

Building Energy Rating Schemes

Assessing Issues and Impacts

Building Energy Efficiency Taskgroup

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ipeec International Partnership for Energy Efficiency Cooperation

Dear Readers,

This report on Building Energy Rating Schemes is the first work product of IPEEC's Building Energy Efficiency Taskgroup (BEET).

IPEEC (the International Partnership for Energy Efficiency Cooperation) is a high-level international forum that provides global leadership on energy efficiency by identifying and facilitating government implementation of policies and programs that yield high energy-efficiency gains. IPEEC also aims to promote information exchange on best practices and facilitate initiatives to improve energy efficiency. Founded in May 2009, IPEEC is a voluntary, high-level forum of developed and emerging economies that represent a significant fraction of the global economy.

IPEEC's BEET was established in 2013 to increase multilateral cooperation in the field of buildings energy efficiency, specifically in relation to the development and implementation of national building energy efficiency rating systems, and enhance the development of instruments that enable effective implementation of energy efficiency policy measures. The Australian government currently serves as Chair of the BEET, and the Australian and US governments contributed funding to launch this first project.

Building rating schemes are an important policy lever that can provide regular feedback about the energy efficiency of individual buildings, and also inform whether progress is being made toward broader, buildings sector efficiency improvements. As such, much of the future work of the BEET will build off this first project. In 2014, the BEET will initiate a broader Building Energy Performance Initiative, focused on development of metrics to gauge progress in building energy performance and resilience, and identify key areas in the building efficiency sector that would benefit from additional international collaboration.

This report on building energy rating schemes sets the stage for the upcoming, expanded BEET activity. Rating schemes can provide important input to broader building sector energy performance metrics. By their very nature, energy performance ratings are a metric to gauge performance. Regular monitoring of large numbers of building energy performance ratings can monitor progress (or lack of progress) toward efficiency goals - as evidenced by jurisdictions that have regular energy benchmarking and disclosure policies in place. Reviewing operational rating trends over time can give input on whether progress is being made toward reducing energy use from the building sector.

We hope you find this report informative.

Sincerely,

Adam Cullen
Australian Government Department of Industry
Energy Efficiency and Renewables Division (BEET Chair)

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Abbreviation List

ABGR	Australian Building Greenhouse Rating
BEET	Buildings Energy Efficiency Taskgroup
BREEAM	Building Research Establishment Environmental Assessment Method
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
DEC	Display Energy Certificate
DOE	Department of Energy (US)
EPA	Environmental Protection Agency (US)
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
EU	European Union
GRESB	Global Real Estate Sustainability Benchmark
HERS	Home Energy Rating System
IDEAL	Improving Dwellings by Enhancing Actions on Labelling (EU EPBD)
IEA	International Energy Agency
IPEEC	International Partnership for Energy Efficiency Cooperation
IMT	Institute for Market Transformation
ISO	International Organization for Standardization
IT	Information Technology
LEED	Leadership in Energy & Environmental Design
LES-TER	Landlord's Energy Statement–Tenant's Energy Review
MF	Multi Family
NABERS	National Australian Built Environment Rating System
NatHERS	Nationwide House Energy Rating Scheme (Australia)
RICS	Royal Institute of Chartered Surveyors
SEAI	Sustainable Energy Authority of Ireland
SF	Single Family
UK	United Kingdom
US	United States
WGBC	World Green Building Council

1 Executive Summary

1.1 Report Objectives

Building energy rating schemes are gaining traction throughout the world, with a growing number of jurisdictions mandating building performance rating as part of a comprehensive energy efficiency policy package targeting buildings. The International Partnership for Energy Efficiency Cooperation (IPEEC)[1] has established a Buildings Energy Efficiency Taskgroup (BEET) to increase multilateral cooperation in the field of building energy efficiency, specifically in relation to the development and implementation of building energy rating schemes.

The BEET has launched an initial project to understand how building energy rating schemes can be used to have the greatest impact on meeting building energy efficiency policy goals. This is intended to be helpful to policy makers in IPEEC countries. Our intent was not to perform assessments of existing rating schemes, but rather develop an assessment framework that policy makers can use going forward as part of developing or refining building rating schemes. We also believe that this framework might serve as a useful foundation for future research comparing the effectiveness of schemes in different jurisdictions to understand which types of schemes are delivering the greatest impacts.

1.2 Background

Building energy rating schemes are often used to underpin labeling or disclosure programs and as a mechanism to determine minimum energy performance standards for buildings. The ultimate goal of building energy rating schemes, however, is usually to help reduce energy consumption (or greenhouse gas emissions) in the building sector.

However, building energy performance rating is just one part of a comprehensive policy package to achieve energy efficiency policy objectives. A building energy rating scheme does not in and of itself improve building efficiency. Rather, the rating is essential for defining the existing energy performance of a building and enabling other policies geared at reducing building energy consumption. Building energy rating schemes can thus be used in a variety of ways, both as a direct policy instrument (performance disclosure) or to underpin other policies (such as minimum standards or financial incentives).

Our focus in this report is on building rating schemes (which include both the rating tool as well as the programmatic elements that support the tool's use) rather than solely on the analytical and information technology (IT) platform that generates a building rating (rating tool). Throughout this report, we use the phrase "rating

1. IPEEC member countries include Australia, Brazil, Canada, China, European Union, France, Germany, India, Italy, Japan, Mexico, Russia, South Korea, United Kingdom, and United States.

scheme" (or rating program or rating regime) to refer to the broader policy program and the phrase "rating tool" to refer to the analytical and IT platform.

