of an asset rating to industry stakeholders
  - to illustrate and address the impact of an asset rating on the decision criteria of building owners, investors, developers, operators, and financiers.
- Assess existing national and international rating programs to identify best practices/lessons learned.
- Provide market feedback for program and tool design.

1.2 Approach Overview

To meet these objectives, work consisted of a literature review of relevant writings, examination of existing asset and operational rating schemes and tools, interviews with industry stakeholders, a series of webinars, focus group gatherings and an in-depth stakeholder meeting, and an analysis of the potential impact of asset and operational rating systems on commercial properties and owner decision making.

Under contract to PNNL, HaydenTanner

- Reviewed more than 65 articles, peer-reviewed reports, and books on topics related to asset and operational ratings, labeling, real estate sustainability and value; impact of financial and policy mechanisms; energy pricing and utility regulation; cost of sustainable improvements, and human behavior, social psychology, decision making, and change management.
- Researched in depth existing and emergent asset and operational rating schemes worldwide (19 programs).
- Interviewed key stakeholders. More than 226 organizations were contacted. Stakeholder interviewees included property owners, institutional and private equity investors, financiers, appraisers, property and asset managers, and senior managers from nonprofit organizations and state and federal government agencies.
- Presented seven stakeholder webinars tailored to address key sector issues. Participants included corporate owners/user; investors/owners; state, municipal, and federal government agencies; the engineering community; nongovernmental organizations; and finance and appraisal representatives.
- Conducted four focus groups consisting of stakeholder participants in multiple cities.

- Published a Request for Information in the *Federal Register* (DOE EERE 2011a); more than 400 comments were received from 52 unique individuals and organizations.
- Evaluated the linkage between asset ratings and value, particularly in terms of the financial and competitive impact.
- Assessed the practical implications of an asset rating diagnostic tool and associated recommendations.

1.3 Report Organization

Section 2 provides insight into the market feedback received. In Section 3, background is given on the forces driving the need for and interest in a national commercial building energy rating system and an asset rating certificate and diagnostic tool. Section 4 provides an overview of existing and proposed regional, national, and international rating tools, along with an assessment of best practices and lessons learned. An assessment of real estate market stakeholders is provided in Section 5 to put the impact and practicality of an asset label into context. The decision framework for property investment decisions and how an asset rating scheme interrelates is explained in Section 6. Section 7 offers a discussion of value perceptions prevalent among the industry decision makers, culled from stakeholder input derived from webinars and a stakeholder workshop. Tools, measures, and links between existing operational rating programs and other third-party applications are discussed in Section 8. The findings from the overall analysis are summed up and discussed in Section 9, and a suggested path forward is presented. Literature sources cited in the text are listed in Section 10. Publications reviewed but not cited in text are listed in the bibliography in Section 11. Appendix A provides in-depth details on current U.S. state and municipal programs and legislation. In Appendix B, detailed summaries of national and international rating programs are presented. Appendix C offers a list of stakeholder drivers determined as a result of this research.

2.0 Market Feedback

The objectives of the stakeholder outreach and market research were as follows:

- to identify the benefits and market value of an asset rating to industry stakeholders
- to illustrate and address the impact of an asset rating on the decision criteria of building owners, investors, developers, operators, and financiers
- to identify the value proposition derived from asset rating (cost/benefit analysis)
- to identify stakeholders and potential impacts from the rating program
- to develop a consist set of metrics and standards, which involved
  - identifying key energy-related data factors that impact asset value proposition (focus on factors that drive the most significant changes)
  - identifying where the data will be derived, who will enter the information (including necessary level of skill and expertise), and how much time will be required for data entry.

To obtain input from stakeholders and other parties interested in its asset rating program, DOE issued a Request for Information (RFI; DOE EERE 2011a) on August 9, 2011, and hosted seven webinars that same month (DOE EERE 2011b). Subsequent outreach activities included holding four focus groups, interviewing more than 60 people, and facilitating a stakeholder workshop in December 2011. Through these efforts, DOE received input from 226 unique organizations as well as a number of independent individuals. The RFI alone received more than 400 comments from 52 unique respondents.

The interviews, webinars, focus groups, and responses to the RFI reflected a mix of opinions from stakeholders. Most respondents acknowledged the value of deconstructing a building's energy use profile into the separate components of building structure, operations, and occupant behavior, to determine where meaningful improvements may be made. Many were concerned about confusion surrounding multiple rating systems, conflicting requirements among the rating systems, validity of the data, and additional burden associated with data collection. Representative comments from respondents are reproduced in Figure 2.1.

Review of the literature and responses from stakeholders led to several key findings about the market. First, ENERGY STAR Portfolio Manager (ESPM) is the most commonly used energy rating system in the United States. Most large real estate owners have incorporated ESPM into their business models, and many regularly benchmark their assets. In addition, most investors use ESPM as a baseline for evaluating the energy efficiency of their buildings; the program provides a year-over-year comparison in terms of cost per square foot.

Second, the real estate industry looks to building ratings and certifications as a proxy for quality. Stakeholders indicated believing that ENERGY STAR certified buildings do consume fewer resources, which implies lower cost. This belief is generally borne out by the fact that ENERGY STAR certified buildings typically reflect an average of 35% lower energy consumption than peer buildings. The literature review provided further details. A March 2011 study of 1,100 recent rental transactions in the Dutch market shows offices with a "green" asset rating are achieving rental rates 6.5% higher on average

Our buildings have so many different tenants with different uses that it is difficult to sort out what is the occupant vs. the building. The only place the building owner has control is over the shell and base systems of the building. Institutional Investor

The ability to decouple the asset from the use is helpful in identifying which buildings have the greatest potential long term. Institutional Investor/Owner

An asset rating is a reflection of modeled energy efficiency - how efficient, in this case, is a commercial property, on paper. The actual "in-use" performance of the building is strongly dependent on operations and maintenance as well as plug loads and occupant behavior. Ideally, an asset rating is accompanied by some kind of "in use" rating (like ENERGY STAR). Energy Modeler/Engineer

An asset rating system would evaluate the existing building's potential performance. If that were available alongside an actual performance data point, the industry would have a very powerful tool to accelerate capital investment for financial and environmental returns. Real Estate Investor/Owner

A lot of this [an asset rating tool] could positively impact the mid size players with Class B buildings. There is a significant difference between players who hold assets in high rent markets and those who hold the same square footage in lower rent markets. When you have rents that are 85% lower than the high rent properties, you have less capital to work with, lower margins and probably less sophisticated systems internally to do all of the auditing, retro commissioning, etc. Investor/Owner

ENERGY STAR Portfolio Manager is becoming the benchmarking standard among commercial office buildings. Any voluntary asset rating system should be based on or highly interoperable with ENERGY STAR Portfolio Manager. Investor

Data transfer to/from Portfolio Manager should be as seamless as possible to ease use and avoid redundant effort. Engineer

The building community and policy makers should focus on acceptance of a single method or program to reduce confusion, contradictions, and complications. Industry Organization

Modeling the as-built building using the actual weather and operating conditions and comparing it to the actual utility consumption and operational rating, possibly exported from Portfolio Manager, could provide an indicator that the building is actually operating in an optimum manner. Engineer/Modeler

Figure 2.1. Representative Comments from Stakeholders[1]

[1] The quoted comments represent overall sentiments from the stakeholder interviews.

than comparable non-green buildings (Kok and Jennen 2011). 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). More evidence comes from published studies that found investment in energy efficiency (retrocommissioning and retrofitting) leads to financial returns greater than institutional hurdle rates (Goldman et al. 2005; Mills 2009).[1]

Other key findings about the market include the following:

- Stakeholders suggested they would use information provided by an asset rating tool to support investor due diligence and capital allocation. In a potential acquisition, some investors noted being more concerned with replacement costs than with historic energy expenses.
- An asset rating tool could both ease the cost burden of evaluating buildings and help target the use of limited incentive (government and utility) and capital (private investment) dollars to those buildings with the greatest potential for improvement.
- Owners, lenders, investors, and occupants could gain insight into a building's value distinct from maintenance and occupant behavior.
- Feedback tying the asset rating system to ongoing performance metrics will likely make financing more feasible and drive accountability on the part of designers, contractors, and energy modelers.
- Tracking benchmarking, or comparing a building to itself over time, is useful in identifying changes in building performance.
- A slight majority of respondents expressed preference for a technical scale over a relative one, similar to that used by ESPM. A technical scale is a grade-based system calibrated and set without the use of a database of energy data such as CBECS, based instead on a reference value.
- Several respondents supported the use of a ratio scale such as the Zero Energy Performance Index (Eley 2009), although concerns around using net zero as a fixed end-point were raised.
- Respondents suggested the scale be periodically revisited to take into account improvements in building technology.
- Investors generally expressed preference for using a scale consistent with ESPM.

[1] Note, however, that this applies to "institutional investor returns" who generally invest in Class A space, which itself implies the lowest (although presumably safest) hurdle rates.

3.0 Prevailing Winds – Changing Market Forces

As indicated, while awareness of energy efficiency is rising and seems to be housed in the large commercial or government sector, up to this point there has been limited interest in the private sector in doing deep retrofits that could significantly impact energy use. In Germany, for example, only 7% of the public buildings (and far fewer privately owned properties) have undergone energy efficiency renovations.[1] These same challenges apply to the U.S. private markets. However, the winds appear to be changing.

3.1 Investor Demand

According to the Global Real Estate Sustainability Benchmark (GRESB) survey, 32% of institutional real estate investor respondents are able to report on energy usage. This is up significantly from 2009 when the figure was only 19% (GRESB Foundation 2010). Institutional investors are increasingly aware of the impacts of sustainability on their portfolios. More than 70% of those reporting in the 2011 GRESB survey indicate they are tracking sustainability factors as part of their assessment process, and 88% indicate they incorporate sustainability into their major retrofit plans. These companies represent the large property portfolio owners—those most likely to be benchmarking to ESPM and representing about half of the total square footage of commercial space in the United States (although only 5% of the buildings). Although this signifies a significant movement toward energy efficiency, implementation in the broader market continues to suffer because of the lack of basic information at a granular level. Gaining this information can be expensive; the information itself may not be easily accessible, and skilled contractors are not always available. Accordingly, retrofits and efficiency measures are not readily undertaken in the Tier 2 (and 3) markets, or by owners of small and mid-size buildings. (These challenges apply equally to the United States and internationally.)

Some of the lack of forward momentum can be ascribed to the following factors:

- lack of information and awareness
- split or conflicting incentives
- comparatively small profits.

Many building owners have little working knowledge of what makes up the components of their energy use, much less what can be done to increase efficiency. Ultimately, there is a need to establish a baseline from which recommendations may be made. What is the potential efficiency for the building, given its structural makeup? How much energy and electricity is the building currently using? An onsite energy audit creates considerable disruption for tenants. In addition, there are significant contractual complexities such as distinguishing among those future savings that are due to greater efficiency, those that may occur because of occupancy changes, and those due to unusual weather. A number of building managers say it is hard to convince the owner of the building to purchase an efficient-building energy package because of its complexity. The rule of thumb in renovating buildings is that it is relatively easy

[1] As a result of several Executive Orders, U.S. federal agencies have aggressive energy and greenhouse gas reduction goals. The DOE Federal Energy Management Program (FEMP) facilitates the federal government's implementation of sound, cost-effective energy management and investment practices.

and cost-effective to reduce energy consumption by 15%–20% in most older commercial buildings through lighting upgrades and operational fixes.[1] Easy no-cost and low-cost savings come from enhanced operation and maintenance, retrocommissioning, and retuning.[2] Few owners see the need or the benefits in taking on a more detailed retrofit without being further educated on the results.

Incentives conflict between landlords and tenants. In most commercial buildings, the tenant pays in one form or another for operating expenses. In some cases, this is achieved through submetering, in which the tenant pays directly for the actual use, such as electricity bills. In other cases, using triple-net leases, all the building operating expenses are paid by the landlord and then passed through and reimbursed by the tenant. Even in leases where the landlord pays the base operating expenses, there is usually a provision in the lease stating that increases or decreases in operating expenses after the first year are passed through to the tenant. Thus, there is a misalignment of incentives, with the landlord responsible for the capital costs for making the building more energy efficient but the tenants benefiting from the savings.

The profits are small. With utility costs in U.S. office buildings averaging about $\$2.20/ft^2$, a 20% reduction in energy use yields savings of $\$0.44/ft^2$ (DOE EERE 2011c). A comprehensive energy audit and modeling analysis can cost up to $\$0.50/ft^2$ (California Energy Commission 2000). Therefore, detailed audits and modeling can often be cost-prohibitive for all but the largest buildings and commercial building owners.

Recent surveys indicate the momentum may be shifting—propelling property owners and managers to press for more granular understanding of what is driving energy use and could drive efficiency. Results of a global survey released in June 2011 (Johnson Controls 2011) note that a 70% majority of senior-level executives at responding companies identify energy management as "extremely or very important."[3] The largest increase (from 52% to 66%) was seen in respondents from the United States and Canada. The key driver both in the United States and globally is the potential for energy cost savings.

In the United States and Canada, limited funding was cited as the biggest barrier to pursuing energy efficiency in all sectors (institutional—government, hospitals, schools, industrial, and commercial). The

[1] According to the DOE Energy Information Administration, approximately 29% of electricity used by the average office building can be attributed to lighting. Reducing electricity used by lighting by 50% alone will save approximately 15%. Adding motion sensors, timers, and other operational controls can contribute another 15% of savings (http://www.eia.doe.gov/emeu/consumptionbriefs/cbecs/pbawebsite/office/office_howuseenergy.htm, January 2011). And, according to the Building Owners and Manager Association (BOMA) *Green Guide – Sustainability: The Great Differentiator,* there are a number of operational best practices that are low to no cost that can result in a 15% to 20% reduction, and other technologies can save up to 25% or 50% (BOMA Magazine, May/June 2011, available from http://www.boma.org/SiteCollectionDocuments/Org/Docs/Get%20Involved/Green/Pages%20from%20BOMA_MayJune2011_final.pdf).

[2] A series of Advanced Energy Retrofit Guides was developed by Pacific Northwest National Laboratory and PECI on behalf of DOE. The guides provide general retrofit planning guidance and financial payback metrics for five key segments of commercial property sector in the United States. The guides indicate that most properties can achieve 5%–25% savings on the basis of retro-commissioning and changes to operations and maintenance (available from http://www.peci.org/sites/default/files/aerg-office.pdf).

[3] For the fifth consecutive year, Johnson Controls, International Facility Management Association, and the Urban Land Institute conducted the North America Energy Efficiency Indicator (EEI) survey of 1,435 decision makers responsible for managing energy use within commercial buildings across North America. The March 2011 EEI survey examined the attitudes, practices, investment plans, and expected return-on-investment for energy management initiatives among decision makers in commercial buildings.

second largest hurdle, cited by 29% of commercial property respondents, was limited funding with insufficient payback/return on investment noted by 25% of respondents. Lack of awareness about opportunities was cited only 8% of the time, and uncertainty regarding savings or performance was cited by 13%. Interestingly, industrial and commercial respondents are seeking external expertise to assist in devising efficiency strategies that may provide an opportunity for the asset rating tool to assist in identifying options.

Further, a March 2011 survey of large corporate energy users in the commercial and industrial sector (E Source 2011) asked a variety of questions about past energy management successes and future priorities for managing energy. The replies from 54 energy manager respondents indicate that tracking facility energy performance data on an increasingly granular level is a growing priority. In the recent past, energy managers have been focused on achieving cost savings through maintenance and procurement practices. However, now they are being asked to focus on measuring, understanding, and managing microscale energy use.

A 2011 survey completed by CBRE, Inc. of its portfolio of managed properties shows the focus over the last 2 years has largely been on solutions directly under the control of building managers—primarily operational in nature or low- to no-cost improvements such as installation of compact fluorescent lighting (Pogue and Laquidara-Carr 2011). A more far-reaching analysis is planned in the future with survey respondents looking at occupancy sensors and light-emitting diode lights. Building managers who participated in the survey noted the greatest impact comes from updates to heating, ventilating, and air conditioning (HVAC) systems, retrofits to lighting, and the installation of energy management systems.

Performance metrics are tracked in almost every property surveyed—98% of respondents report tracking whole-building energy metrics, while 58% measure on the basis of kilowatt-hours per square foot (Pogue and Laquidara-Carr 2011).