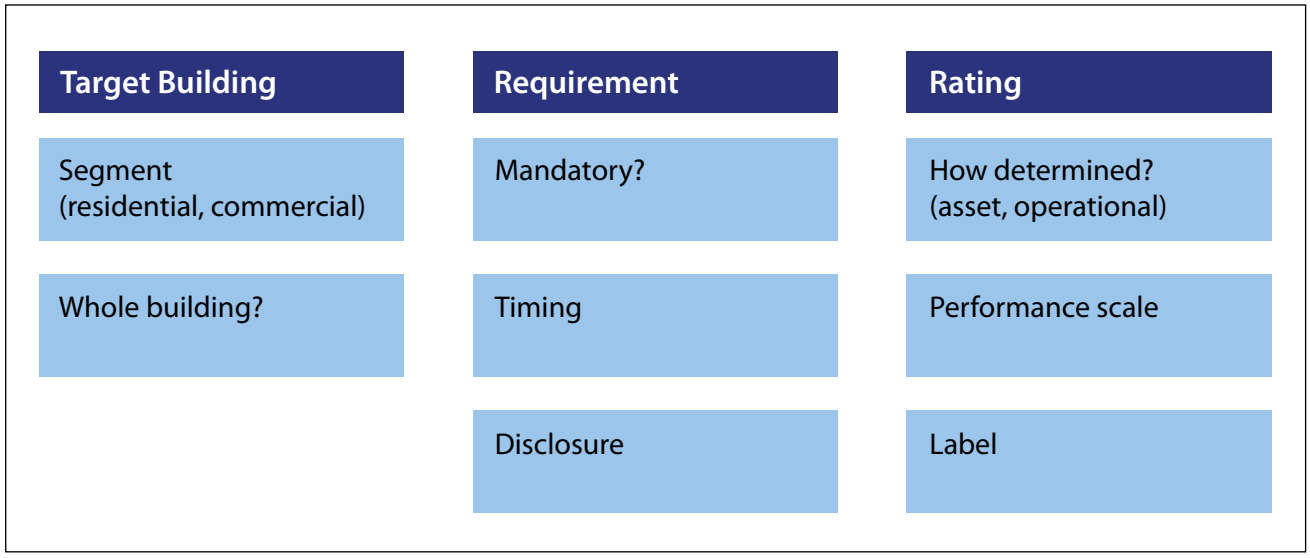
1.3 Diversity of building rating schemes

Building rating schemes tend to have similar objectives but can vary significantly in their design and implementation. There are valid reasons for this diversity. Building stock varies by climate and local expectations. Landlord-tenant arrangements vary by country. The ability of governments to implement mandatory ratings and disclosure policies depends on their political landscape. Finally, the ongoing procedures and requirements for real estate sector regulation often informs and influences the design and implementation of a building rating scheme. However, key elements of building rating schemes can be used to establish a framework to understand and compare descriptive elements of rating schemes, as shown in Figure 1.

There are three main components to how building rating schemes differ. First, which buildings do they target (i.e., commercial or residential and potential minimum size thresholds) and do they target the whole building or just tenant or landlord portions? Second, what are the requirements of the rating regime? Is it mandatory or voluntary? When does the building have to be rated—regularly or just at the time of a real estate transaction? Is the rating disclosed—to interested parties in the real estate transaction, to the government, or to the public? Third, what are the key characteristics of the rating? Is it an asset or operational rating? Against what metric is a given building's performance evaluated? What information does the rating's label contain and how intuitive is it?

Two topics provoke significant debate among policy makers and rating experts: does the scheme use an asset or operational rating, and whether the building is evaluated as a whole or broken down into the tenant/landlord portions.

Figure 1. Overview of How Building Rating Schemes Differ



There is much ongoing debate about the "best" way to assess building energy use and the role that asset and operational ratings have in that assessment process. Asset and operational ratings are not opposites and both are needed for different purposes. Asset ratings (sometimes called "calculated" ratings) focus on the theoretical energy use in a building as calculated under a set of defined, standardized conditions. Operational (or "measured") ratings focus on the actual energy use in a building based on energy bills and consumption, and reflect the occupants' behavior.

Some rating schemes focus on "whole building" (all energy use going into a given building) ratings, while other scheme administrators have developed different tools for tenants and landlords. There are advantages to both approaches. If we truly want to look at minimizing building energy consumption, many policy makers argue that it is critical to look at the whole building. At the same time, separate ratings provide more relevant information for tenants and landlords to act on. There are clearly benefits to having ratings for tenants and landlords be calculated separately but this is complex to implement in many jurisdictions.

As an illustration of the diversity of building rating regimes, we provide an overview of building rating schemes in several IPEEC countries. More detailed information on the schemes in most IPEEC countries is provided later in this report.

In addition to building energy rating programs, sustainability rating programs also often factor the energy efficiency of a building into their ratings. Sustainability ratings mainly target commercial properties and are usually voluntary programs. The growing popularity of broader sustainability ratings needs to be carefully considered as policy makers develop and refine their building energy rating programs.

1.4 Assessing building rating scheme design and implementation

While there is significant research on building rating tools and schemes, there are only a few studies that attempt to assess at a broad international scale the effectiveness of building energy rating schemes. Current assessments of building rating schemes are usually limited to self-assessments or regional comparisons. Moreover, assessments do not consistently focus on whether the scheme was designed and implemented in such a way to give policy makers, industry stakeholders, and scheme participants the tools, resources, and information they need.

Our intent is not to assess existing building rating schemes in this report, but rather to lay out an assessment framework that a large number of IPEEC member states have provided input on and which can be used for future collaborative efforts. We developed this framework with two key objectives: to allow for national and regional diversity in rating schemes and to provide a systematic and consistent evaluation approach that can be used by policy makers and other researchers.

There are three key elements to the scheme design and implementation assessment framework:

Figure 2. Summary of Key IPEEC Building Rating Schemes

Country	Scheme	Mandatory?	Assessment type		Building Type					
			Asset	Operational	New	Existing	Public	Non-Res	Res SF	Res MF
Australia	NABERS			●	●	●		●	●	
	Commercial Building Disclosure	Y		●		●		●		
	NatHERS	Y	●		●	●			●	
Canada	EnerGuide Rating System		●		●	●			●	●
	ENERGY STAR Portfolio Manager			●	●	●	●	●		●
	REALpac Energy Benchmarking Program			●		●	●	●		
China	China 3 Star Building Energy Efficiency Evaluation		●	●	●	●	●	●		●
European Union	Energy Performance Certificates (EPCs)	Y	●	●	●	●		●	●	●
	Display Energy Certificates (DECs)	Y		●			●			
USA	ENERGY STAR			●		●	●	●		●
	Home Energy Score		●		●	●			●	
	Commercial Building Energy Asset Score		●		●	●	●	●		●
	HERS		●		●	●			●	

Res = Residential; SF = Single Family; MF = Multi Family

- **Robustness of the rating tool.** Does the tool work as intended? Is the tool output independently verified such that there is a strong comfort that it is accurate and replicable? Is the tool accepted by relevant industry stakeholders?
- **Resources harnessed for scheme implementation.** What are the labor, financial, and organizational needs to implement and support the tool? How are these needs being funded? What are implications for the cost-effectiveness from the user perspective? What are trade-offs between the expense of the scheme and its validity?
- **Suite of ancillary supporting programs in place.** Have the necessary supporting policies and programs (such as communication, enforcement, funding,

stakeholder engagement) been put in place to enable the success of the overall rating scheme?

1.5 Assessing building rating schemes indicators and impact

The ultimate goal of rating schemes is to help reduce energy consumption in buildings by providing actionable information to key decision makers. Following the framework for how to assess the design and implementation of building rating schemes, we then focus on how to assess whether or not building rating schemes are effective.

Our framework looks at the impact of building rating schemes through two key performance indicators as well as at several measures of the overall impact of the scheme. The key performance indicators were:

- **Consumer awareness and use.** Do consumers know about the scheme, trust it and use it?
- **Compliance and participation rates.** How many buildings are getting rated? What is the rate of participation and compliance?

The framework then considers the impact that these schemes are having on participant behavior and resulting energy savings as well as on the building's value. There is little data available as of yet on changes in participant behavior or macro level impacts on energy consumption. We identify numerous topics that merit additional research and analysis and would provide useful input to policymakers.

Thus, for the purpose of this report, most of the discussion focuses on the linkage between building rating schemes and asset valuations. Understanding how markets value real estate and buildings is complex but is particularly important to the design of building rating schemes. While reducing energy consumption in buildings can reduce operational expenses this has a relatively minimal overall impact on the profitability of a building. Increasing the building's economic value, whether monetized through its sale or higher rents and/or occupancy rates, will ultimately have a faster impact on mobilizing the real estate sector to make their buildings more efficient than small changes to a building's bottom line. Understanding the relationship between building rating schemes and subsequent impacts of that rating on a building's asset valuation is thus a key input to assessing the effectiveness of building rating schemes.

A large number of studies on transaction prices, market valuation, and increased rental value from energy and green certifications have been done in the past five years. Virtually all of the studies conducted on this topic all show a positive impact between good performance on energy or sustainability ratings and resulting asset valuations. However, many experts are skeptical about the magnitude of premium cited in some studies. Overall, the latest results from Australia are robust and suggest there is some increasing value for higher rated energy performance, but more extensive analysis is needed in a broad array of markets before any major conclusions can be drawn. In addition, there are several major challenges to conducting

quantitative analysis on whether building energy ratings influence property values, which need to be factored into the analysis and addressed as building rating schemes evolve.

1.6 The Path Forward: Conclusions and next steps

There were three key findings of our research. First, building energy rating programs should not be viewed as the ultimate goal by policy makers. Rather, these programs are one (albeit an important one) of several policy levers that policy makers can use to drive ultimate energy efficiency or climate change goals. Building rating programs have the greatest impact when they are integrated into a strategic and coordinated energy efficiency policy framework including other key elements such as code enforcement, financial incentives, and a robust outreach and communications effort.

A second, but equally important,finding is the importance of ancillary programs supporting rating schemes. Such ancillary programs include (though are not limited to) quality assessments, assessor training, public outreach, and maintaining an up-to-date and accurate data repository of building ratings and compliance. The existence of these ancillary programs have a significant impact on scheme effectiveness, and are vital to the success of building rating scheme implementation.

Third, providing some sort of recommendations about how a building's energy performance can be improved appears to help the effectiveness of the building rating scheme. In European energy certification schemes, providing these recommendations is often a part of the scheme, while in other jurisdictions separate "energy audits" are a complementary activity. As more jurisdictions move toward mandatory ratings and/or periodic energy audits, the line between ratings and simple audits is beginning to blur.

There are also several challenges that face policy makers. First, there is little concrete data and analysis that has been developed that clearly demonstrates the link between energy rating programs and demonstrated reduced energy consumption by the building sector. More work developing appropriate methodologies and subsequent analysis is needed. Second, while there is more research that does indicate a link between improved building energy performance and impacts on building economics (as measured through increased rents, sales prices and/or occupancy rents), that research is in early phases and needs more substantiation as additional data becomes available. Finally, policy makers need to carefully evaluate how to best leverage the growing popularity of sustainability ratings without having energy performance become just one in long list of compliance items.

Our research and analysis also helped us identify several other topics that would be useful for future research as well as additional topics that would merit international collaboration. Those are discussed in more detail in Section 7 of the report.

2 Introduction

2.1 Introduction to the Building Energy Efficiency Taskgroup (BEET)

Building energy and environmental rating schemes are gaining traction throughout the world, with a growing number of countries and jurisdictions mandating building performance labeling or disclosure as part of a comprehensive buildings energy efficiency policy package. In response to this development, the International Partnership for Energy Efficiency Cooperation (IPEEC) established a Buildings Energy Efficiency Taskgroup (BEET) in 2013 to increase multilateral cooperation in the field of building energy efficiency. The BEET's specific focus relates to the development and implementation of building energy rating systems. Australia is Chairing the Taskgroup, with initial project funding from Australia and the United States (US).