3.2 State and Local Mandates

Existing and proposed regulations at the U.S. municipal and state levels that link to energy ratings were also studied for this report.

In the United States, two states and five major cities have passed legislation for privately owned commercial buildings (Table 3.1). Cities such as New York, San Francisco, Austin, Seattle, and Washington, D.C. are leading the way on benchmarking and transparency. According to the Institute for Market Transformation (IMT 2011), most of these programs require energy benchmarking and some level of disclosure, ranging from confidential disclosure to the governing body to full public disclosure. In 2007, California approved legislation that required benchmarking and limited disclosure as of the first of 2010. In 2008, the District of Columbia went further and required phased-in public disclosure, also starting in 2010. And in what has been called the most sweeping commercial building energy-efficiency legislation, New York City passed the Greener, Greater Buildings Plan in December 2009 (City of New York 2011). The legislation increases energy efficiency requirements for renovations and requires most properties to undergo energy use audits and retrocommissioning[1] every 10 years. The audit process will identify capital improvements that will pay for themselves in a "reasonable" period. Perhaps most

[1] Retrocommissioning involves retuning measures that ensure building systems are operating efficiently.

significant is the requirement that all commercial buildings greater than 50,000 ft^2 benchmark and publicly report their energy use. The city of Seattle followed suit in January 2010 (Buildingrating.org 2011).

Another 10 states and the city of Portland, Oregon, are considering commercial building ratings along with some form of disclosure. Specific details of the state and municipal programs are highlighted in Appendix A.

As municipalities require disclosure based on operational data, stakeholders indicate concern over their inability to 1) dictate occupant behavior and/or 2) access whole-building information on energy use for reporting purposes. Without legislation requiring or allowing such information release by the utilities, revised lease terms, or a voluntary sharing of information by each tenant individually, this information will be difficult to provide for many landlords. Asset ratings could provide an alternative disclosure data point for many owners.

Table 3.1. U.S. Commercial Building Energy Rating and Disclosure Policies. Source image copyright © 2012 Institute for Market Transformation; reproduced with permission.

		Legislation			Building Type & Size Threshold			Disclosure				Rating System		Additional Elements	
	Jurisdiction	Short Name	Enacted	Effective	Gov't	Commercial	Multi family	Public Website	Gov't	Transaction	Tenants	Energy Star	Other	Utility Support	Audit/Improvement Requirement
Cities	Austin	Energy Conservation Audit & Disclosure (ECAD) Ordinance	Nov 2008	June 2011	✓	10K SF+	Audits	-	✓	Buyers	-	✓	ACLARA	-	Audits & mandatory upgrades for multifamily buildings
	District of Columbia	Clean and Affordable Energy Act of 2008	July 2008	2010 -2014	10K SF+	50K SF+	50K SF+	✓	✓	-	-	✓	Energy Star Target Finder	-	-
	New York City	LL No. 476-A	Dec 2009	2010 - 2013	10K SF+	50K SF+	50K SF+	✓	✓	-	-	✓	-	-	ASHRAE level II audits & RCx, public building audits & upgrades
	San Francisco	Existing Commercial Buildings Energy Performance Ord.	Feb 2011	2011 - 2013	10K SF+	10K SF+	-	✓	✓	†Buyers, Lessees, Lenders	✓	✓	-	†	ASHRAE level I or II audits every 5 years
	Seattle	CB 116731	Jan 2010	2011 - 2013	10k SF+	10K SF+	5+ units	-	✓	†Buyers, Lessees, Lenders	✓	✓	-	✓	-
States	California	AB 1103	Oct 2007	2012 - 2014	†	5K SF+	-	-	✓	Buyers, Lessees, Lenders	-	✓	-	✓	Mandatory upgrades to be developed under AB 758
	Washington State	Efficiency First SB 5854	May 2009	2011 - 2013	10K SF+	10K SF+	-	-	-	Buyers, Lessees, Lenders	-	✓	-	✓	Audits for public buildings with low ratings
Under Consideration	Massachusetts	Building Energy Asset Labeling Program	-	-	10K SF+	10K SF+	10K SF+	TBD	-	-	-	TBD	Asset & Operational	-	ASHRAE level II audits and modeling
	Portland, OR	High Performance Green Building Policy	-	-	-	20K SF+	20K SF+	-	✓	-	-	✓	-	-	Mandatory upgrades for blds w/ scores <30

4.0 Existing Rating Systems

To inform the asset rating research, both national and international energy rating and verification programs were reviewed for robustness and maturity. The key objectives were to identify best practices and lessons learned, highlight linkage to value impacts where available, and use these insights to support the design of the asset rating program.

International programs reviewed included Energy Performance Certificates (EPCs) and Display Energy Certificates (DECs) in Europe (United Kingdom [UK], Ireland, Denmark, Portugal); the National Australian Built Environment Rating System (NABERS); and rating systems from China and Brazil. Domestically, programs reviewed included the Minnesota B3 rating program and the Massachusetts-proposed asset rating program about to move into a pilot stage. HaydenTanner also reviewed the EPA ESPM, the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) program, and the Building Energy Quotient (bEQ) program developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

4.1 Overview

First adopted in Denmark in 1997, energy rating policies are now mandatory in 30 countries worldwide. The most commonly known rating system is the European Union (EU) Energy Performance of Buildings Directive (EPBD), enacted in 2002. The EPBD requires building energy rating and disclosure in all member states for both commercial and residential properties. Australia, Brazil, and China also have passed building energy rating laws over the last 5 years.

Other programs exist at the local level, including voluntary programs in a number of provinces, territories, and municipalities in Canada; a mandatory disclosure program for commercial properties within the city of Tokyo at the time of sale, lease, or transfer; and mandatory home energy disclosure at the time of sale in Australia.

There is increasing awareness, especially for large portfolio and institutional owners, of the operational and financial risks associated with owning and running inefficient properties. As states and municipalities begin to implement ratings and disclosure regulations on both a voluntary and mandated basis, owners and investors are taking a greater interest in understanding the link between building characteristics and energy use. Government and corporate tenants of tenant-occupied space increasingly prefer or require markers of energy efficiency and sustainability using metrics such as the EPA ESPM and the USGBC LEED programs as proxies for sustainability. Property owners are tasked with identifying the critical areas in which capital deployment will garner the most efficiency and achieve "certifiable" results. The ability to distinguish between energy use due to the building structure and that resulting from systems, operations and maintenance, and occupant behavior becomes crucial in identifying the most effective use of limited resources.

Rating systems can generally be segregated into two categories—operational ratings and asset ratings. Asset ratings, commonly although not exclusively used in Europe, estimate energy based on the building's structural components and simulated operations. The objective of an asset rating is to compare similar buildings solely on the basis of their physical building characteristics. Operational ratings, also called "measured ratings," look at energy use based on actual operations established by utility bills. The

two are complementary but not directly comparable. An operational rating incorporates the basic framework of the building but is determined primarily by building use, occupant behavior, and operations and maintenance. The operational rating provides input on how the building is being used and what operational changes may be made to improve performance. The asset rating strips away the unique characteristics attributable to human activity and looks at only the building structure. The asset rating is derived strictly from modeled performance.

Reviews of each of the programs produced invaluable information on best practices and lessons learned. The majority of the existing governmental rating programs are predicated on the basis of measured energy data. The details of each can be found in Appendix B. Highlighted here are lessons learned from two of these programs, along with a summary of guidance gleaned from all of the programs.

4.2 Generic Lessons Learned

4.2.1 European Union

In 2010, the Royal Institute of Chartered Surveyors (RICS) and Investment Property Databank (IPD) released a study of UK properties[1] that showed no apparent correlation between Energy Performance Certificates and total return on commercial properties. (Their study suggests there may be a relationship between EPC rating and income return, although the data were not sufficiently clear to show causal effect.) The study examined over 7,000 EPCs for buildings (and parts of buildings) where investment performance data is held by IPD, a global commercial real estate information firm that provides benchmarks and market indices to institutional and large property investors. The study found that in the UK, 64% of investment-grade property has EPC ratings of C or D. (Buildings in band A are found to be the most energy efficient.) The key issue identified by the researchers as having the most impact on the relationship between value and ratings was strong concern over the accuracy of the EPC rating itself. Consequently, there was little evidence of EPC ratings being taken into account during the investment or leasing decision process.

In December 2010, the Buildings Performance Institute Europe (BPIE) published a review of the EU experience under the Energy Performance Building Directive (BPIE 2010). Their research suggests that certain measures should be taken to increase the effectiveness of implementation and public acceptance of the rating systems. Accuracy can be improved in terms of its reproducibility by simplifying the data acquisition and subsequently increasing the number of default values required for the calculation. The report found by reducing the number of variables, overall data inaccuracy was reduced by 5% (from approximately 20% to ±15%). The deviation from calculated performance to actual building performance reduced from ±30% to ±10%.

The BPIE report concluded there is a need for a centralized registry system to allow for monitoring and evaluation, quality assurance, and enforcement. The report also identified a need for transparency between expectations and outcomes; for example, establishing a link between the calculated energy performance (EPCs) and measured performance (DECs).

[1] Third draft, *Analysing Energy Performance Certificates (EPCs) with financial performance information in the commercial property industry of England & Wales,* C Cudworth, R Graham, R Martinez Diaz, and B Olaluwoye, 2010, RICS Education Trust/IPD, London, UK. Information available at http://www1.ipd.com/Pages/DNNPage.aspx?DestUrl=http%3A//www.ipd.com/sharepoint.aspx%3Ftabid%3D3070 (November 2011).

4.2.2 United States

In 2008, the Commonwealth of Massachusetts began to evaluate how best to achieve net-zero energy construction in both the commercial and residential sector. In December 2010, the Massachusetts Department of Energy Resources (Mass DOER) released *An MPG Rating for Commercial Buildings: Establishing a Building Asset Rating Program in Massachusetts*, which outlined a framework to implement a commercial building asset labeling program as the first step toward a mandatory requirement. The Massachusetts work resulted from an exhaustive evaluation of most of the existing operational rating programs. While recognizing the value of the existing rating systems, Massachusetts determined that an asset rating, akin to the miles-per-gallon (MPG) rating for automobiles, was key to moving the market and allowing energy efficiency measures to be incorporated into building asset value.

The Massachusetts study (Mass DOER 2010) recommended a rating scale with the following attributes:

- Use a technical, rather than a statistical rating scale, rating buildings against a zero-energy benchmark.
- Use site energy use intensity (EUI) instead of source.
- Adjust the asset rating scales to account for different building types.
- Standardize inputs into modeling tool (data collection).
- The initial assessment will establish a building's energy asset and performance baseline and will result in a preliminary set of efficiency recommendations.
- Integrate with utility incentive and financing programs.
- A post-energy retrofit reassessment of the building should be done to finalize the utility incentive award and provide the new asset rating grade.
- Incorporate quality assurance measures such as education, training, and verification of those with sign-off authority.

4.3 Rating Program-Specific Guidance

4.3.1 ENERGY STAR Portfolio Manager

The EPA ENERGY STAR Program developed a performance rating system for commercial buildings. The national energy performance rating "was created to provide an easy, cost-effective method to compare the efficiency of a building relative to the national building stock, provide a simple 1-100 metric to help communicate that relative performance, and establish a national performance target for excellence" (Von Neida and Hicks n.d., p. 2). Through EPA's online tool, ENERGY STAR Portfolio Manager (ESPM), property owners can enter their building data and receive a rating.

ESPM has experienced wide adoption nationally, especially for owners of large buildings and portfolios. As of December 2010, the energy use of more than 200,000 buildings representing 18 billion ft^2 of floor space has been evaluated with ESPM. Of those, 12,612 buildings representing 2.1 billion ft^2 were qualified for the ENERGY STAR certification, which equates to about 6% of the total number of buildings evaluated using ESPM and 12% of total square footage (EPA n.d.). What is clear

from these numbers is that the majority of buildings verified would be considered large properties (>50,000 ft^2). This is borne out by the institutional market's acceptance of ESPM and its widespread use of the rating system as a benchmarking tool. Many of these firms have incorporated ESPM into their business models and look to the rating as a proxy for value. Increasingly, both government and corporate occupants are favoring (and in some cases requiring) ESPM-verified properties when they lease or acquire property.

Further, ESPM is the basis for a number of state and municipal rating and disclosure programs as well as the USGBC Leadership in Energy and Environmental Design certification system. In addition to the mandated programs in place across the United States, there are more than 20 national voluntary incentive programs and competitions that leverage ESPM tools. These programs generally use some comparison of Portfolio Manager's efficiency scores to rate and reward the "greenest" properties (EPA 2010).

ESPM is a measured energy rating tool that allows a building owner to compare actual energy use to similar buildings within their climate zone. The program produces a comparative rating relative to the mean score of similar buildings based on the most recent DOE Commercial Buildings Energy Consumption Survey (CBECS). ESPM scores present the building in a historical context based on the CBECS data for the specific building type. ESPM-verified buildings represent the top 25% of buildings as compared to the relevant CBECS data pool and reach a minimum score of 75 on a relative scale of 0 to 100 where 100 is the best. CBECS, a survey of approximately 5,000 buildings nationally (about 0.1% of the number of total buildings), is typically done once every 4 years. The most recent data available are based on the survey conducted in 2003 (EIA 2006).

ESPM requires a fairly simple set of data based on a minimum of 50% occupancy, 12 consecutive months of metered utility bills, and basic building and space use characteristics, such as building size and location, operating hours, and number of occupants, to compute performance metrics. It normalizes for factors including climate, vacancy, and space use. ESPM takes into account both the physical characteristics of the building and the operational aspects.

Although ESPM is the predominant rating system currently in use in the United States, stakeholders identified components that limit the usability of the system. Some of these include the following:

- ESPM benchmarking rules require that all buildings, including those with mixed uses, benchmark as a single structure.
- 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.[1] State-level benchmarks (or anything geographically smaller) are also not available. (Other localized data sources, such as the California Energy Use Survey (CEUS), are beginning to address this need.)

[1] ENERGY STAR Performance Ratings Technical Methodology, http://www.energystar.gov/ia/business/evaluate_performance/General_Overview_tech_methodology.pdf, and Guidance for Benchmarking Mixed Use Properties in Portfolio Manager, http://www.energystar.gov/index.cfm?c=eligibility.bus_portfoliomanager_eligibility_mixed.

- Although all properties are able to use ESPM to track their energy use, not all can achieve a rating. Ratings are predicated on 12 months of continuing operations and minimum occupancy that preclude new buildings or those with low lease-up from participating. Whole-building utility data are not always readily or legally available for multitenant buildings.
- The rating scale at the top end is insufficiently granular to differentiate substantive efficiency improvements.
- Although owners can make reasoned guesses about the drivers of energy use, the tool does not provide the means to isolate the components of building form, operations and maintenance, and occupant behavior.
- There is no feedback loop between the energy design and construction function and "in-operation" performance of the building.

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.

4.3.2 The Complementary Nature of Asset and Operational Rating Systems

> *Given the extent of Portfolio Manager's market penetration, I think that first and foremost it is in the industry's interest that any new government programs leverage the existing web and information portal: Portfolio Manager.* Investor

As tenant and investor requirements for assurances of energy efficiency increase and state and local benchmarking and disclosure mandates come into play, owners increasingly are finding they do not have the requisite information to achieve an ESPM rating. An asset rating tool that allows differing building types to be evaluated as a package and does not require operational data can provide an alternative means of evaluating energy efficiency.

Financing mechanisms and government incentives can be structured based on the combination of efficient structures and systems. Incorporated with a means of gauging operational success provides the means to track and ensure the persistence of energy savings, thereby increasing certain of returns, thus reducing risk. Energy modeling is also used as the basis for tax credits. However, there is no feedback loop. Combining asset rating and operational rating provides a necessary feedback loop and accountability providing greater confidence over the long term.

The ability to compare the as-designed/as-built building structure to the actual performance of the building supports greater accountability, learning, and ultimately innovation in the design and construction sector. Further, it supports the appraisal community by creating the means to concretely value the efficiency improvements and confidently incorporate the energy savings into the building analysis.