The BEET has the following key objectives:

- Identify and assess existing building energy rating schemes and instruments that enable effective implementation of energy efficiency policy measures and
- Analyze the various implementation mechanisms and assess the impacts of rating tools and other buildings programs.

Through the IPEEC BEET, member countries can work collaboratively to research, inform and support the development and implementation of effective building energy rating systems. IPEEC countries have a wealth of experience in a variety of policy contexts and a collaborative approach will ensure that this knowledge and experience is shared.

2.2 Project objectives and scope

The focus of this first BEET project has been on building energy rating schemes. The objective of the project was to review building energy rating activity in IPEEC member countries, identify and discuss reasons for the differences and similarities of these schemes, and identify useful opportunities for international collaboration. At a high level, the project seeks to understand how building energy rating schemes can be used to have the greatest impact on meeting building energy efficiency policy goals. This is intended to be helpful to policy makers in IPEEC countries as they develop or modify rating schemes.

Out of that review of international building energy rating schemes, we saw that it would be useful to develop an assessment framework that could better compare a diverse range of different building energy rating schemes, focusing on the ultimate effectiveness of those rating schemes. The broad range of rating activity in IPEEC member countries gave us the opportunity to refine that framework with diverse international feedback.

Our intent in this project and report was not to perform assessments of existing rating schemes, but rather to develop such an assessment framework that policy makers can use going forward as part of developing or refining building rating schemes. We also believe that this framework might serve as a useful foundation for future research comparing the effectiveness of different schemes.

This initial project of the BEET also sought to identify current building energy rating knowledge gaps and areas where there might be opportunities for additional international collaboration.

2.3 Roadmap

This report will first provide some background on building rating schemes. Section 3 discusses key objectives of building rating schemes, how they are related to other energy efficiency policies, and introduces and defines relevant terminology that will be used throughout the report.

The report then provides an overview to the diversity of building rating schemes around the world, with a focus on IPEEC countries.[2] Section 4 discusses the key elements that define building rating schemes, provides additional context on particularly thorny issues related to some of those elements, details the status of building rating schemes in IPEEC countries, and discusses how building rating schemes differ from broader sustainability ratings.

In Section 5 of the report, we focus on developing a framework to assess the rating scheme's design and implementation. This section starts with a summary of existing assessments and then proposes a framework that may be useful for a more comparative approach in an international context. The framework includes three pivotal categories of criteria related to scheme design and implementation to assess—the robustness of the building rating tool, the resources put into scheme implementation, and the ancillary ecosystem of programs that are needed to support an effective rating scheme—and provides a discussion of best practices.

In Section 6, we suggest a framework by which to assess the impacts that the scheme is having. The categories that we focused on were consumer awareness and use, level of participation and compliance, impact on participant behavior, overall energy savings, and impact on asset valuations. The last category is of particular interest to the project sponsors and we summarized the existing research to date on the topic, discussed challenges in conducting this research, and ways that policy makers might better facilitate this analysis.

Finally, Section 7 provides some concluding thoughts regarding the path forward for building energy rating schemes. It first summarizes the key findings from this report. It then identifies knowledge gaps that would merit additional research and analysis. Finally, it provides a list of topics that would benefit from international cooperation and could potentially be taken on by IPEEC.

2. IPEEC member countries include Australia, Brazil, Canada, China, European Union, France, Germany, India, Italy, Japan, Mexico, Russia, South Korea, United Kingdom, and United States.

3 Background

3.1 Objectives of building energy ratings

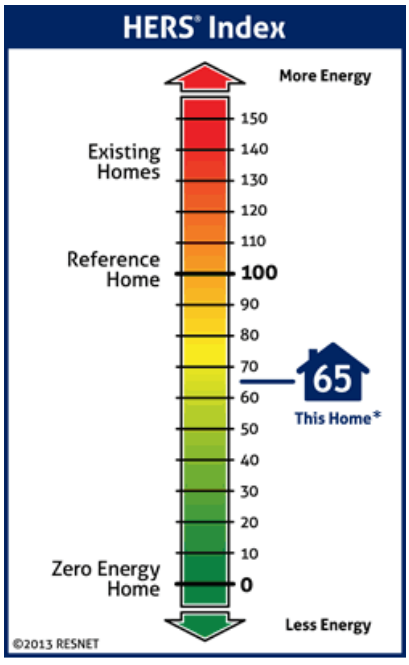
Since the 1990s, many countries have been developing and utilizing building energy rating systems in both new and existing buildings. They are often used to underpin labeling or disclosure programs and as a mechanism to determine minimum energy performance standards for buildings. The ultimate goal of building energy rating programs, however, is to help reduce energy consumption in buildings. Building rating programs give useful information to decision makers, showing how energy consumption is evolving over time and/or how it compares to peer buildings. Certain schemes can also give credit to the design and construction team. The development of building energy rating schemes is often costly, time consuming and requires a dedicated effort to maintain and improve the accuracy, performance and usability of the system over time. Many building energy rating systems have developed independently of one another, but sometimes borrow algorithms and methodologies from each other.

At their core, building energy rating systems attempt to simplify complex, technical information: design principles; physics of heat flow; and performance of energy using systems—to make the information digestible by the majority of building owners, occupants and managers. Due to the numerous systems within a building that impact one another as well as external factors that building owners do not necessarily have control over, buildings are complex to rate in a systematic and comparable way. Residential and commercial buildings are distinctly different from an energy rating perspective and approaches to each building category must be assessed separately.

It is, therefore, much more complex to accurately assess the efficiency of a building than to determine the fuel efficiency of a car or the nutritional value of a food item, though the impetus behind fuel efficiency and nutrition labels is similar to the logic behind building energy rating labels. Further complicating matters is the complex relationship between the relative contribution to energy efficiency of the inherent properties of the building components (insulation, glazing), the behavior of the occupants (leaving energy using devices running when not needed, or leaving windows open), and hidden defects or operational problems in the building system.