4.3.3 U.S. Green Building Council – Leadership in Energy and Environmental Design

Verification of new buildings and now existing buildings under the USGBC Leadership in Energy and Environmental Design (LEED) is increasingly common within the commercial building sector. LEED is a well-known green building certification system in the United States, particularly for Class A office space. Under the voluntary program, building design is rated on a points scale, evaluating various metrics such as energy usage, water efficiency, indoor air quality, and stewardship of resources. The LEED rating is based on seven categories; the largest of the point allocation in the current version is accorded to energy. Under LEED 2009, 35 of the total 100 base points in the rating system relate directly to building energy efficiency.

Under the LEED rating system, a building must achieve minimum energy performance as determined by an approved energy modeling program (for new constructions or major renovations) or by meeting a minimum ESPM score of 69 (for existing buildings). Because the energy section for LEED requires minimum energy saving performance and allocates points for going beyond minimum requirements, LEED verification levels have been considered a proxy for an energy performance value. Updates to LEED verification have resulted in substantially greater points allocated to energy optimization. However, a LEED rating is not necessarily representative of the relative energy performance of a building. Studies have shown that buildings with the same LEED rating having widely varying projected compared to actual energy use.[1] These conclusions were supported in a report issued by the New Buildings Institute (NBI) for the USGBC (Turner and Frankel 2008).

LEED for new construction requires the building design to meet minimum standards under an approved energy modeling program. With confirmation of the validity of the inputs, an asset rating verification could provide an acceptable alternative to the existing approved modeling tools.

4.3.4 ASHRAE Building Energy Quotient

The ASHRAE Building Energy Quotient (bEQ) is an energy labeling program slated to include both an operational label and an asset label. The operational label provides information on measured energy use based on building type and operations. The asset (or "as-designed") label, which is currently being piloted, will provide a modeled assessment of the building, taking into account design components such as mechanical systems, envelope, orientation, and daylighting. The rating will be based on the results of an energy model comparing the building to a median baseline building. It is designed to provide granular information and is expected to be particularly useful to those buildings at the top end of the energy efficiency spectrum—those high-performance buildings striving toward net zero performance. The DOE energy asset rating is not intended to compete with the ASHRAE bEQ or replace a full energy audit but rather to provide an entry-level analysis for all commercial buildings.

[1] Within each of the metrics, measured performance displays a large degree of scatter, suggesting opportunities for improved programs and procedures. Measured EUIs for over half the projects deviate by more than 25% from design projections, with 30% significantly better and 25% significantly worse. "A handful of buildings have serious energy consumption problems" (Turner and Frankel 2008).

4.4 Lessons Learned from Existing Rating Systems

The lessons learned from the existing rating systems are summarized as follows:

- Accurate data input and consistent modeling method are necessary. Qualified and trained building assessors are needed to enhance the quality of the rating system.
- The credibility of the certificate and relevance of energy efficiency recommendations rely on reproducible and reliable modeling results.
- The key program challenge is balancing the validity of results (via rigor of data collection and modeling) with the cost to implement. Data input requirements need to be simplified and limited. More simplified data acquisition requires a lower level of expertise and less time and effort from the assessors, thus resulting in lower costs for the assessment. It is critical to have the right balance between default values and data acquisition. Design should involve multidisciplinary stakeholders to ensure the correct balance between default values and data acquisition. Innovative technology may be used to reduce input and modeling error and increase scalability.
- Consistent use of input values, certificate design, and terminology across platforms will increase market acceptance and usage. A rating certificate should be familiar to the general public and in line with existing rating systems. For example, Energy Ireland has paid specific attention to balancing issues like practicality, costs, clarity, and consistency, which has resulted in relatively high public acceptance and awareness of their asset rating.
- Efficiency improvement recommendations must be both reasonable and relevant to the target building (type and size) as well as practical and cost-effective.
- Support functions such as a help desk and technical assistance have been shown to be useful.
- A link between calculated and measured performance should be established.

5.0 Market Stakeholders

5.1 Target Audience

Existing buildings hold the key to unlocking energy savings. As of 2003, there were approximately 4.9 million commercial buildings in the United States comprising 72 billion ft^2 of floor space. Although the average building is only 14,700 ft^2, 50% of the total space is composed of buildings larger than 50,000 ft^2 (EIA 2006). Commercial buildings consumed 19% of all energy in the United States in 2009—up from 14% in 1980 (EIA 2010). Office and retail are the largest users of energy in the commercial space (DOE EERE 2011c). All told, the private sector has the largest stake in the commercial markets, owning 77% of all commercial floor space, divided evenly between owner-occupied buildings and leased (non-owner-occupied) buildings (EIA 2006); government entities own the remaining 23%.

Large portfolio/building owners, mid-size players, and small property owners will likely use the asset rating system and tool in different ways. Large property owners actively using ESPM to benchmark their building stock are likely to use the asset rating tool to do a first pass on their portfolio to assess opportunities to dispose and acquire buildings. Secondarily, they will use the verified data as a further means of differentiating their assets from those of their competitors. Owners of small and mid-size buildings are more likely to use the tool and accompanying recommendations as a cost-effective means of determining what types of improvements may be made to their properties. These asset owners may be less likely to do the requisite validation to receive a verified asset rating certificate. Smaller property owners may be expected to use the tool as a cost-effective means of evaluating energy efficiency and identifying specific actions that may be taken to improve building performance.

Secondary users are anticipated to be financing sources (banks, investors, rating agencies), valuation experts (appraisers), designers/engineers (to do a preliminary modeling in support of more in-depth analysis and recommendation), municipalities, and other third-party users, such as the USGBC for LEED or ASHRAE, who may wish to integrate a national asset rating into their systems.

5.2 Market Breakdown

There are various categories and subcategories of commercial real estate owners and investors. Owner/users are those who use buildings to house their own employees to meet their own business needs—these may be corporate, institutional, or government entities. Then there is a broad category of real estate investors—institutional, private, core, opportunistic, large, and small. Of the total number of commercial buildings, only 5% are larger than 50,000 ft^2 (Figure 5.1). These large properties account for more than 50% of the total space by square footage and are generally owned by institutional investors and corporate owner/users. According to the 2003 Commercial Building Energy Consumption Survey (EIA 2006), 95% of the total number of commercial buildings in the United States are 50,000 ft^2 or less, and 72% of the total are 10,000 ft^2 or less (Figure 5.2). The majority of these smaller buildings are privately owned and evenly split between owner occupied and non-owner occupied. Overall, these figures reflect a fragmented ownership market.

Most energy efficiency projects are undertaken as part of a larger, more comprehensive retrofit project often done for repositioning purposes. Consequently, the state of the market and the age of the buildings impact the timing of efficiency projects and likelihood of investment. Currently, only 2% of

construction projects are for new buildings, while 86% of construction dollars go into renovation of existing building stock. As a cost-effective means of evaluating potential energy efficiency improvements, the asset rating tool can be used prospectively and enable building owners to plan future renovations to take into consideration efficiency improvements.

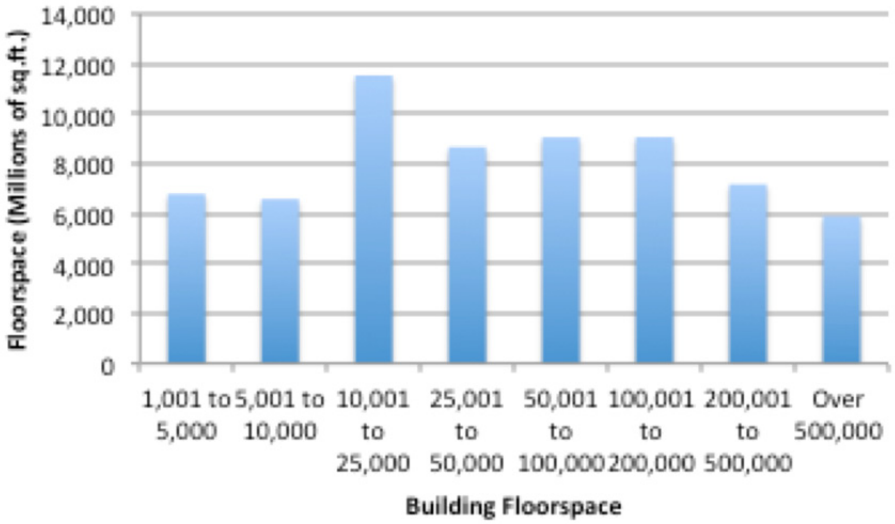

Figure 5.1. Breakdown of Total Commercial Building Space in the United States (EIA 2006)

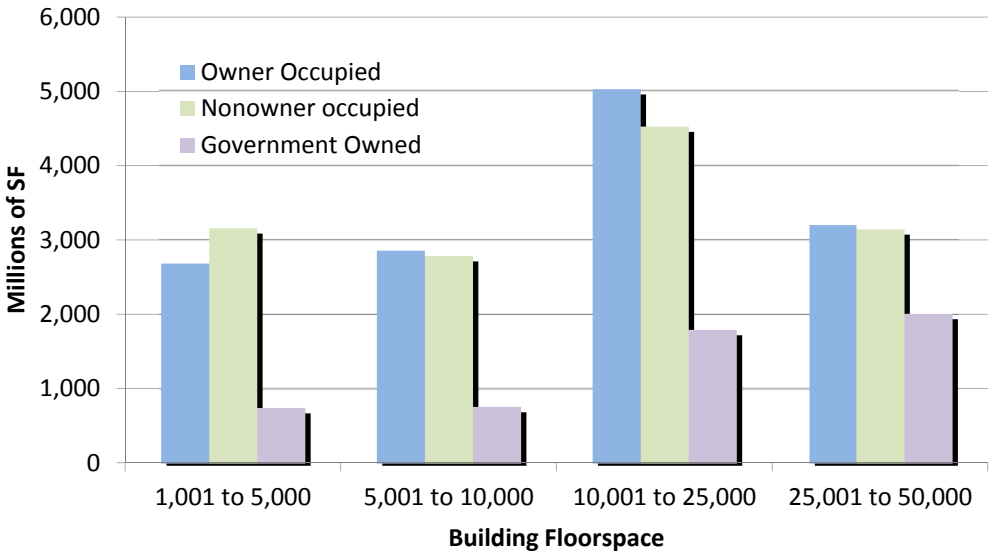

Figure 5.2. Breakdown of Space Ownership in Small to Mid-Size Buildings (EIA 2006)

5.3 Commercial Real Estate Market Conditions

With the exception of large institutional owners who, in many cases, have large pools of internal capital or credit capacity to borrow from the large banks, many in the commercial real estate market are currently hampered by a lack of available external capital and the overarching economic downturn, which impacts owners directly and indirectly though inability to finance projects. Tenant downsizing (and

bankruptcy), reduced discretionary spending, and budgetary restrictions also limit available capital. There are significant differences in the capacity and focus between those large owners in Tier 1 markets and the mid- and small-size market players. Many larger players are actively benchmarking their portfolios in ESPM and making capital decisions accordingly. A study among firms with revenues of $250 million and higher shows that 85% of their energy efficiency projects were funded through capital budgets and company profits (McGraw-Hill 2011). The mid- and small-size owners often do not have the same capacity—either capital or expertise—to consider efficiency measures. In either case, energy efficiency must compete with owners' other priorities for a limited pool of capital.

According to real estate research firm Reis Inc., the commercial office market had a national vacancy rate of 17.5% as of the end of the second quarter of 2011, on par with a year earlier. Washington, D.C. had the lowest vacancy at 9%, while Detroit had the highest at 26.7%.[1] Rental rates are up in some major urban markets—tending to favor large institutional owners who own Class A properties in these markets. In a wide variety of markets however, owners need to fill space to increase rental revenue—and preserve value. Consequently, many commercial real estate investors are conserving cash to deal with tenant rollover and debt repayment rather than putting money into large retrofit projects.

Current sentiment is that economic growth is proceeding far slower than anticipated. In its June 2011 meeting,[2] the Federal Reserve System Federal Open Market Committee projected the economy will grow at a moderate pace, impacting the ability and desire for many real estate owners and investors to invest capital in capital improvements of any nature.

[1] http://www.reuters.com/article/2011/07/06/usa-officemarket-idUSN1E7641W620110706.
[2] Minutes of the Federal Open Market Committee, June 21-22, 2011. Available from http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20110622.pdf.

6.0 Decision Framework – Market Strategies

For any given real estate owner, the decision to invest in energy efficiency is predicated on their individual risk/return perspective, worldview, and their own long-term objectives and corporate values, as reflected in Figure 6.1. The asset rating tool allows for each stakeholder to make decisions that are relevant to their unique situation.

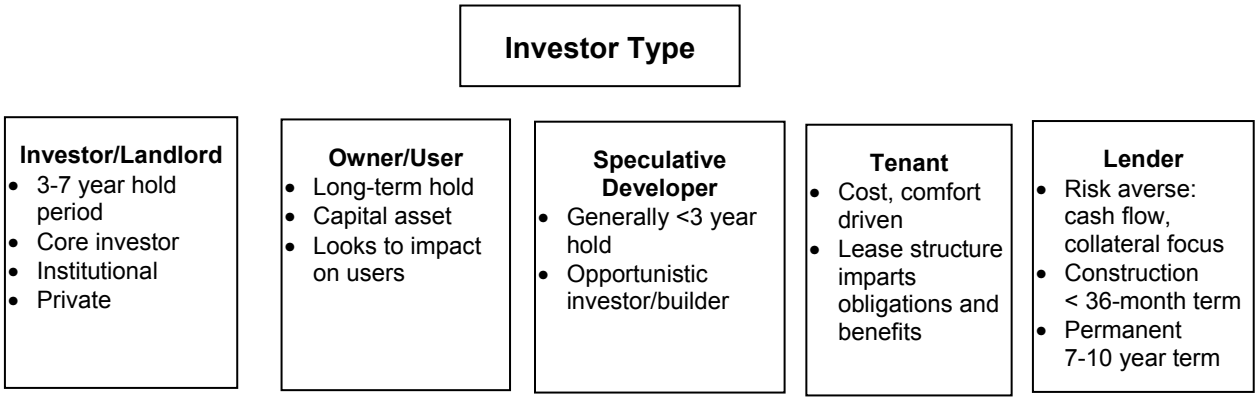

Figure 6.1. Basic Investor Context

Owners/users who tend to have longer-term hold mindsets are generally more likely to invest in technologies that require a longer payback period because they are able to wait longer to recoup their investment and tend to reap the rewards of efficiency for a longer period. Institutional and other mainstream real estate investors will prioritize competing capital needs on the basis of necessity, returns, and the potential to improve leasing, use, or competitive position in the market. For example, will improvement ensure the property maintains its status as a Class A space with correspondingly higher rents? Again, depending on the nature of the investor, these owners may take a long- or a short-term view of their investments. Properties that by the nature of their lease structures, which allocate capital costs to owners and operating benefits to tenants/occupants, will likely require new contractual agreements, financial structures, or both. Further, owners of leased property as well as real estate brokers often make money from utility charges passed along to tenants. Reduced utility costs due to resource efficiency could reduce revenue for both, leading to a disincentive to invest or to push for higher efficiency.

Property type also plays into the likelihood of capital investment for energy efficiency and other sustainability measures. Those assets with greatest homogeneity and size are likely to be the first to adopt and use an asset rating (GRESB Foundation 2011, p. 17):

- transaction costs – Investments to improve the efficiency of small commercial properties are relatively expensive compared to investments in high-rise office or large retail space.
- asset homogeneity– The difficulty in predictably modeling and benchmarking mixed-use or other nonstandard buildings limits the credibility and usefulness of the asset rating report and diagnostic tool.
- lease structure – The lease contracts that are prevalent in different property types (gross versus net leases) also affect the flow of savings stemming from efficiency retrofits, influencing the investment

decisions of landlords. In addition, operational control of investors in industrial and retail space is typically limited, and this restricts intervention by the landlord before the expiry of the lease.

- tenant demand – Tenant demand regarding the energy efficiency often differs between property types. The greatest lever in this space has come from government tenants and large corporate entities for office space; lower interest has been shown from industrial users and those needing limited space.

The framework for any property investment decision can be divided into three types of decisions: strategic, tactical, and property-specific (Muldavin 2010, p. 80, Exhibit IV-5). A voluntary asset rating program enables decisions at the tactical and property specific level. An asset rating enables owners to evaluate their asset or portfolio and to clearly understand the context of that building in relation to others. Based on the results of the asset rating analysis and resulting recommendations, buildings and investments may be prioritized.

Tactical decisions are portfolio-wide and apply to investment and divestment strategies. Property-specific decisions are focused explicitly on individual properties—which property to invest and which property to sell. These decisions are made "on the ground" by those responsible for analyzing different investment choices and making reasoned recommendations.

For small property owners, the asset rating may be sufficient to make these decisions. For most large portfolio owners, it will provide a low-cost way to triage the portfolio and determine on which assets to do further energy modeling. *What are the risks and returns for specific investments for a given property? How will the sustainability features impact the property value and its competitive positioning in the marketplace?*

6.1 Owner/User

Property owners who can be characterized as owner/users include both large scale users—essentially the corporate market, municipal, state, and federal government entities, universities, or hospitals with holdings over 50,000 ft^2 and small business owners, the majority of the market by building number. These owners generally are long-term holders of property where real estate ownership is not their primary business. They control real estate as a means to conducting business or governing. They manage the movement of their own occupants/workers in and out of space. They are interested in occupant comfort and health because this meets their corporate values and believe it translates into enhanced worker satisfaction, retention, and recruitment, and possibly productivity. Although the large property owners might get their buildings ENERGY STAR- or LEED-rated, they do it more because it correlates with their fundamental values or for public relations purposes rather than with any residual value driver. In the current economic environment, these entities may be capital constrained and want to retain cash for operational purposes. However, they are interested in ways of increasing cash flow, which allows them to invest more in their core business.

Owner/users evaluate the investment in the context of competing needs for capital along with a desire to meet certain corporate objectives (e.g., expense reduction, corporate social responsibility[1] goals, corporate values, and public image. This segment of the commercial owner market is more likely to engage immediately in an efficiency project due to their long-term hold horizon, the direct benefits

[1] Corporate social responsibility goals also may be referred to as *environmental, social, and governance*.

derived by their workers, and the corresponding impact on cash flow. An asset rating tool can help them identify and prioritize these capital improvements both drive efficiency and cash flow.

6.2 Investor/Owners

Private-sector investors have, in the past, looked to a short-term bump in net operating income that they can parlay into a higher sale value in the near term. In comparison, energy efficiency measures are generally seen as investments with longer-term returns. Most private sector investors look to hold properties for 3 to 5 years; 7 years is rare and would be considered a long-term hold. Consequently, efficiency improvements have not garnered a lot of interest. However, as the markets have become more challenging, many investors, particularly in the institutional sector, now consider efficiency improvements and opportunities for energy-efficient capital improvements in their due diligence analysis. Capital improvements are made to increase efficiency, reduce operating expense, protect against future rises in energy costs, and create a differentiating factor when trying to attract tenants or buyers. An asset rating tool can facilitate this initial analysis and support capital allocation.

To meaningfully accrue value to the building upon sale, efficiency improvements will translate both into ongoing cash flow as well as the residual value. To do this, the improvements must be clearly identified and performance indicators benchmarked. All things being equal, if one compares two similar buildings, the one retrofitted with efficiency improvements will inevitably have a greater value than the one without, simply on the basis of the improvements. Although it may not be a dollar-for-dollar value increase as compared to the cost of the improvements, the commercial building without efficient equipment will sell at a discount to the one with the efficient equipment. The ability to verify the improvements translate into persistent savings supports the value enhancement.

Typically, high-performance and energy efficiency improvements are done in conjunction with a major retrofit—driven largely by the age of the property and its improvements but driven also by a desire to avoid competitive obsolescence as other more efficient buildings come on line. Capital projects are budgeted in advance and prioritized on the basis of necessity, enhanced lease desirability, and anticipated returns.

In smaller-size properties, the energy cost savings is generally not sufficiently significant to offset the transaction costs inherent in implementing a full-scale energy audit. The asset rating tool is useful in identifying the energy profile of a building and providing the property owner with simple and easy-to-follow recommendations.

Research reflects a split between large portfolio owners, even those with a similar amount of square footage under ownership or management. Some owners have only Class A office space in strong urban markets—New York City, Washington, D.C., or elsewhere. Others may hold a similar amount of square footage and/or number of buildings but in varying property types (office, industrial, multi-family, Class A, Class B) and in Tier 2 or even Tier 3 markets. Those in the first category see the value in sustainability and are anticipating regulatory changes, and their buildings are considered among the most desirable in their marketplace. For these property owners in these markets, rents are consistently high and vacancy is typically low.

Those in the second category may or may not be bought in, but they do not have the rents to support a lot of capital investment and often do not have the internal capacity or expertise to do extensive auditing

or retrocommissioning, much less continuous commissioning. These property owners are significantly impacted by market dynamics, particularly in those markets where vacancy is high and rents are low. Their focus is just to keep the building leased. These are the owners who benefit the most by an asset level energy efficiency diagnostic.

In fact, the top 10 property owners of office space already actively benchmark to ESPM. Some are also partners in the Better Buildings Challenge announced by the White House in late 2011.

Table 6.1. Top Ten Office Building Owners Globally as of Year End, 2009 (DOE EERE 2011c)

Owner	Floor Space Owned (million ft^2)
1. RREEF Americas	80.7
2. The Blackstone Group	68.0
3. Brookfield Properties Corp.	61.5
4. Vornado Realty Trust	60.0
5. Hines	58.8
6. CB Richard Ellis Investors	58.3
7. TIAA-CREF	46.4
8. LaSalle Investment Management	41.4
9. Duke Realty Corp.	38.1
10. Boston Properties	35.4
Total for Top 10	**548.6**

According to the GRESB Foundation (2011, p. 16),

> Size matters in explaining environmental performance, in line with scientific evidence on the diffusion of energy efficiency technologies in buildings. Larger property funds seem to have the scope to obtain the necessary economies of scale when implementing environmental policies. Interestingly, this contrasts with the perception that smaller funds, with fewer buildings under management, should be able to outperform larger funds when it comes to improving environmental performance.

6.3 Occupants/Tenants

A key driver in efficiency will be a tenant who identifies high-performance attributes as a best practice. The Office of the Future project is directly engaging tenants through pilot projects that use direct utility incentives to supplement tenant improvement allowances and incentivize tenants to choose efficient upgrades when building out their space.[1] Once energy demand in tenant spaces is reduced, central systems can be replaced with smaller equipment, thus reducing first costs and the overall energy use of the building. However, the timing must be synchronized with existing business plans, capital improvement plans, and equipment replacement cycles to leverage the opportunity with the property owner. Either full-service or triple-net leases that allow the landlord and tenant to share in the efficiency

[1] http://newbuildings.org/advanced-design/advanced-buildings (February 2012).

gains can enhance owner motivation.[1] Although this is more likely to be practical with a full-service lease, specialty clauses or addenda to existing contracts are common. (With reporting standards for energy efficiency leaning toward increased transparency in places like New York City, property owners who have benefited from utility pass-throughs as an additional revenue source likely will see increasing pressure to modify their agreements. Without recognition of this issue and care in drafting new lease structures, these property owners may resist efficiency measures and/or transparency.)

The fundamental nature of the real estate industry skews the distribution of benefits among the various stakeholders, which can be called the "agency issue." Unfortunately, the various stakeholders do not always perceive or capture the immediate benefits of sustainable or energy-efficient design. There are two agency issues at hand—the first is the different accruals of benefits. For example, if tenants are responsible for a building's electric bill, then the building's owners may not see the advantage in installing energy-saving heating, ventilating, and air conditioning (HVAC) or lighting systems. It is hard for anyone to rationalize an additional expense, without an immediate return on investment. The second agency issue is differing perspectives of the agents on the actual value of the investments; for example, societal benefits that do not directly translate into individual owner benefits, such as reduced chance of energy grid blackouts, lower utility capital costs because there is a sufficient power supply, upfront training costs to get workers trained on new equipment.

6.4 Industry Service Providers

6.4.1 Engineering and Design Community

Another benefit provided by linked asset rating and operational rating systems is the benchmark and feedback mechanisms for the designers and builders. These tools in combination enable designers and builders to understand how their decisions influence the efficiency of the building, be held accountable for ongoing building performance, learn from design decisions, and innovate more rapidly and with greater confidence.

6.4.2 Energy Performance Contractors/Energy Service Companies

An *energy service company* (ESCO) provides energy-efficiency–related and other value-added services to building owners. Performance contracting is a core part of its energy-efficiency services business. An ESCO typically provides four main services: the development, installation, and arrangement of financing for energy efficiency improvements and then, through an energy services performance contract (ESPC), ongoing maintenance, operation, and a guarantee of energy savings. The cost of the improvements is paid from the savings generated by the efficiency. The ESCO market is driven by the institutional and governmental sectors. According to a 2006 study by Lawrence Berkeley National Laboratory, the federal government and the "MUSH" market (municipal, university, schools (K-12), and hospitals) account for 82% of industry revenues (Hopper et al. 2007). Only 9% of revenues come from the commercial real estate market, despite significant efficiency opportunities.

[1] Full service gross lease: a lease in which the stated rent includes the operating expenses (including utilities) and taxes for the building. It is the opposite of a triple net lease (NNN). A triple net lease requires the tenant to directly pay, in addition to rent, all expenses of the property, such as utilities, taxes, insurance. The tenant would reap any benefits of lower property expenses.

An asset rating tool could be used either by the building owner to evaluate the opportunities for efficiency, or and as an initial analysis tool for the ESCO. In conjunction with an operational rating, it could provide a meaningful baseline for improvements. Through an ESPC, the ESCO "guarantees" the project will maintain a stipulated level of energy savings over a certain period—anywhere from 7 to 20 or even 25 years, based upon specific parameters such as load, usage patterns, hours of operation, and maintenance. However, private commercial property owners report a distrust of the energy savings purported to be achieved by the ESCOs. An asset rating tool would provide the building owner a means of independently analyzing the recommended solutions and making a more informed decision.

7.0 Perception of Value

Value considerations are important in framing the message—both the value of the energy efficiency measures in practice and the value of the label as a proxy for high performance.

Several recent studies (Pivo and Fisher 2010; Eichholtz et al. 2010a, 2010b; Kok et al. 2010, 2011) have shown a correlation between energy ratings and increased rent and value. A report published in 2012 (Kok and Jennen 2012) highlighted value premiums associated with high asset ratings on commercial property in Denmark.

An analysis done in the United States (Eichholtz et al. 2011) showed that properties with ESPM ratings above 75 have a 3.5% increase per dollar of energy savings in rent and 4.9% increase per dollar of savings in value. Generally speaking, there is an argument that a third-party rating supports the premise that a higher-performing building equates to higher quality overall. This is supported by a strong measurement and verification of performance and energy savings and ongoing commissioning as well as a robust operations and maintenance (O&M) process. And tenants, especially large corporate and government ones, recognize this and have begun to use high-performance measures as a litmus test.

A September 2011 report for the Australian Property Institute and Property Funds Association found a correlation between building ratings and value (Newell et al. 2011). A green premium in value for office buildings was evident for the National Australian Built Environment Rating System (NABERS) energy rating. This saw the 5-star NABERS energy rating delivering a 9% green premium in value and the 3–4.5 star NABERS energy ratings delivering a 2%–3% green premium in value as compared to benchmarked non-green buildings in similar markets. In addition, the report provides evidence of major discounts in value in the lower NABERS energy rating categories (less than 3 stars) for the Sydney central business district(10% discount in value) and Canberra (13% discount in value).

NABERS is a scaled rating system in which all properties receive a score (from 1 through 6 with, half-point increments, with the median score being 2.5; Appendix B). The Newell et al. study shows that less energy-efficient buildings are discounted in all categories of value, rent, and occupancy. Buildings with 3.5 stars and below have less value than average buildings in the market. It is relevant to note that disclosure of energy performance metrics at the time of sale is mandated in Australia.

However, there is still work to be done to educate stakeholders. A recent analysis by CBRE of its real estate portfolio indicates only 13% of occupants were aware their building was ENERGY STAR-labeled, and only 45% noted that it was LEED-rated (Pogue and Laquida-Carr 2011).

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 (Eichholtz et al. 2011). At the same time, the expectation in these markets is that a Class A property has met the minimum standards associated with these labels. Further, as investors look to reposition an asset through deep efficiency retrofits (either to maintain their position as a Class A property or up-tier from one below), the improvements and active ongoing maintenance and commissioning signal the market that this building is best in class.

If the goal is to align everyone's interests, then we must focus on accountability and shared benefits while we create standardized performance metrics that define and measure success. To be successful, solutions and messaging must directly address value and bottom-line results.

8.0 Market Linkage

There is a need to link high performance and energy efficiency to the value of the property beyond that which can be achieved in operating savings. In the private sector, efforts to capture these data continue to be centered on linkages between properties that achieve certain levels of ENERGY STAR and LEED ratings and their corresponding rent and sale values. As noted previously, these provide some compelling directional data but are still limited in the size and scope of their results. The USGBC now requires submittal of performance data on properties that receive LEED certification. CoStar, a firm that collects real estate information on the sales and lease rates for commercial properties, has added a screen to its database that includes a check for properties rated as LEED or ENERGY STAR.[1] The CoStar database notes if a property has received a designation but does not collect data related to property improvements or performance.

8.1 Validating Energy Efficiency

Supporting efforts to develop more accurate methods of verifying energy use provides clarity around efficiency results and allows private-sector capital to finance improvements. A nationally agreed-upon standard for determining an energy baseline, measurement, and verification, akin to ISO 50001[2] and that targets protocols aimed at ensuring strong persistence of savings, also would help. Certainty around actual energy performance and savings requires increased focus on analytic tools that allow for accurate measurement and transparency of information. Stakeholders recommended, and the asset rating team supports, using the Commercial Energy Services Network modeling default recommendations (COMNET 2010) in the asset rating tool.

The notion of savings is predicated on the credibility of a valid baseline. To achieve legitimacy, we need to

- Understand and agree on the baseline.
- Validate the baseline; prove out the energy models, via measurement and verification.
- Track efficiency over time – monitoring and verification equate to transparency.
- Proactively manage efficiency measures through robust O&M.

Tools that facilitate this level of transparency increase awareness, reduce risk by alleviating uncertainty, and set standards upon which appropriate benchmarks may be based by property type and region. Monitoring and verification, ongoing commissioning, and robust maintenance are critical. Through metering and response, they provide both feedback and transparency and enable persistent efficiency, increasing stability and continuity and reducing uncertainty over time. These in turn give comfort to tenants, owners, and investors that the savings are achievable and credible and allow for the efficiency to be monetized and the benefits allocated.

[1] www.costar.com.
[2] International Organization for Standardization (ISO) Draft International Standard 50001, http://www.iso.org/iso/pressrelease.htm?refid=Ref1337.

8.2 Industry Consensus Metrics, Standards, and Reporting

Industry consensus metrics verified by a credible third party will ensure transparency and enable sustainability value to be incorporated into value and financing decisions. The real estate industry has embraced ENERGY STAR, but additional work is necessary to enhance and create standards that support a rating for all property types.

One means of reporting and disclosure could be an energy usage "sticker" (akin to a fuel mileage sticker[1]) affixed to the building or incorporated as part of the building sales or lease package. Given varying occupancy conditions, weather variations, and energy price differences, the information would be specific to both region and property type. Focus group participants who viewed a proposed energy usage sticker recommended adding information correlating the modeled energy usage to cost per square foot of the savings over time. (Given that most investor/owners retain a property for 3–7 years, a 5-year horizon would be appropriate.)

[1] The Zerofootprint Foundation in Canada is rolling out a voluntary sticker program. Further details can be found in "Let's Do For Buildings What We Have Done For Cars" available from http://www.zerofootprintfoundation.org/images/uploads/Lets_Do_For_Buildings_What_We_Have_Done_For_Cars_US.pdf (September 2010).

9.0 Discussion and Conclusion

Mandates in reporting and disclosure requirements at the state and local level are driving interest in the ability to better understand a building's overall efficiency. The inability of landlords to control tenant behavior and, consequently, operational ratings, creates a need for an alternative means of providing information to the local jurisdictions.

Studies continue to show a positive correlation between properties with high energy ratings and value. Institutional investors in particular are already benchmarking their assets and looking for further granularity in their energy analysis. The ability to deconstruct energy use provides an additional means of valuing improvements and seeing the efficiency clearly reflected in total returns and appraised value.