Some countries began experimenting with building rating programs in the 1990s as building energy efficiency became better understood as a cost-effective way to reduce energy use and costs. Denmark was the first country to launch a mandatory energy rating system for commercial and residential buildings. In 2002,

Figure 3. Example of Building Energy Rating Label Focused on Single Family Homes



*Sample rating representation.

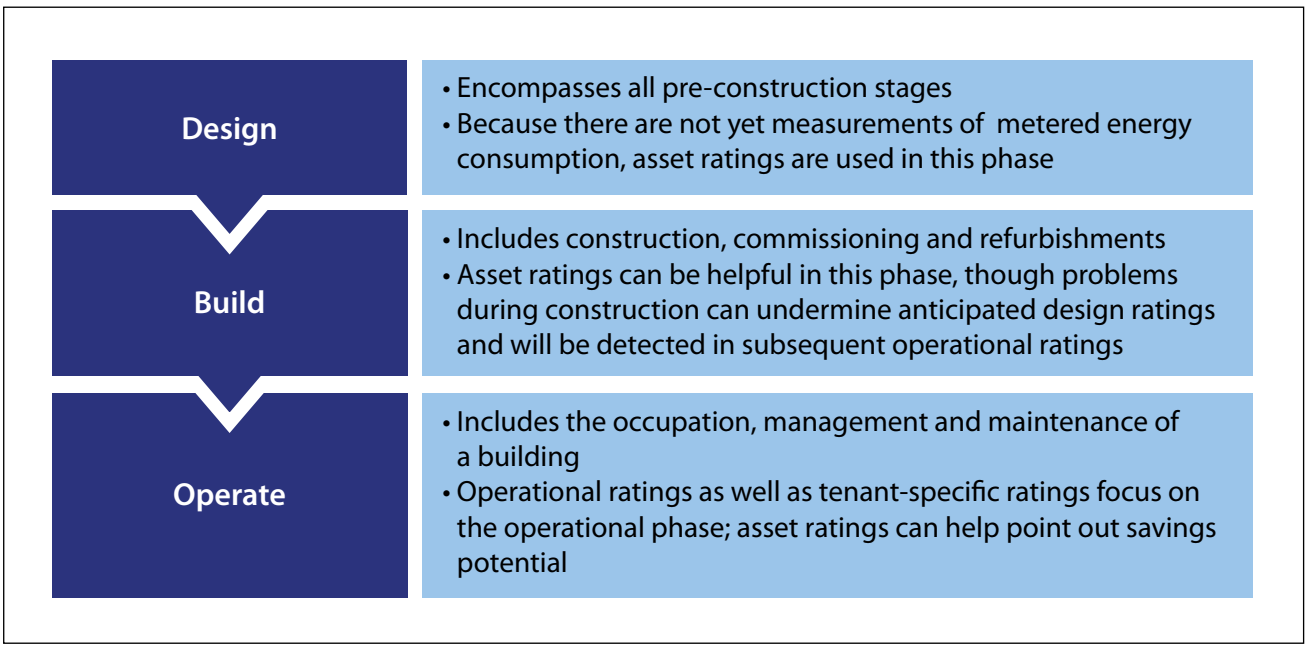
Source: www.resnet.us

the European Union (EU) introduced its "Energy Performance of Buildings Directive," or EPBD, which mandated that all EU member states implement a building energy certification program, including a building energy performance rating, though some less extensive regulations were introduced in the early 1990s. Over the past five years, the popularity of building energy rating schemes has grown significantly and has spread around the world.

Most existing rating schemes target just one of the three phases of the building lifecycle: Design, Build or Operate. The design stage of a building includes all pre-construction stages, such as developing the building concept, developing drawings and specific technical plans, and obtaining required approvals. Incorporating energy efficiency measures in the design stage benefits the building in all future stages. It is usually easier and far less expensive to integrate energy efficiency measures at the time of construction, as compared to retrofitting those systems or equipment after the building is built and occupied. Asset (or calculated) ratings, which focus on the calculated, or theoretical, efficiency of a building, are usually aimed mainly at the building as designed, but when combined with information about actual consumption can also be useful to diagnose operational problems. Examples of asset ratings include the UK's Energy Performance Certificate (EPC), the Australian Nationwide House Energy Rating Scheme (NatHERS), and certified Home Energy Rating System (HERS) in the US.

The build stage includes the actual construction, commissioning and refurbishment of the building. While there is no explicit type of building energy rating that targets the build phase, much can go wrong in the construction or renovation/refurbishment of a building that can undermine the energy efficiency effectiveness of the design and this will appear in subsequent operational ratings. Appropriate

Figure 4. Overview of Building Lifecycle Phases and Energy Ratings



commissioning during, and toward the end of, the construction period, can help ensure the efficiency level remains as intended during the design phase.

The operation stage includes the occupation, management and maintenance of a building. Energy performance during the operation phase may be greatly affected by the way that occupants use the building, as well as (or even more so) by the efficacy of the operations crew. Examples of operational (or measured) ratings include the US ENERGY STAR score and European Display Energy Certificates, as well as the National Australian Built Environment Rating System (NABERS).

3.2 Building ratings as part of energy efficiency policy

Policy makers usually have one or more objectives in mind when developing and implementing building energy rating schemes. Usually, they are focused on providing information and incentives to building owners, managers and occupants to reduce their energy consumption and thereby reduce overall environmental emissions. Economic theory is clear that for markets to encourage energy efficiency, market participants must have access to accurate and reliable information about energy performance. As such, building energy ratings are seen as a way to encourage a change in behavior of all parties in the real estate sector regarding a building's energy use and efficiency. Building energy rating policies are thus a foundation for a broader market transformation to improve a jurisdiction's energy efficiency.