Many building owners simply do not have the information to evaluate their energy use. Although they may be interested, they are not familiar with their building systems or they are not tracking their resource use because they do not have effective metering and submetering through which to do so. Then there are investors who may be interested in efficiency but who do not have ready access to capital. Either they are too small or their real estate exposure is in less desirable markets and capital availability is more limited. Finally, there are those smaller owners and investors who have never considered energy efficiency or high-performance attributes and for whom the issue is a low priority. There are other investor-related participants, such as tenants, lenders, real estate brokers, and rating agencies, all of whom have a stake in a property's performance and returns and have significant impact on the owner/investor's decision.

If the goal is to engage property owners in a way that motivates them to invest in energy efficiency we need to give them the tools to evaluate their buildings and recommendations on what to do. For greater efficiency to take hold, messaging needs to be centered on the financial impact to the property and/or portfolio, focused on risk and return. Ultimately, there is a need to assist property owners, investors, and lenders in evaluating the risks associated with a given property in concert with the opportunities for return. Overall, high-performing properties save money—money that will increase net operating income and consequently the value of the property.

An asset rating program facilitates an owner or investor's analysis for capital allocation; that is, for purchasing or divesting of a property. A typical institutional investor currently has a short investment horizon—which means they typically want a 3–5 year payback or less. This is because the only value they see is in the operational cash flow. The disaggregation that an asset rating provides allows the value of the improvements to be more easily incorporated into a discounted cash flow valuation both in terms of the operational savings as well as the reversionary value of the improvements at 10 years.

9.1 Key Findings

In summary, the market research suggests that operational ratings alone provide an incomplete picture of the potential energy performance of the building. The energy performance of a building is subject to wide variation because occupancy, usage, and management are likely to change. Combining the asset rating with an operational rating can provide detailed information that can enable building operators, owners, and tenants to identify, prioritize, and justify energy investments and strategies.

The asset rating validity must be ensured, while rigor must be balanced with cost. Clear reference points (square footage, building type classification normalization factors) are needed. Quality control and quality assurance are key issues for stakeholders. Simplified inputs and increased default factors can be used to reduce the data-gathering burden on the user. A web-based asset rating tool can provide a foundation for tracking change in building as-built efficiency over time. The tool should also provide efficiency recommendations that must be practical and relevant. To enhance financing and investment, efficiency improvement must be meaningful and proven to be persistent over time.

Linkage between the asset rating, operational rating, and third-party verification systems (ESPM, LEED, ASHRAE bEQ, state programs, and third-party applications) must be in place. Data gathering, inputs, and outputs should link closely with existing programs to reduce redundancy, ensure compatibility, and streamline and augment results. The ability to link modeled as-built performance to actual operational performance provides necessary transparency and feedback to designers, engineers, and contractors. It also enables persistent efficiency. This in turn increases stability and continuity, reduces uncertainty over time, and consequently enhances investment. Monitoring and verification of performance attributes are critical to increase investment and financing in the sector.

To forge common understanding and shared objectives, language needs to be broadened to incorporate financial and energy metrics in the same medium; for example, cost per kilowatt-hour needs to be translated easily to cost per square foot. In addition, the energy asset rating system should also allow for open-source third-party applications to build on the asset rating platform.

9.2 Suggested Path Forward

The following actions should be taken to ensure the success of the energy asset rating effort:

- Develop a value proposition that articulates the link between efficiency and returns.
- Demonstrate leadership by key property owners and publicize best practices.
- Provide clear energy efficiency recommendations and action steps that set the framework for success for a building owner.
- Ensure transparency and certainty around energy use and efficiency performance.
- Connect modeled energy results from asset rating to actual measured results to support financing and investment by proving persistence of high-performance measures over time.
- Provide education/training tailored for key stakeholders such as occupants, operators, and investors.
- Assist investment/financing that values high performance and efficiency as a *bankable* asset.
- Deliver easy and simple solutions that make adoption of high-performance measures effortless.

Many of these needs can be addressed effectively through the asset rating alone or in combination with an operational rating. Needs-driven promotion efforts include the following:

- Facilitate (and publicize) pilot projects by the General Services Administration, portfolio owners, and single-asset owners.

- Develop consistent, agreed-upon standardized metrics and methodology so that properties can be evaluated across the sector, allowing for comparison among assets and allocation of capital as well as enhancing uniform valuation and investment strategies.
- Design the asset rating certificate to provide a visible indicator of building efficiency and potential for improvement. An effectively designed certificate will serve to influence investor, tenant, and occupant interest in building performance and demand for increased efficiency.
- Partner with industry organizations to present tailored and targeted training for major stakeholder groups, such as the Building Owners and Managers Association, Urban Land Institute, Institute of Real Estate Managers, National Association of State Energy Officials, and the American Bankers Association.

10.0 References

BPIE. 2010. *Energy Performance Certificates across Europe. From design to implementation.* Building Performance Institute Europe, Brussels. Available from http://bpie.eu/energy_performance_certificates.html and http://dl.dropbox.com/u/4399528/BPIE/BPIE_EPC_report_2010.pdf (January 2012).

City of New York. 2011. Greener, Greater Buildings Plan. Available from http://www.nyc.gov/html/planyc2030/html/theplan/the-plan.shtml (January 2012).

COMNET. 2010. COMNET: Commercial Buildings Energy Modeling Guidelines and Procedures. Commercial Energy Services Network. Available from http://www.comnet.org/sites/default/files/images/COMNET-MGP-2.pdf (March 2012).

DOE EERE. 2011a. Commercial Building Asset Rating Program. Request for Information, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. *Federal Register* Vol. 76, No. 152, August 8, 2011, pp. 48152–48158. Available from http://www1.eere.energy.gov/buildings/commercial_initiative/pdfs/asset_rating_rfi.pdf (December 2011).

DOE EERE. 2011b. Commercial Building Asset Rating Program. Webinar slides, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. Available from http://www1.eere.energy.gov/buildings/commercial_initiative/pdfs/asset_rating.pdf (December 2011).

DOE EERE. 2011c. Office Building Markets and Companies. Chapter 3 in *Buildings Energy Data Book*, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. Available from http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx?3#6 (January 2012).

Eichholtz P, N Kok, and JM Quigley. 2010a. Doing Well by Doing Good? Green Office Buildings. *American Economic Review* 100(5):2492–2509.

Eichholtz P, N Kok, and JM Quigley. 2010b. *Sustainability and the Dynamics of Green Building: New Evidence on the Financial Performance of Green Office Buildings in the USA*. RICS Research report, Royal Institute of Chartered Surveyors, London, UK. Available from http://www.rics.org/site/download_feed.aspx?fileID=8862&fileExtension=PDF (April 2012).

Eichholtz P, N Kok, and JM Quigley. 2011. *The Economics of Green Building*. WP-002, UC Center for Energy and Environmental Economics, Berkeley, California. Available from http://www.uce3.ucsb.edu/WP_002.pdf (January 2012).

Eley C. 2009. *Rethinking Percent Savings – The Problem with Percent Savings and the New Sale for a Zero Net-Energy Future*. CS 08.17, Southern California Edison, Rosemead, California. Available from http://newbuildings.org/sites/default/files/Rethinking_Percent_Savings.pdf (January 2012).

EPA. N.d. Expanding C&I Program Reach with ENERGY STAR. U.S. Environmental Protection Agency, Washington, D.C. Available from http://www.energystar.gov/ia/partners/reps/ci_program_sponsors/downloads/Expanding_CandI_Program_Reach.pdf (April 2012).

EPA. 2010. Federal, State, and Local Governments Leveraging ENERGY STAR (Updated June 20, 2011). U.S. Environmental Protection Agency, Washington, D.C. Available from http://www.energystar.gov/ia/business/government/State_Local_Govts_Leveraging_ES.pdf (January 2012).

E Source. 2011. E Source Announces Energy Management Survey 2011 Results. E Source Companies LLC, Boulder, Colorado. Available from http://www.esource.com/ES-PR-EnergyMgmt-11-11/ Press_Release/EnergyMgmt (January 2012).

EIA. 2006. *2003 Commercial Buildings Energy Consumption Survey – Commercial Energy Uses and Costs.* Energy Information Administration, U.S. Department of Energy, Washington, D.C. Available from http://www.eia.gov/emeu/cbecs/contents.html (January 2012).

Goldman CA, NC Hopper, and JG Osborn. 2005. Review of US ESCO industry market trends: an empirical analysis of project data. *Energy Policy* 33(3):387–405.

GRESB Foundation. 2011. *The Global Real Estate Sustainability Benchmark Research Report 2011.* The Global Real Estate Sustainability Foundation, Amsterdam. Available from http://gresb.com/content/GRESB-Report-20112.pdf (November 2011).

Hopper N, C Goldman, D Gilligan, T Singer, and D Birr. 2007. *A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000 to 2006*. LBNL-62679, Lawrence Berkeley National Laboratory, Berkeley, California. Available from http://eetd.lbl.gov/ea/emp/reports/62679.pdf (April 2012).

IMT. 2011. Building Energy Performance Benchmarking and Disclosure. Institute for Market Transformation, Washington, D.C. Available from http://www.imt.org/rating (November 2011).

Johnson Controls. 2011. 2011 Energy Efficiency Indicator GLOBAL Survey Results. Institute for Building Efficiency, Johnson Controls, Milwaukee, Wisconsin. Available from http://www.institutebe.com/Energy-Efficiency-Indicator/2011-global-results.aspx (January 2012).

Kok N and M Jennen. 2011. The value of energy labels in the European office market. Available from http://nilskok.typepad.com/KJ/KJ_NL_220511.pdf (November 2011).

Kok N, P Eichholtz, R Bauer, and P Penada. 2010. *Environmental Performance – A Global Perspective on Commercial Real Estate*. The European Centre for Corporate Engagement, Maastricht University School of Business and Economics, Netherlands. Available from http://nilskok.typepad.com/ PDFonderzoeken/ECCE_Report_Environmental_Real_Estate_Survey.pdf (November 2011).

Kok N, M McGraw, and JM Quigley. 2011. The diffusion of energy efficiency in building. *American Economic Review* 101(3): 77–82. DOI:10.1257/aer.101.3.77.

Mass DOER. 2010. *An MPG Rating for Commercial Buildings: Establishing a Building Energy Asset Labeling Program in Massachusetts*. Massachusetts Department of Energy Resources, Boston. Available from http://www.mass.gov/eea/docs/doer/energy-efficiency/asset-rating-white-paper.pdf (November 2011).

McGraw-Hill. 2011. *Business Case for Energy Efficient Building Retrofit and Renovation*. McGraw-Hill Construction, Bedford, Massachusetts. Available from http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/business_case_for_energy_efficiency_retrofit_renovation_smr_2011.pdf (April 2012).

Mills E. 2009. *Building Commissioning – A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions*. Lawrence Berkeley National Laboratory, Berkeley, California. Available from http://cx.lbl.gov/documents/2009-assessment/LBNL-Cx-Cost-Benefit.pdf (January 2012).

Muldavin SR. 2010. *Value Beyond Cost Savings – How to Underwrite Sustainable Properties*. Green Building Finance Consortium, San Rafael, California. Available from http://www.greenbuildingfc.com/ (February 2012).

Newell G, J MacFarlane, and N Kok. 2011. *Building Better Returns. A Study of the Financial Performance of Green Office Buildings in Australia.* University of Western Sydney Australia and the University of Maastricht Netherlands in conjunction with Jones Lang LaSalle and CBRE. Available from http://www.api.org.au/assets/media_library/000/000/219/original.pdf?1315793106 (February 2012).

Pivo G and J Fisher. 2010. Income, value and returns in socially responsible office properties. *Journal of Real Estate Research* 32:243–269. Available from http://www.u.arizona.edu/~gpivo/PIVO%20FISHER%20RPI%20Feb%2010.pdf (February 2010).

Pogue DL and D Laquidara-Carr. 2011. Do Green Buildings Make Dollars & Sense. CBRE, Inc., and McGraw-Hill Construction. BuildingRating.org, Washington, D.C. Available from http://www.buildingrating.org/sites/default/files/DoGreenBuildingsMakeDollarsAndSense-v3.pdf (January 2012).

Turner C and M Frankel. 2008. *Energy Performance of LEED® for New Construction Buildings*. New Buildings Institute, Vancouver, Washington. Available from http://www.usgbc.org/ShowFile.aspx?DocumentID=3930 (February 2012).

Von Neida B and T Hicks. N.d. Building Performance Defined: the ENERGY STAR™ National Energy Performance Rating System. U.S. Environmental Protection Agency, Washington, D.C. Available from http://www.energystar.gov/ia/business/tools_resources/aesp.pdf (April 2012).

11.0 Bibliography

Ariely D. 2008. *Predictably Irrational – The Hidden Forces That Shape Our Decisions*. HarperCollins Publishers, New York.

Ariely D. 2010. *The Upside of Irrationality – The Unexpected Benefits of Defying Logic at Work and Home.* HarperCollins Publishers, New York.

Bauer R, P Eichholtz, N Kok, and JM Quigley. 2011. How green is your property portfolio? The global real estate sustainability benchmark. *Rotman International Journal of Pension Management* 4(1):34–44. doi:10.3138/rijpm.4.1.34.

Brounen D and N Kok. 2011. On the economics of energy labels in the housing market. *Journal of Environmental Economics and Management* 62(2):166–179. doi:10.1016/j.jeem.2010.11.006.

Bruhns H, P Jones, R Cohen, B Bordass, and H Davies. 2011. *CIBSE Review of Energy Benchmarks for Display Energy Certificates – Analysis of DEC Results To Date.* Final Public Report, CIBSE Benchmarks Steering Committee, Chartered Institution of Building Services Engineers, London. Available from http://www.cibse.org/content/Knowledge_Bank/tech_bulletin/CIBSETM46ReviewFinal2web.pdf (November 2011).

Deng Y, Z Li, and JM Quigley. 2011. *Economic Returns to Energy-Efficient Investments in the Housing Market: Evidence from Singapore*. E^3 WP-011, University of California Center for Energy and Environmental Economics, Berkeley, California. Available from http://www.uce3.berkeley.edu/WP_011.pdf (November 2011).

Dunsky P, J Lindberg, E Piyale-Sheard, and R Faesy. 2009. *Building Energy Efficiency through Disclosure and Upgrade Policies: A Roadmap for the Northeast U.S.* Dunsky Energy Consulting, Montreal, Quebec, Canada. Available from http://neep.org/uploads/policy/NEEP_BER_Report_12.14.09.pdf (November 2011).

Dunsky P, J Lindberg, E Schmidt, and R Faesy. 2010. "$300,000, 4 Bedrooms and a 'B+' Energy Rating" – Transforming markets with mandatory building energy labeling. In *ACEEE Summer Study 2010 – Energy Efficiency in Buildings – The Climate for Efficiency is Now*, R Hawsey and C Wray (co-chairs), pp. 8-114–8-125. American Council for an Energy-Efficient Economy, Washington, D.C. Available from http://eec.ucdavis.edu/ACEEE/2010/data/papers/2169.pdf (November 2011).

European Parliament and Council of the European Union. 2010. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast). *Official Journal of the European Union* 153:13–35. Available from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF (November 2011).

Fuerst F and PM McAllister. 2008. Green Noise or Green Value? Measuring the Price Effects of Environmental Certification in Commercial Buildings. School of Real Estate and Planning, Henley Business School, University of Reading, United Kingdom. Available from http://mpra.ub.uni-muenchen.de/16625/ (February 2012).

Fuerst F and P McAllister. 2009. New Evidence on the Green Building Rent and Price Premium. (Presented to the American Real Estate Society). Henley Business School, Reading University, United Kingdom. Available from http://www.henley.reading.ac.uk/rep/fulltxt/0709.pdf (February 2012).

Harris Williams. 2010. ESCOs – Enabling Energy Efficiency – An Introduction to Energy Service Companies ("ESCOs"). White paper, Harris Williams & Co., Richmond, Virginia. Available from http://www.harriswilliams.com/sites/default/files/industry_reports/HW%26Co.ESCOWhitePapeFinal.pdf (April 2012).

Kjaerbye VH. 2008. *Does Energy Labelling on Residential Housing Cause Energy Savings?* AKF, Danish Institute of Governmental Research, Copenhagen. Available from http://www.akf.dk/udgivelser/2008/pdf/energy_labelling.pdf (November 2011).

Lamberts R, S Goulart, J Carlo, and F Westphal. 2007. Regulation for energy efficiency labeling of commercial buildings in Brazil. In *PALENC 2007 – 2nd PALENC Conference and 28th AIVC Conference on Building Low Energy Cooling and Advanced Ventilation Technologies in the 21st Century*, Volume 2, pp. 602–609. Available from http://www.inive.org/members_area/medias/pdf/Inive/PalencAIVC2007/Volume2/PalencAIVC2007_V2_002.pdf (November 2011).

Maine PUC. 2010. *Building Energy Efficiency and Carbon Performance Ratings – Report to the Joint Standing Committee on Utilities and Energy*. Maine Public Utilities Commission, Energy Programs Division/Efficiency Maine, Augusta. Available from http://www.maine.gov/tools/whatsnew/attach.php?id=90756&an=1 (November 2011).

Majumdar A. 2009. Testimony Regarding Reducing Energy Consumption in Buildings. Statement of Arun Majumdar, Director, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory. Available from http://eetd.lbl.gov/news-archives/pubs/majumdar-testimony-022609.pdf (February 2012).

Moore E, S Moersfelder, N O'Neil, B Lynch, N Hillis, E Rowe, A Robbins, and M Frankel. 2010. Small Buildings, Big Savings: Prescriptive Solutions for Energy Efficiency and Green Certification in Small Commercial Buildings. In Proceedings of the *2010 ACEEE Summer Study on Energy Efficiency in Buildings -- The Climate for Efficiency is Now*, R Hawsey and C Wray (co-chairs). American Council for an Energy-Efficient Economy, Washington, D.C. Available from http://eec.ucdavis.edu/ACEEE/2010/data/papers/2023.pdf (March 2012).

Thaler RH and CR Sunstein. 2008. *Nudge – Improving Decisions About Health, Wealth and Happiness*. Yale University Press, New Haven, Connecticut.

Appendix A

State and Local Programs and Legislation

Appendix A

State and Local Programs and Legislation

A.1 State of California

In 2006, the California Legislature passed Assembly Bill (AB) 32, *the Global Warming Solutions Act of 2006*, which set a 2020 greenhouse gas emissions reduction goal into law, limiting emissions for 2020 to the 1990 level of 427 million metric tons of carbon dioxide equivalent of greenhouse gases. In January 2011, the mandatory provisions of the Green Building Standards Code or CALGreen came into effect, instituting minimum environmental performance standards for all properties.

In California, buildings represent the second largest source greenhouse gas (GHG) emissions. The state recognized that significant GHG emission reductions could be achieved through sustainable construction, operation, and renovation of new and existing buildings. In 1978, under Title 24, building energy efficiency standards were adopted, resulting in significant energy savings and a leveling of per-capita energy use. Total consumption per capita in California was 5,312 kWh/person, or 43% less than that of the United States in 2005. On a sector-by-sector basis, industrial and residential differences each account for about 40% of the difference while commercial consumption makes up the other 20% (Kandel et al. 2008).

In 2007, the California Legislature passed AB 1103, the Commercial Building Energy Use Disclosure Program (California Energy Commission 2012). Under AB 1103, the state legislature mandated commercial property owners within California to benchmark and disclose their actual energy performance to the California Energy Commission (CEC) at the time of a financial transaction. Benchmarking is predicated on actual use (e.g., an operational rating). Information is provided through utility company uploads to ENERGY STAR Portfolio Manager. Upon a trigger event, benchmarking through ENERGY STAR must be completed. The California Energy Disclosure Report is created via an automated custom template through ENERGY STAR Portfolio Manager that the owner must send to the CEC. From this information, the CEC generates a California Building Energy Use Disclosure (CBEUD), which is then returned to the property owner for disclosure as required by law. According to Burr et al. (2011, pp. 11–14), information contained in the Energy Use Report includes

- ENERGY STAR Portfolio Manager energy performance rating for the building, if available[1]
- national average energy use intensity (EUI) for the ESPM building type, if available
- annual energy consumption data, including, but not limited to, electricity, natural gas, and renewable energy
- total site energy use for the previous 12 months measured in thousands of British thermal units
- gross building area

[1] Because ENERGY STAR Portfolio Manager uses CBECS as the basis for comparison, the CEC plans to add a California-specific energy performance rating from the California Energy Use Survey (CEUS) to provide more tailored information based on comparable buildings in California.

- space use and operational characteristics, including weekly operating hours, number of occupants, number of computers, and percentage of the floor area heated and cooled.

The disclosure requirement comes into effect only when the entire building is leased, sold, or financed. The mandatory provisions come into effect January 2012 for leased properties greater than 50,000 ft^2 and owner-occupied properties greater than 1,000 ft^2. As of July 2012, the requirements encompass properties larger than 10,000 ft^2 and, as of January 2013, those above 1,000 ft^2. The property owner is required to share the CBEUD with only prospective financial transaction parties such as buyers, tenants, and lenders.

Beginning in 2009, utility companies were obligated to maintain energy consumption records in a way that is compatible with ENERGY STAR Portfolio Manager. However, implementation is complicated by privacy and capacity issues. The larger utility companies have been working with the CEC to ensure their ability to upload utility data into ENERGY STAR Portfolio Manager. Concerns remain over privacy issues related to occupant (as opposed to owner) energy use information. Building owners have been tasked with obtaining written permission from separately metered occupants. From a capacity issue, many smaller utilities across the state do not have the capability of uploading consumption data.

California will rely on the private market to provide quality assurance for data inputs at the point of disclosure.

A.2 Commonwealth of Massachusetts

In 2008, the Commonwealth of Massachusetts convened a Zero Net Energy Building Task Force to evaluate how best to achieve net-zero energy construction in both the commercial and residential sectors. Subsequently, Massachusetts was chosen by the National Governors Association Center for Best Practices to participate in its Policy Academy for Building Energy Retrofits. Through these processes, the commonwealth began identifying and addressing the barriers to a commercial building asset labeling program. In December 2010, the Massachusetts Department of Energy Resources (Mass DOER) released *An MPG Rating for Commercial Buildings: Establishing a Building Asset Rating Program in Massachusetts*, outlining a framework and proposed pilot to implement a commercial building asset labeling program as the first step toward a mandatory requirement (Mass DOER 2010). The proposed pilot was subsequently publicized in a notice of intent issued jointly by Mass DOER and the Northeast Energy Efficiency Partnership (NEEP 2011, p. 2):

> The Massachusetts Department of Energy Resources and the Northeast Energy Efficiency Partnerships (NEEP) plan to implement a two-phase pilot program, focused on commercial office buildings, to identify and test innovative methodologies that reduce the cost of calculating as-built energy use. Phase 1 of the pilot … will identify and field-test, on a small scale, innovative methodologies that reduce the cost of data collection and modeling used to calculate as-built energy use; Phase 2 will more broadly field-test one or more methodologies identified in Phase 1. The overall goal of the pilot is to inform the development of a national building energy asset rating system that can be implemented on a broader scale so as to facilitate energy efficiency investment in the commercial building sector.

Phase 1 of the pilot, slated to occur during winter and early spring of 2012, will use innovative technologies to predict as-built energy use for 8 to 12 commercial office buildings sited in Boston and Cambridge and varying by age and available documentation. For comparative purposes, the as-built energy use for this same set of buildings will be predicted using traditional methods such as on-site visits and full-scale energy modeling protocols. "The as-built energy use calculated using the innovative methodologies will be compared to the as-built energy use calculated using the traditional methodologies, as well as historical building energy usage patterns, and the results will be used to assess the relative accuracy of the innovative methodologies" (NEEP 2011, p. 2).

Mass DOER (2010) did an extensive analysis of the options, including scale, label design, and inputs, for an asset rating program. Initial recommendations that should be taken into consideration in the design of a national asset rating program include the following:

Rating Scale

- use of a technical, rather than a statistical, rating scale that would rate buildings against a zero energy benchmark
- use of site (EUI as the basis for an asset rating, with a complementary GHG emissions metric, rather than the use of a single metric that relies on only source energy
- adjustment of the asset rating scales to account for different building types
- standardized inputs into energy modeling tools (such as the Commercial Energy Services Network (COMNET) guideline).

Label Information

- letter grading system based on modeled EUI to make building-to-building comparisons easy to understand for the intended audience
- design of a simple, visually appealing label that effectively communicates the letter grade, the site EUI, and a GHG emissions measure and also includes key findings and recommendations for improvements.

Assessment Process

- an initial on-site assessment akin to an ASHRAE Level II audit to establish a building's energy asset and performance baseline and to determine a preliminary set of efficiency recommendations
- integration with utility incentive and financing programs made available to building owners to support implementation of efficiency measures
- a post-energy retrofit reassessment of the building to finalize the utility incentive award and provide a new asset rating grade
- development of standard protocols for data collection and data modeling to improve modeling consistency and transparency

- development of quality assurance measures including, but not limited to, assessor training, energy modeling training, and verification programs with relevant stakeholders
- finalization of an energy rating standard that would be applicable equally to new and existing commercial buildings.

Pilot Program

- a 2- to 3-year pilot that focuses on the office, multifamily rental, and public building sectors
- creation of an "Energy Leaders" program to publicly recognize significant achievements in energy use reduction in existing buildings.

Future Statewide Implementation

- transition from pilot program to a broader statewide program based on the results from and evaluation of the pilot
- minimum building size threshold of 10,000 ft^2
- development of a schedule for existing buildings to acquire an asset rating within 10 years of the program launch or following a specific "trigger event" (e.g., building sale, refinance, or major renovation)
- renewal of the building energy asset rating every 10 to 15 years (with earlier renewal triggered by specific events)
- periodic operational ratings to complement the asset rating
- development of a database to provide appropriate stakeholders with access to rating and label information with which to compare energy performance across buildings.

A.3 The State of Minnesota

Developed by the University of Minnesota Center for Sustainable Buildings Research (CSBR), the Buildings, Benchmarks and Beyond Project (B3) incorporated sustainable building guidelines for the state. The B3 Benchmarking program started in 2004 as a coordinated effort to achieve advanced energy performance in Minnesota public buildings and to guide the allocation of energy conservation investments in existing buildings. In addition to the benchmarking program, which focuses on existing buildings, a complementary effort, the B3 Guidelines (CSBR 2011), supports the design process of new public buildings. To date, 6,368 public buildings totaling more than 280 million ft^2) have been benchmarked using the B3 Benchmarking program.

The B3 Benchmarking program compares the actual consumption of each building to the consumption predicted by an as-built engineering model. The benchmarks are used to rank a building portfolio and identify the buildings that have the greatest opportunity for improvement. A recent update to the tool allows building owners (public sector only) to gauge their ENERGY STAR rating if the building type meets ENERGY STAR parameters to receive a rating.

The data collection process relies on a web-based tool to enter building characteristics and utility bills on the basis of both energy and cost units. The model weighs the base benchmark for a given space type

by changes in key input variables, such as fuel source, number of operating hours per day, number of days of operation per week, number of months of operation per year, and percentage heated or cooled. The user may also adjust for other special use conditions such as a swimming pool, data center, parking lot, or kitchen. The 154-space usage types currently available in the tool were developed with DOE2 energy simulation models to match the public building stock in Minnesota. The performance metric used is a building annual EUI. The EUI, expressed in thousand British thermal units per square foot per year, includes the energy to heat, cool, ventilate, light, and run typical equipment inside a building, as if the building were built to the current Minnesota energy code. The tool is designed to be flexible enough to adjust as building codes change.

Users can compare their building to individualized benchmarks as well as actual metered consumption. The approach allows for a representation of a specific building's performance without comparing it to other buildings. Of the 1,205 analyzable buildings, those buildings with actual energy use significantly above their benchmark were found to have a better return on investment for conservation measures than those buildings that performed more efficiently (Greden et al. 2008).

A.4 Washington State and City of Seattle

Washington State Senate Bill 5854, passed in 2009, tied the state's energy code to Architecture 2030[1] requiring that all buildings be operating at an efficiency rate 70% below the 2006 code and on carbon free fuels by the year 2030. It also requires benchmarking and disclosure for nonresidential buildings larger than 10,000 ft^2 (on a phased-in basis beginning in 2012 for buildings greater than 50,000 ft^2) involved in a financial transaction, and benchmarking and public disclosure for state-owned buildings.

In 2010, the city of Seattle passed its Building Energy Benchmarking and Disclosure ordinance, requiring that all commercial buildings larger than 10,000 ft^2 track and disclose their energy use data. Specifically, the ordinance instructs building owners and managers to benchmark energy performance with the ENERGY STAR Portfolio Manager tool, release building energy information, generated through ENERGY STAR Portfolio Manager, to any prospective tenant, lender, or buyer upon request, and annually report energy performance to the city's Department of Planning and Development (DPD). The Disclosure Ordinance also requires utilities to upload whole-building energy consumption data to ENERGY STAR Portfolio Manager.

The DPD will annually download building data via an automated link with ENERGY STAR Portfolio Manager. The information DPD downloads includes a building's total annual energy consumption, the energy performance rating (where available), EUI, and estimated GHG emissions. At this point, although the city will maintain a database of all buildings, full public disclosure is not anticipated.

Compliance is being phased in from 2011 to 2012. As of October 1, 2011, nonresidential buildings 50,000 ft^2 and larger, plus mixed-use buildings with fewer than four residential units, must comply. As of

[1] The Architecture 2030 Challenge originally put forth in 2002, has a goal of reducing carbon emissions from the building sector. The targets for new buildings and major renovations would ratchet down from 60% below the 2003 CBECS numbers in 2010 to be carbon neutral in 2030. The targets may be accomplished by implementing innovative sustainable design strategies, generating on-site renewable power and/or purchasing (20% maximum) renewable energy. http://architecture2030.org/2030_challenge/the_2030_challenge.

April 2012, this requirement will expand to nonresidential buildings larger than 10,000 ft^2, mixed-use buildings with five or more residential units, and multifamily units with five or more units.

A.5 New York City

Under PlaNYC, adopted in 2007, New York City set a goal of achieving a 30% reduction in the city's annual GHG emissions below 2005 levels by 2030. Recognizing that nearly 80% of citywide emissions result from the energy used in buildings, the Greener, Greater Buildings Plan (GGBP), passed in late 2009, is a comprehensive framework that requires ongoing efficiency improvements in existing large buildings. The plan has six complementary components that use a series of mandates, challenges, and incentives to reduce demand among the city's largest energy consumers:

- more stringent requirements in the New York City energy code
- lighting upgrades and submetering
- benchmarking
- audits and retrofits
- green workforce development training
- green building financing.

Local Law 84, a component of the GGBP, requires annual energy and water benchmarking for nonresidential and multifamily buildings, and the annual public disclosure of benchmarking information. Starting August 1, 2011, buildings larger than 50,000 ft^2 (or multiple buildings, whose square footage exceeds 100,000 ft^2 and are on the same tax lot or managed by a single condominium board) must be benchmarked using ENERGY STAR Portfolio Manager and must submit a New York City Benchmarking Compliance Report for the previous calendar year to the city. The report, completed electronically in Portfolio Manager, must be made through a web link. Minimum data required in the compliance report include

- EUI
- water consumption per square foot
- Portfolio Manager energy and water performance ratings, if available
- comparison of the building's benchmarking information across two or more calendar years, if available.

Although the law does not require the utilities to provide whole-building energy use data, both Con Ed and National Grid are voluntarily providing such information to building owners.

One year following the annual receipt of information, the city will post the benchmarking information for each building to a public website. In addition to benchmarking and disclosure, the city is requiring buildings larger than 50,000 ft^2 to complete energy audits and retrocommissioning every 10 years. The energy efficiency report must be submitted to the city to document compliance. An energy audit is not required if the building receives the ENERGY STAR label (a score of 75 and above) for 2 of the 3 previous years, if the building is ineligible for an ENERGY STAR rating but can demonstrate superior

energy performance, receives LEED for Existing Building certification, a maximum of 4 years prior, or complies with certain energy efficiency standards dictated by law.[1]

As part of the program, the city is developing a revolving loan fund that will be provided at no cost to New York City taxpayers. The city will use $16 million in federal stimulus funding allocated to the city under the EECBG program for this direct lending program

A.6 Washington, D.C.