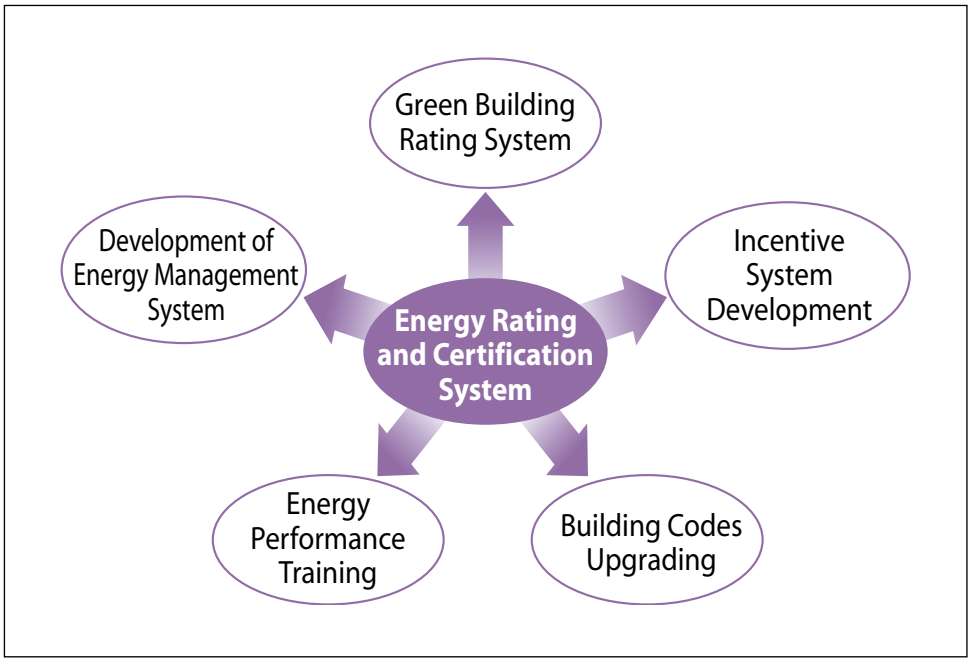
However, building energy performance rating is just one part of a comprehensive policy package to achieve energy efficiency policy objectives. Building energy rating does not in and of itself improve building efficiency. Rather, the rating is essential for defining the existing energy performance of a building and enabling other policies geared at reducing building energy consumption.

Energy ratings are often accompanied by tailored recommendations for how to improve the rating score (installation of a more efficient boiler, better insulation, etc.). These recommendations will usually be prepared by a trained assessor who understands potential improvements that can be made to reduce the energy use. Sometimes rating labels will include both the current rating score as well as how the score would improve if all recommendations were implemented. It has been shown that having these recommendations can lead to greater response rates than just providing a rating score.[3]

Building energy rating schemes can thus be used in a variety of ways, both as a direct policy instrument (disclosure) or to underpin other policies (such as minimum standards or financial incentives). For example, the relationship between building codes (construction regulations) and energy ratings is an important one. Are buildings in a given jurisdiction required to be brought up to code? What code level is that? Is it one that reflects the latest thinking in terms of energy efficiency requirements? Is the building rating scheme comparing a building to current code

3. IDEAL EPBD, *Key Findings & Policy Recommendations to Improve the Effectiveness of Energy Performance Certificates and the Energy Performance of Buildings Directive,* September 2011.

Figure 5. Linkages between Energy Ratings and other Energy Efficiency Policies



Source: Centre for Total Building Performance, Singapore, as presented in IEA Policy Pathway: Energy Performance Certification of Buildings (2010)

requirements? Is the rating being used as a way to identify buildings that are potentially not at current code level?

The linkage between building energy ratings and financial incentives is also important and should be closely coordinated. Many jurisdictions help subsidize the auditing of a property and some of the energy efficiency investments that need to be made. However, those financial incentives need to be linked to and coordinated with energy rating programs such that building owners are informed about available incentives at the time of their building energy rating. In addition, policy makers need to think about how best to incentivize the improvement of the overall building stock through the effective application of financial incentives to ever tightening standards.

One added element of complexity is the fact that policy makers often have to obtain support from other stakeholders for new policies and programs. While their stated goals regarding building energy ratings may be simple (reduce carbon emissions, reduce energy use, etc.), the way that such policies and programs have to be marketed in order to obtain the broad-based support often required for any legislative policies, means that additional program benefits (such as an increase in the number of jobs created or an increase in the building's value) may be emphasized while trying to "market" the program or policy to stakeholders. This can create confusion during program implementation if the program is not seen to accomplish those secondary goals.

3.3 Importance of establishing a "common language"

Before we delve any deeper into this topic, a quick discussion of vocabulary is merited. Many terms regarding building energy rating programs are used differently depending on jurisdiction and profession. For example, the term "energy rating" in Europe refers to the process of assessing a building's energy efficiency, while in the US, energy rating can refer to the rating scheme overall, the rating tool specifically as well as the resulting score.

Those in more technical professions or roles can interpret "rating" to refer to the actual rating tool (i.e., the quantitative algorithms and Information Technology (IT) platform that is used to evaluate the building), while those in public policy roles are more likely to interpret "rating" as referring to a suite of policies that support implementing a rating program, including training, quality assurance, and a penalty structure. This makes cross-jurisdictional discussions and comparisons challenging.

This complexity is addressed particularly well in the Institute for Market Transformation's (IMT's) How is Energy Efficiency Assessed? (2013). The table below from the 2013 IMT report highlights some of these differences in terminology.

While a broader, consensus-based dialogue about developing a "common language" of building efficiency policy is warranted, for the purposes of this report, we have explicitly defined the terms below as we use them in this report.

- **Assessor.** Person or company responsible for conducting the building energy rating and submitting required paperwork to authorities.
- **Benchmarking.** Process of measuring building energy performance, consisting of assessing a building's pattern of energy consumption and then comparing it against its historical usage or to consumption patterns of similar buildings.[4]

Figure 6. Table Comparing Use of Different Building Energy Rating Terms

	Australia	Canada	China	EU	US
Assessment system	Rating	Labeling; benchmarking	Rating	Certification	Benchmarking; Rating
Evaluation methodology	Rating	Rating	Rating	Rating	Rating; Rating
Results of evaluation	Rating; Score	Rating; Score	Rating	Class; Rating	Rating; Score
Physical product of assessment	Certificate	Label	Label	Label; Certificate	Label; Rating; Statement

Source: Adapted from Institute for Market Transformation, How is Energy Efficiency Assessed? (2013)

4. L. Pérez-Lombard, J. Ortiz, R. González, I. R. Maestre. "A review of benchmarking, rating and labelling concepts within the framework of building energy certification schemes," *Energy and Buildings*, Volume 41 (2009) 272–278].