The Clean and Affordable Energy Act of 2008 requires all nonresidential and multifamily buildings larger than 50,000 ft^2 to be annually benchmarked using ENERGY STAR Portfolio Manager and the information to be disclosed to the District Department of the Environment (DDOE). Compliance will be phased in through 2014. As of July 1, 2011, buildings larger than 200,000 ft^2 must benchmark; as of April 2012, those greater than 150,000 ft^2, those greater than 100,000 ft^2 by April 2013, and finally as of April 2014, those larger than 50,000 ft^2. Upon receipt of the second benchmarking report, the DDOE will make the data publicly accessible through an online database.

New construction or major renovation projects will be required to generate and report energy performance projections using ENERGY STAR Target Finder prior to receiving a construction permit. Subsequent to completion and occupancy, the property will be required to disclose its ENERGY STAR Portfolio Manager rating, allowing for the DDOE to compare modeled projections to actual energy use.

The law did not require Pepco, the local utility, to disclose whole-building data and instead requires the building owner to gather and compile individual tenant data for benchmarking purposes. Pepco is voluntarily providing whole-building data to property owners upon request and is considering proactively creating a means to link to ENERGY STAR Portfolio Manager, similar to California's program.

A.7 San Francisco, California

In February 2011, the San Francisco Board of Supervisors passed the Existing Commercial Buildings Energy Performance Ordinance.[2] The ordinance requires annual benchmarking, periodic energy audits and the public disclosure of benchmarking information for nonresidential buildings 10,000 ft^2 and above. It supports a nonresidential benchmarking and disclosure law enacted by the state legislature in 2007. Beginning in October 2011, buildings larger than 75,000 ft^2 must benchmark using ENERGY STAR Portfolio Manager and report an Annual Energy Benchmark Summary (AEBS) to the San Francisco Department of the Environment (SFDOE).[3] As of April 2012, buildings greater than 30,000 ft^2 must submit an AEBS; in April 2013, buildings larger than 10,000 ft^2 are required to report. The AEBS must be made available to all tenants occupying the building. Further, nonresidential buildings larger than 10,000 ft^2 must submit an ASHRAE Level I audit, and those larger than 50,000 ft^2 an ASHRAE Level II energy audit, every 5 years.

[1] www.nyc.gov/ggbp.
[2] Ordinance No. 17-11, San Francisco Existing Commercial Buildings Energy Performance Ordinance, 2011, San Francisco Board of Supervisors.
[3] http://www.sfenvironment.org.

Annually, the SFDOE will post summary statistics on nonresidential building energy consumption derived from AEBS reports. It also has the authority to publicly post information on those buildings that have not complied with the data disclosure ordinance.

A.8 Austin, Texas

The Energy Conservation Audit and Disclosure (ECAD) ordinance passed in 2008 requires benchmarking and disclosure for commercial properties and a combination of energy audits, disclosure, and mandatory energy retrofits for multifamily properties[1] for all properties larger than 10,000 ft^2 that receive electricity from Austin Energy, the municipally owned utility. Implementation will be phased in starting with buildings greater than 75,000 ft^2 on June 1, 2012, followed by those larger than 30,000 ft^2 in 2013 and more than 10,000 ft^2 in 2014. Buildings must annually report an energy rating using ENERGY STAR Portfolio Manager or the Austin Energy Business Energy Analysis tool.[2]

Rating the building and disclosing the score to Austin Energy is required, and improvements to the building are voluntary. Rating disclosure is required to the municipality only (through Austin Energy). Quality assurance measures are being evaluated.

A.9 References

Burr A, C Keicher, and D Leipziger. 2011. *Building Energy Transparency: A Framework for Implementing U.S. Commercial Energy Rating and Disclosure Policy.* Institute for Market Transformation, Washington, D.C. Available from http://www.buildingrating.org/sites/default/files/documents/IMT-Building_Energy_Transparency_Report.pdf (March 2012).

California Energy Commission. 2012. AB 1103 – Commercial Building Energy Use Disclosure Program. California Energy Commission, Sacramento. Available from http://www.energy.ca.gov/ab1103/documents/ab_1103_bill_20071012_chaptered.pdf (March 2012).

CSBR. 2011. The State of Minnesota Sustainable Building Guidelines (MSBG). Center for Sustainable Building Research, College of Design, University of Minnesota, Minneapolis. Available from http://www.msbg.umn.edu (March 2012).

Greden L, T McDougall, L Steidel, and J Streff. 2008. Minnesota B3 Benchmarking Results: Prioritizing the Energy Savings Opportunity in Minnesota Public Buildings. In *Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings – Scaling Up: Building Tomorrow's Solutions*, M Baechler and R Brown (co-chairs). American Council for an Energy-Efficient Economy, Washington, D.C. Available from http://www.aceee.org/proceedings-paper/ss08/panel03/paper09 (March 2012).

[1] It also requires time-of-sale audits for single-family residential properties.

[2] The Austin Energy Business Energy Analysis rating tool is available from Austin Energy at http://www.austinenergy.com/energy efficiency/tools and tips/Commercial/Online Energy Audit/index.htm.

Kandel A, M Sheridan, and P McAuliffe. 2008. A Comparison of Per-Capita Electricity Consumption in the United States and California. In *Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings – Scaling Up: Building Tomorrow's Solutions*, M Baechler and R Brown (co-chairs). American Council for an Energy-Efficient Economy, Washington, D.C. Available from http://www.aceee.org/proceedings-paper/ss08/panel08/paper12 (March 2012).

Mass DOER. 2010. *An MPG Rating for Commercial Buildings: Establishing a Building Energy Asset Labeling Program in Massachusetts*. Massachusetts Department of Energy Resources, Boston. Available from http://www.mass.gov/Eoeea/docs/doer/Energy_Efficiency/Asset_Rating_White_Paper.pdf (March 2012).

NEEP. 2011. Notice of Intent: Massachusetts Commercial Building Benchmarking Pilot Program. Issued October 24, 2011. Northeast Energy Efficiency Partnerships, Lexington, Massachusetts. Available from http://neep.org/uploads/policy/codes/MABERNOI%20%20with%20webinar%20information.pdf (November 2011).

Appendix B

National and International Rating Programs

Appendix B

National and International Rating Programs

The first national building energy rating program was created in Denmark in 1997. The European Union (EU) enacted the Energy Performance of Buildings Directive (EPBD) in 2002, requiring building energy rating and disclosure programs in all member states. In the past 5 years, Brazil, China, and Australia have also passed national building energy rating laws. Including EU Member States, more than 30 countries worldwide have national programs for energy rating and disclosure (IMT 2010).

Internationally, energy performance systems take the form of both asset and operational ratings. In the EU, operational ratings are called "measured" ratings and asset ratings "calculated ratings." In China, where the primary measuring stick is an asset rating, these are called "theoretical ratings."

B.1 European Union

The EPBD of 2002 requires all member nations to rate and disclose energy use in buildings. Member States can choose whether to use an asset rating based on calculation or an operational rating based on measured annual use. Predominantly, the EU states use energy modeling and asset ratings as the basis for rating and disclosure. In some cases, most notably Denmark, the process does take into account some operational performance. Germany combines the two. Energy labels are generally based on a technical scale, using a grade-based system calibrated and set without the use of a database of energy data such as CBECS, based instead on a reference value determined by each member state. In the United Kingdom (UK) for example, the reference is the 2002 building standards by which improvement must be made by set percentages. By 2012, all EU countries will, at minimum, require Energy Performance Certificates (EPCs) for all new buildings and for existing buildings upon major renovation, lease, or sale.

Some of the critical complaints about the EPBD in practice include lack of consistency in modeling; inaccurate data input; lack of reproducibility of results, resulting in widely divergent energy outcomes and consequent erosion of label credibility; differing levels of auditor expertise; and inconsistent enforcement.

In December 2010, the Buildings Performance Institute Europe (BPIE) published a review of the EU experience under the EPBD. The research (BPIE 2010) suggests that certain measures should be taken to increase the effectiveness of implementation and public acceptance of the rating systems:

- Accuracy can be improved in terms of its reproducibility by simplifying the data acquisition and subsequently increasing the number of default values required for the calculation.
  - Overall inaccuracy is reduced from ± 20% to ± 15%; the deviation from calculated performance to actual building performance is reduced from ± 30% to ± 10%.
  - More simplified data acquisition requires a lower level of expertise and less time and effort from the assessors, resulting in lower costs for the assessment.
- It is critical to have the right balance between default values and data acquisition. Design should involve multidisciplinary stakeholders to ensure the correct balance.

- A centralized registry system is needed to allow for monitoring and evaluation, quality assurance, and enforcement.
- Transparency is needed between expectations and outcomes (e.g., establishing a link between the calculated energy performance (Energy Performance Certificates) and measured performance (Display Energy Certificates)).

B.1.1 United Kingdom

B.1.1.1 Energy Performance Certificates

In the UK, Energy Performance Certificates (EPCs) became mandatory for all new and existing residential and commercial buildings in 2007. The EPC is an asset rating, a prediction of energy use based on a simulation of the building design. Building performance is separated into an *Energy Efficiency Rating* (e.g., the overall efficiency, in which a higher rating equates to lower operating costs for the building) and the *Environmental Impact Rating* (e.g., a measurement of CO_2 emissions, in which a higher rating equates to a more 'environmentally friendly' building). An A-to-G chart is used, representing a scale of 1 to 100, on which a building with a rating of 100 is the most efficient (essentially putting out no carbon emissions).[1]

An EPC is required for any building that "uses energy to condition an indoor climate"— essentially, any building with heating, mechanical ventilation, or air conditioning. An EPC must be commissioned when a building is constructed, refurbished, sold, or leased. An accredited energy assessor who submits the EPC to a national register must produce them. The building owner must ensure that an EPC is available for prospective buyers.

In the UK, energy efficiency assessment and rating is carried out in accordance with the National Calculation Method (NCM) as defined by the Department for Communities and Local Government. The NCM is used to reflect compliance with UK building regulations in energy terms by evaluating the building design against a 'notional' building. This shows whether the proposed (built) building emission rate is less than the target emission rate. Every 4 years, improved targets for the UK Building Regulations are imposed through updates to the notional building. The calculation includes a buildup of walls, roof, floors, windows, and other structural elements, along with the energy efficiency of heating, hot water, and lighting.

In addition to the rainbow-colored A-to-G chart, the EPC contains a comprehensive advisory report that includes a list of measures that could be carried out to improve the building, in order of cost (with an approximate payback on the investment). The EPC also estimates a second rating, indicating what the building could potentially achieve if some of these improvements were made. This information is presented to the consumer with cost-effective solutions for future energy savings.

In May 2011, Chris Huhne, UK Climate and Energy Secretary, announced that under new legislation, the Green Deal starting in 2018, it will no longer be legal for landlords to rent out homes or business premises with an energy efficiency rating that is less than an E on an EPC. According to UK government

[1] http://www.buildingrating.org/sites/default/files/UK-EPC (March 2012).

figures, this means in today's market that at least 682,000 properties would have to undergo some form of improvement in order to better their energy efficiency (DECC 2011).

A number of further changes will come into force related to the EPC as its role is extended and incorporated into the Green Deal program that comes into effect in 2012. Only recently, proposed changes to the EPB regulations have been seen, which incorporate several changes as to how and when EPCs are commissioned, marketed, and policed.

B.1.1.2 Display Energy Certificates

In the UK, operational ratings are reflected on a Display Energy Certificate (DEC). Whereas EPCs are a prediction of energy use based on design, DECs are an actual measurement of in-use energy performance. The DEC displays the previous 3 years' actual energy consumption and must be procured after a building has been in use for a year. Real energy data must be used, including meter readings and bills. It must be renewed every year to maintain the currency of data.

Unlike EPCs, DECs currently affect only public buildings. Public buildings greater than 1,000 m^2 (10,764 ft^2) now must display a DEC. The Recast of the EPBD directive was published in July 2010. It requires that as of July 2012 all public buildings over 500 m^2 (5,382 ft^2) with a previously issued EPC must display DECs. And, in March 2011, the UK government committed to roll out DECs to all commercial buildings by the end of October 2012; however, legislation that contains these mandatory provisions has not been introduced.

The DEC includes a chart showing the change in CO_2 emissions over the previous 3-year period (or less for new buildings), allowing improved performance to be easily reflected on the certificate. The DEC rating also allows comparison with a typical building of the same type. Just like the EPC, the DEC has an accompanying list of recommendations in an advisory report and can be produced only by accredited assessors.

B.1.2 Denmark

Denmark was the first EU country to begin issuing EPCs. Like most EU states, Denmark uses only an asset rating for its labeling program. The EPC is mandatory for all buildings that are sold or rented out (except for certain multifamily housing), along with the public display of the certificate in public buildings. For new buildings, the calculation of energy performance used to receive a building permit is valid as a certificate for 10 years.

B.1.3 Ireland

Ireland required EPCs for new residential buildings in 2007, new nonresidential and public building in 2008, and all existing buildings in 2009. Sustainable Energy Ireland (national energy authority) is responsible for developing and administering the EPC scheme. In Ireland, the EPC is called a Building Energy Rating (BER). Like most of the EU, the chosen assessment method is calculated rating.

In the development of the EPC scheme, Sustainable Energy Ireland paid specific attention to balancing issues like practicality, costs, clarity, and consistency. This has resulted in relatively high

public acceptance and awareness. The rating label is familiar to the general public and is in line with that used for household appliances. An advisory report accompanies the BER, with usable information on how to improve the building's energy performance. A system is in place to register qualified and trained building assessors. There is a database for BERs and advisory reports, a quality assurance mechanism, and an administrative system with support functions such as a help desk.

The national database allows issued BERs to be validated (with unique reference number) and can be used for verification at the time of transaction. The BER Issuing Authority is responsible to check the work of energy assessors and can impose reasonable sanctions. The performance certificates are issued by specially trained building professionals with relevant background and registered by Sustainable Energy Ireland. They have to follow initial accreditation training with examination and follow-up periodic training courses and pay a fee to be reregistered annually. Assessors have to sign a Code of Practice, which includes requirements to act in a professional and independent manner, to comply with the scheme rules, and ensure confidentiality. Furthermore the national database is used for practical quality control of issued certificates. Audits are taken both on a random basis and as a result of any unusual or suspect data.

In Ireland, the action plan was central to the successful implementation of buildings certification, as it set out key tasks and dealt with issues such as legal transposition, institutional arrangements, technical systems development, training and accreditation, tasks and time frames, consultation, and promotion and information campaigns (IEA 2010).

B.1.4 Portugal

The EPC scheme was launched in July 2007; first for new buildings, and from January 2009 also for existing buildings. In Portugal, the EPCs cover indoor air quality as well as energy performance. Like the UK, Denmark, and Ireland, Portugal uses a calculated asset rating. Compliance is generally high; 90% of building completions and transactions reflect an issued EPC.

There is a national database in use for the registration of EPCs. The database is accessible to the general public. The database is also used for random quality checks of the issued EPCs. Only qualified experts may issue certificates. These must be registered architects or engineers with at least 5 years of relevant experience. Qualified experts must attend courses and pass a national exam. Quality control to check the content of issued certificates is done by independent experts whereby a parallel analysis of the certified building is performed, with an onsite visit.

Portugal also took on a large education initiative to engage the public. The energy targets were promoted through the media, the Internet, seminars, and workshops to make industry and the public aware of the benefits of such high expectations (Maldonado 2009).

B.2 China

In China, the Ministry of Housing and Urban-Rural Development (MOHURD) has developed and is piloting a national building energy rating and labeling program (Chinese State Council 2008, Chapter 2, Article 21). The program makes public disclosure of energy use mandatory for new government-owned offices, large commercial buildings, and those buildings applying for public retrofit funding or green labels. The ratings reflect five levels, from 1 to 5 stars; the 5-star level represents the most energy

efficient. The rating level is determined by parameters in three categories: *basic items*, *required items*, *and optional items*. Basic *items* refer to regulated energy use per square meter, obtained by simulation or measurement. *Required items* refer to minimum performance requirements for building enclosure and HVAC. *Optional items* refer to application of renewable energy, innovative energy efficient technologies, or energy management systems that exceed the standards. A building's theoretical (asset) rating is tied to the building standard applicable in its climate zone.