- **Certificate.** Document recognized by a member state or legal person designated by it, which includes the energy performance of a building.[5]
- **Certification.** The process of a building being officially rated, including the assessment process, the results of that process (certificate or label) and the dissemination of that information.[6]
- **Compliance.** The act of meeting regulatory or legislative requirements of an energy ratings scheme in a complete and timely basis.
- **Label.** The presentation of energy performance information, including the energy rating or score and potentially other information about the building's energy consumption or performance.[7]
- **Rating.** The quantitative or qualitative score that the building receives from the rating tool. The rating usually compares the building to other similar buildings or to an ideal standard.
- **Rating Scheme** (also regime, initiative or program). The overall program put in place to rate the efficiency of buildings, including the rating tool and any associated programmatic elements, such as enforcement, communication or quality control.
- **Rating Tool.** The actual analytical and IT platform for developing a building rating, including the user interface.

This confusion about terminology is particularly pronounced in discussions that involve both a rating tool and the overall rating scheme (i.e. the suite of programs needed to implement a building energy rating scheme, including training, certification of trainers, communication and outreach, centralized oversight, etc.). Policy makers and experts even in the same jurisdiction will sometimes disagree about what constitutes a rating tool versus what constitutes a rating scheme. International discussions on this topic become even more complex due to linguistic nuances.

Our focus in this paper is on rating schemes (which includes both the rating tool as well as the programmatic elements that support the tool's use) rather than solely on the analytical and IT platform that generates a building rating (rating tool). We use the phrase "rating scheme" (or rating program or rating regime) to refer to the broader policy program and the phrase "rating tool" to refer to the analytical and IT platform.

5. International Standards Organization, *Energy performance of buildings—Common terms, definitions and symbols for the overall energy performance rating and certification.* ISO/TR 16344:2012(E)
6. IEA Policy Pathway Series, *Energy Performance Certification of Buildings: A policy tool to improve energy efficiency,* 2010. p. 57.
7. Ibid.

4

Diversity of Building Rating Schemes

As introduced in Section 3, building rating schemes are becoming an increasingly popular policy instrument across the world for helping to reduce energy consumption in buildings. These schemes vary in both their design and implementation as this section will detail. Understanding the diversity of building rating schemes and the rationale for that diversity is important before trying to assess such schemes in terms of their effectiveness or their impact.

4.1 Overview of building energy rating schemes

There are many dimensions to building energy ratings: asset versus operational, whole building versus tenant ratings; "just energy" versus broader green or sustainability ratings. For the purpose of this project, our focus is building energy rating schemes though we do briefly address broader building environmental or sustainability schemes in Section 4.4.

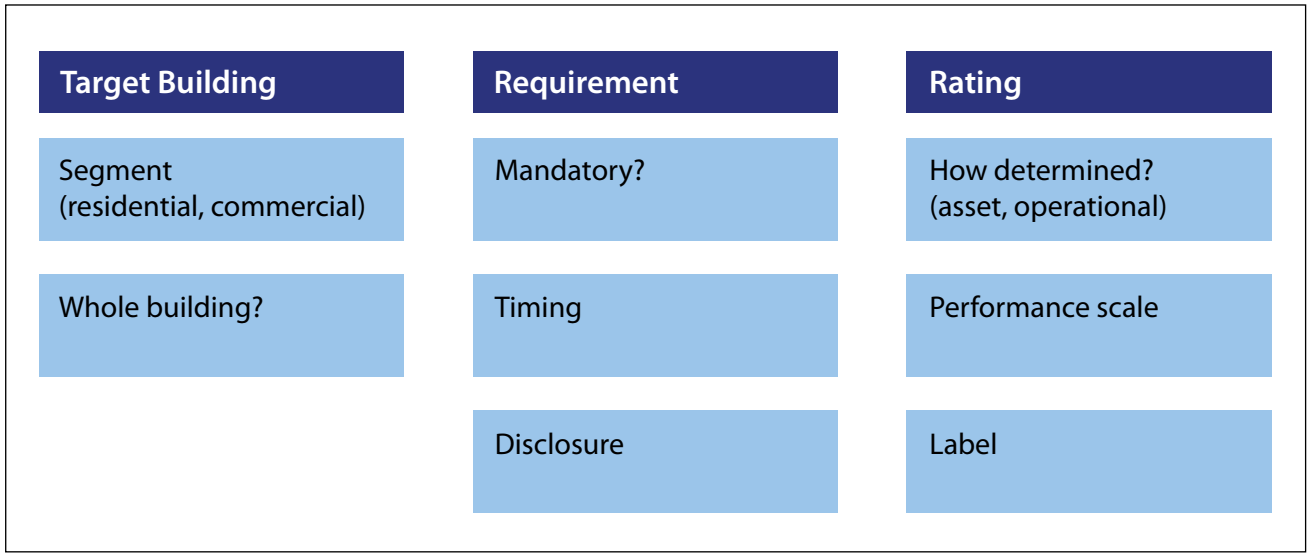
While there are many elements that contribute to the uniqueness of rating schemes around the world, we identified the key elements that define and differentiate a rating scheme in this section. Figure 7 provides an overview to the key elements that we will discuss below.