The program incorporates both asset and operational ratings. The label itself can include both ratings each of which would be obtained at different stages during the building's life cycle. After a building passes the completion inspection, the building owner applies for a theoretical rating label (an asset rating) by submitting simulated energy use generated through an energy modeling program; this portion of the label expires after 12 months. After the building has been occupied for a period of time, the building owner commissions a building rating agency to conduct continuous energy measurement and auditing for no less than 1 year. The result of the measured energy use produces a measured (or operational) rating label, which is effective for 5 years. The actual energy use is recorded on the certificate. It does not change the rating level previously determined by the asset rating, even if the actual percentage of energy savings is lower than simulation, unless the Required Items fail (Mo et al. 2010). Although MOHURD recognizes the benefit of integrating both the operational and asset rating, the ministry has been unable to determine the most effective means of doing so.

Additional challenges relate to the modeling and analysis tools. MOHURD designated several modeling tools to determine ratings. Practical applications have shown that different simulation tools show significantly different results for the same building. Adding concern, only a small group of highly experienced building experts knows how to use the modeling tools.

B.3 Australia

B.3.1 Program Descriptions

The National Australian Built Environment Rating System (NABERS) measures an existing building's (commercial office, hotel, multifamily) environmental performance (energy efficiency and greenhouse gas emissions) during operation. NABERS is a national program, administered by the New South Wales (NSW) Office of Environment and Heritage. NABERS rates a building on the basis of its measured operational impacts in categories such as energy, water, waste, and indoor environment. The NABERS energy rating is similar to the rating provided by ENERGY STAR Portfolio Manager and, like ESPM, it requires 12 months of operating data. Energy use is adjusted to account for region, climate, operational hours, and equipment density, enabling buildings with different attributes to be compared against the same performance targets. The adjusted figure, called the Benchmark factor, puts the building on a level playing field with other buildings in the same geographic location. 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).

Sixty percent of Australian office space has been rated with NABERS Energy, 68% in NSW. Around 5% of rated buildings are currently achieving a 5-star rating, set originally as an aspirational target in 2000. In August 2011, the scale was expanded to 6 stars, with 6 representing "Market Leading"

performance and a 50% reduction in greenhouse gas emissions or water use compared to a 5-star rating. On the rating scale, 2.5 stars represent "average" performance. Five stars represent "excellent" performance, and the new 6-star level is "Market Leading."

> When the five star Benchmark scale is plotted on a graph, the Benchmarks form a linear scale for each location, with an equal reduction in greenhouse gas (GHG) intensity between each star level. High performance buildings are usually designed to be climate-independent, so no adjustment for climate has been included beyond 5 stars. To extend the rating scale to 6 stars, a fixed percentage reduction in actual emissions (without climate normalization) was used that would ultimately take the scale to zero emissions. As zero emissions or zero water consumption would be a 100% reduction from 5 stars, a 5.5 star building represents a 25% reduction from the 5 star GHG emissions, and 6 stars is a 50% reduction (OEH 2011a).

Under the *Building Energy Efficiency Disclosure Act 2010*, there are now mandatory obligations applicable to commercial buildings (Commonwealth of Australia 2010). Set to take full effect November 1, 2011, the Commercial Building Disclosure scheme (CBD scheme) requires a Building Energy Efficiency Certificate (BEEC) to be disclosed when office space of more than 2,000 m^2 (21,527 ft^2) is offered for lease or sale. Under the act, mixed-use properties with less than 75% office space are exempted). The BEEC is valid for 12 months and must be publicly accessible on the CBD Building Energy Efficiency Register.[1] A BEEC goes beyond the NABERS rating and includes three components that allow prospective tenants and purchasers to compare like buildings:

- NABERS Energy for Offices rating for the building
- CBD lighting assessment for the area of the building being sold or leased
- General energy efficiency guidance.

B.3.2 Impacts of Ratings and Disclosure on Value in Australia

In an effort to quantify the impacts of building disclosure policies, the Australian Capital Territory (ACT) conducted a statistical study of residential properties. The results are of interest because the ACT has one of the longest-running disclosure policies (10 years) and, from the beginning, has required disclosure early in the sales process (in all advertising). The Australian system also has a market-based enforcement process in which, subsequent to a sales closing, it can obtain compensation from sellers equal to 0.5% of the sales price if the rating and report are not disclosed and, consequently, a high degree of compliance.

The study used regression analysis on all homes sold in the region within a 12 month period (5,000 homes in all), to assess the impact of the energy asset rating on housing prices. To do so, the study isolated 13 other independent variables more commonly associated with sales price (such as size, location).

The study found that the market now attributes approximately US$9,000 to every additional star on a 6-star scale. In practice, this amounts to a price premium of 3% per star improvement and an improved

[1] http://www.cbd.gov.au/pdfFiles/BEECRegister.pdf (March 2012).

return on investment for efficiency retrofits (Commonwealth of Australia 2008). After a decade of experience with mandatory, enforced, pre-sale labeling, buyers in the ACT region are valuing energy efficiency, thus providing a return to owners who invest in the efficiency of their homes.

B.4 Brazil

The National Program for Energy Efficiency in Buildings, PROCEL EDIFICA, was established in 2003. In 2007, Brazil instituted a voluntary regulation for energy labeling of commercial and public buildings. As of 2012, public disclosure of operational ratings for both residential and commercial properties will be compulsory. The labeling program follows the characteristics of those labels found on household appliances scored on an A to E basis, where A is the most efficient and E the least. The buildings are analyzed during the design phase and again after they are constructed. There are three main evaluation requirements: building envelope thermal performance, lighting system efficiency, and installed power and air conditioning system efficiency. The three groups are evaluated individually, obtaining partial levels of efficiency, which combined in an equation results in a calculation that indicates the level of general efficiency of the building. Brazil is currently working with the UK government to further develop the mechanisms for ratings and disclosure.

B.5 Home Energy Scores

On the residential side of the equation, there are both operational and asset rating programs. An example of an operational rating is the Energy Performance Score. Asset ratings include the DOE Home Energy Score, ENERGY STAR for New Homes, Home Energy Rating System (HERS) Index, and the EnergySmart Home Scale (E-Scale). The HERS Index and E-Scale track most closely with the commercial building asset rating program.

The Energy Performance Score (EPS) is a home energy rating system similar to the miles-per-gallon (MPG) rating for the auto industry. Conceptualized by Earth Advantage Institute and supported by funding from the Energy Trust of Oregon (2012), the EPS provides an estimate of actual home energy consumption and related carbon emissions; it also shows homeowners where they rank in energy use on a regional and national scale. The EPS is an operational rating that allows for comparison among homes. The EPS is used on a voluntary basis for new homes in Oregon and within a 5,000-home pilot of existing homes.

ENERGY STAR for New Homes requires builders to meet certain energy-efficient building standards, including incorporation of energy-efficient insulation, windows, heating and cooling systems, duct work, lighting, and appliances. The builder works with ENERGY STAR from the beginning of the construction process. Plans are submitted to the Energy Star Rater for review and analysis. Recommendations are made to the builder on specific combinations of energy-efficient building features that will maximize efficiency. When the home is complete, the Rater verifies that the features were installed and are performing. An ENERGY STAR label then is awarded. ENERGY STAR-qualified homes have been found to be at least 15% more energy efficient than those homes built to the 2004 International Residential Code.[1]

[1] http://www.energystar.gov/index.cfm?c=new_homes.hm_index.

The two residential rating systems most closely aligned with the commercial asset rating system are the HERS Index and E-Scale. The HERS Index is a scoring system established by the Residential Energy Services Network (RESNET 2012). Homes are compared to the specifications of the HERS Reference Home (based on the 2004 International Energy Conservation Code). The HERS rating system is a means of assessing the structure of a home, assuming characteristic operating assumptions and adjusted for climate and square footage, similar to the commercial building asset rating system. A score of 100 means the home is consistent with a standard home, assuming typical lighting and appliances operated according to average American usage patterns. In comparison, a net zero energy home scores a HERS Index of 0. The lower a home's score, the more energy efficient it is in comparison to the HERS Reference Home. Therefore, a home rating of 70 on the HERS Index is 30% more efficient than the standard new home, and a rating of 130 is 30% less efficient than a standard new home. A certified home energy rater inspects the home and measures its energy characteristics, such as insulation levels, window efficiency, wall-to-window ratios, the heating and cooling system efficiency, and the solar orientation of the home.

> The HERS Index measures the relative performance of your home with respect to a home of equal geometry that is constructed exactly as the HERS reference home is constructed, using a standard set of appliances that are operated according to a standardized set of operating assumptions (Philip Fairey, deputy director, Florida Solar Energy Center, as quoted in Holladay 2011).

DOE's EnergySmart Home Scale (E-Scale) based on the HERS Index simply takes the information and converts it to a different graphical scale on which a home can be compared to a typical reference home.

B.6 References

BPIE. 2010. *Energy Performance Certificates across Europe: From design to implementation.* The Building Performance Institute Europe, Brussels, Belgium. Available from http://dl.dropbox.com/u/4399528/BPIE/BPIE_EPC_report_2010.pdf (November 2011).

Building Research Establishment Ltd. 2011. National Calculation Method. Available from http://www.ncm.bre.co.uk/ (March 2012).

Chinese State Council. 2008. Regulation on Civil Building Energy Efficiency. The Central People's Government of the People's Republic of China. Available from http://www.gov.cn/zwgk/2008-08/07/content_1067038.htm (March 2012).

Commonwealth of Australia. 2008. *Energy Efficiency Rating and House Price in the ACT*. Department of the Environment, Water, Heritage, and the Arts, Canberra, Australian Capital Territory. Available from http://www.nathers.gov.au/about/publications/eer-house-price-act.html (March 2012).

Commonwealth of Australia. 2010. *Building Energy Efficiency Disclosure Act 2010*. Department of Climate Change and Energy Efficiency, Canberra, Australian Capital Territory. Available from http://www.cbd.gov.au/LegalResponsibilities.aspx (March 2012).

DECC. 2011. Huhne Gets Tough on Landlords of Draughty Homes. Press Release 11/040, Department of Energy & Climate Change, London, UK. Available from http://www.decc.gov.uk/en/content/cms/news/pn11_40/pn11_40.aspx (March 2012).

Energy Trust of Oregon. 2012. Energy Performance Score. Energy Trust of Oregon, Portland. Available from http://energytrust.org/residential/new-home-solutions/eps.aspx (March 2012).

Holliday M. 2011. How is a Home's HERS Index Calculated? Green Building Advisor, Newtown, Connecticut. Available from http://www.greenbuildingadvisor.com/blogs/dept/musings/how-home-s-hers-index-calculated (March 2012).

IEA. 2010. *Energy Performance Certifications of Buildings – A Policy Tool to Improve Energy Efficiency*. International Energy Agency, Paris. Available from http://www.iea.org/papers/pathways/buildings_certification.pdf (April 2012).

IMT. 2011. International Building Rating and Disclosure Policy Fact Sheet. Institute for Market Transformation, Washington, D.C. Available from http://www.imt.org/files/FileUpload/files/International Rating Policy FACTSHEET 41.pdf (March 2012).

Maldonado E. 2009. The European Union Energy Performance of Buildings Directive. Presentation to RESNET Building Performance Conference, New Orleans, Louisiana. Available from http://www.resnet.us/conference/2009/presentations/maldonado.pdf (February 2012).

Mo K, L Burt, B Hao, J Cheng, A Burr, and S Kemkar. 2010. Comparative Analysis of U.S. and Chinese Rating Systems. In *Proceedings of the 2010 ACEEE Summer Study on Energy Efficiency in Buildings – The Climate for Efficiency is Now,* R Hawsey and C Wray (co-chairs). American Council for an Energy-Efficient Economy, Washington, D.C. Available from http://www.imt.org/files/FileUpload/files/Benchmark/Comparative_Analysis_of_US_Chinese_Rating_Systems.pdf (March 2012).

OEH. 2011a. Extending the NABERS Rating Scale to 6 Stars. Office of Environment and Heritage, Sydney, New South Wales, Australia. Available from http://www.nabers.com.au/downloadFile.aspx?file_id=361 (March 2012).

OEH. 2011b. National Australian Built Environment Rating System. Office of Environment and Heritage, Sydney, New South Wales, Australia. Available from http://www.nabers.com.au/ (March 2012).

RESNET. 2012. HERS Index – What Is a Home Energy Rating? Residential Energy Services Network. Available from http://www.resnet.us/home-energy-ratings (March 2012).

Appendix C

Stakeholder Drivers

Appendix C

Stakeholder Drivers

C.1 Owner/User

- Lower operating expenses.
- Monetization of incentives—grants, tax credits, tax abatement, fast tracking, accelerated depreciation.
- Monetization of excess electrical capacity through net metering and/or sale back to utility.
- Hedge against utility (electricity, gas, water) price volatility and resource availability.
- Enhanced reputation and branding: public relations from "first mover" advantage and market differentiation as "thought leader":
  - Improved community relations
  - Improved client relations and market opportunity
  - Improved employee satisfaction and loyalty
  - Stronger recruiting capability.
- Potential for increased employee satisfaction (which may lead to enhanced productivity) and health.
- For publicly traded companies, a guard against shareholder initiatives that could force sustainability initiatives, which may or may not be appropriate or desired.
- Long-term—increased market value of property.

C.2 Investor/Owner

- Net revenue enhancement through lower operating expenses and potentially higher rents (increased demand and limited supply).
- Potential for quicker lease-up (absorption) higher occupancy and tenant retention.
- Potential for increased market value due to higher net operating income and lower risk exposure as reflected in reduced cap and discount rates and higher ENERGY STAR or LEED ratings.
- Enhanced reputation and branding: public relations benefit from "first mover" advantage, market differentiation as "thought leader," and limited competition from other sustainable properties.
- Monetization of incentives: grants, tax credits, tax abatement, fast tracking, improved floor-area ratio, accelerated depreciation.
- Hedge against utility price volatility (e.g., electricity, gas, water) and resource depletion.
- Hedge against competitive (or economic) obsolescence.

C.3 Large Portfolio Investor and Asset Manager

- Superior portfolio returns (Innovest 2002).[1]
- Reduced exposure to utility price volatility and resource depletion.
- Monetization of incentives: grants, tax credits, tax abatement, fast tracking, accelerated depreciation.
- Monetization of excess electricity capacity through net metering and/or sale back to utility.
- Monetization of portfolio-wide improvements through buying power associated with scale.
- Hedge against future regulation (e.g., global warming/ carbon, building code, minimum energy requirements).
- Widening of potential pool of socially responsible investors and responsible property investors who are reporting and publicizing their corporate social responsibility activities (e.g., Carbon Disclosure Project, Principles for Responsible Investment).
- Hedge against competitive obsolescence.
- Increased market value of property.

C.4 Tenant/Occupant

- Lower operating expenses.
- Hedge against utility (electricity, gas, water) price volatility and resource availability.
- Enhanced reputation and branding: public relations from "first mover" advantage and market differentiation as "thought leader."
- Improved client relations and market opportunity.
- Improved employee satisfaction and loyalty.
- Stronger recruiting capability.
- Potential for increased employee productivity and health.

C.5 Financial Institution

- Reduced risk due to the owners' and/or tenants' lower exposure to energy price volatility and resource availability, reduced lease-up time, greater tenant retention, and increased property value.
- Hedge against competitive obsolescence.
- Reputation enhancement as a "thought leader."
- Ability to meet corporate social responsibility and Community Reinvestment Act goals.
- Broadened market opportunities.

[1] A 2002 analysis of quarterly returns on 124 U.S. REITS reflected a 10.4% market value premium for portfolios with superior energy efficiency.

C.6 Property Manager

- Market differentiation and reputation enhancement.
- Reduced exposure to operating expense volatility.
- Potential for higher revenues due to lower cost structure or benefit sharing with landlord.
- Stronger recruiting capability for vendors and service providers due to healthier environment.

C.7 Real Estate Broker

- Market differentiation.
- Broaden attraction to key client base—especially with Fortune 500 tenants requiring ENERGY STAR, sustainable, LEED, or high-performance buildings.

C.8 Reference

Innovest. 2002. *Energy Efficiency & Investor Returns: The Real Estate Sector*. Figures updated for UNEP – PRI presentation for 2003. Innovest Strategic Value Advisors, New York. Available from http://www.energystar.gov/ia/business/guidelines/assess_value/reit.pdf (April 2012).

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by **Battelle** *Since 1965*

U.S. DEPARTMENT OF
ENERGY

902 Battelle Boulevard
P.O. Box 999
Richland, WA 99352
1-888-375-PNNL (7665)
www.pnnl.gov