First, what kinds of buildings, and what portion of those buildings, are covered under the rating scheme? Does it apply to new or existing buildings? Public or private sector buildings? Commercial or residential? If residential, is it a single family

Key Take-Aways

- **Wide diversity of rating schemes** makes comparability of building performance schemes among countries challenging
- However, key elements of building rating schemes can be used as a **framework to understand and compare** descriptive elements of rating schemes
- **Different types of ratings** have strengths and weaknesses though policy makers need to be careful that all rating programs in a given jurisdiction are coordinated and internally consistent
- There are **potential benefits to having ratings for tenants and landlords** be calculated separately but this is complex to implement in many jurisdictions
- **The growing popularity of broader sustainability ratings** needs to be carefully evaluated as policy makers develop and refine their building energy rating programs

Figure 7. Overview of How Building Rating Schemes Differ



home or a building with multiple apartments or flats? The rating schemes for these types of property are necessarily vastly different, due to the relative complexity of commercial building systems compared to single family homes, the sophistication of commercial building owners compared to residential owners, and the pressures on maximum cost for a residential rating that consumers are willing to bear. As such, building rating schemes are often developed separately for the small residential segment (single family homes, and perhaps small buildings with one to five residential units) and for large commercial buildings, which often include multiple commercial and retail tenants. Note that in this report, we mainly refer to rating schemes for commercial buildings and single family homes. There are considerable complexities to developing and implementing rating schemes specifically designed for large residential buildings with apartments or flats[8] and, as such, there are fewer of them. In addition, while some jurisdictions do rate specialty buildings, such as hospitals or data centers, this is not a topic we have focused on in this report.

For buildings covered under the rating scheme, does the rating scheme cover the whole building or does it try to address the landlord and tenant energy use separately? The goal with "split" rating schemes is to provide relevant information to the parties capable of changing consumption patterns, thus giving information about the efficiency of common areas and central building issues to the landlord and information about energy performance and opportunities in tenant spaces to tenants. This issue is particularly complex and we address it in more detail in Section 4.2.2 below.

Second, what are the key requirements of the rating scheme? Is it a mandatory or voluntary scheme? There is some confusion about mandatory and voluntary schemes. Part of this is due to the fact that many countries have different levels of government at which building rating schemes can be implemented. While

8. With the phrase "apartment buildings" we are referring to multifamily buildings that possess five or more apartments or flats.

there is not a mandatory building rating scheme in the US,[9] several large US cities (including New York City, Chicago, Seattle and Austin) have mandatory programs. While the country as a whole would be considered a voluntary market, a significant percentage of its commercial floor area is actually covered under mandatory local or state building rating programs. Figure 8 highlights some of these local and state programs.

Some programs start as voluntary and then transition into mandatory programs once there is more comfort with the building rating concept. As an example, the Australian NABERS Energy rating program began as a voluntary scheme (originally known as the Australian Building Greenhouse Rating Scheme, or ABGR), but once the market had widely accepted the system, the Australian government was able to promulgate the mandatory Commercial Building Disclosure scheme.

Another key requirement is when the building rating obligation is triggered. Some mandatory programs are only triggered by the sale of a property, which limits their impact, given that many buildings are sold on average every 10 years. Is it temporal—i.e., annual or every three to five years? Is it triggered at the time of sale or lease? How does the timing of the rating relate to the availability of the information—i.e., is it included in marketing and advertising of properties?

The timing of the rating can be influenced by the type of rating used. Asset ratings have traditionally been done as a one-time snapshot of the calculated performance with a given set of assumptions about the building's physical characteristics, while operational ratings track changes in performance over time and are usually required on an annual or otherwise regularly scheduled timeframe, providing input toward whether policies or operational changes are having their intended impact. There is growing recognition of the opportunity for regularly updating asset ratings as the building characteristics and uses change, as both a tool to understand savings potential, and also re-evaluate the building's intrinsic energy performance for valuation.

In the early implementation of the EPBD, Denmark had only required that residential Energy Performance Certificates (EPCs) be presented to prospective buyers or tenants at the time of contract signing, which was too late to have the desired impact on changing decision-making behavior. More recently, in line with the recast EPBD, Denmark has changed the requirements, mandating that the energy rating be included as part of mandatory advertising requirements leading up to any sale or rental. This has made a significant change in the availability of information for consumers to make informed decisions.

The third key requirement of building ratings is the level of required reporting and/or disclosure. The concept of public disclosure is important as it addresses the problem that not all market participants have the same information about a building's energy performance.[10] Thus potential tenants or acquirers of a building are not

9. This is because the federal government generally does not have jurisdiction over building energy use in the US; other countries have similar issues.

10. In economic theory, this is referred to as the challenge of information asymmetry.

Figure 8. Examples of Different Types and Levels of Disclosure Requirements in US Cities

Jurisdiction	Benchmarking (Building Type and Size)		Reporting	Disclosure					Audits	RCx
	Non-residential	Multi-family	To local gov't	On public web site	To tenants	To transactional counterparties				
						Sale	Lease	Financing		
Austin	10k SF+	5+ units	✓	-	-	✓	-	-	✓	-
Boston	35k SF+	35k SF+/ 35+ units	✓	✓	-	-	-	-	✓	✓
California	5k SF+	-	✓	-	-	✓	✓	✓	-	-
Chicago	50k SF+	50K SF+	✓	✓	-	-	-	-	-	-
Washington, DC	50k SF+	50k SF+	✓	✓	-	-	-	-	-	-
Minneapolis	50k SF+	-	✓	✓	-	-	-	-	-	-
New York City	50k SF+	50k SF+	✓	✓	-	-	-	-	✓	✓
Philadelphia	50k SF+	-	✓	✓	-	✓	✓	-	-	-
San Francisco	10k SF+	-	✓	✓	✓	-	-	-	✓	-
Seattle	20k SF+	20k SF+	✓	-	✓	✓	✓	✓	-	-
Washington state	10k SF+	-	-	-	-	✓	✓	✓	-	-

Source: IMT Analysis of US Benchmark and Disclosure Laws (SF means square feet, unit of measure); available at www.buildingrating.org

privy to the same information as the building owner. Public disclosure can also be important in terms of "naming and shaming" particularly underperforming buildings. The issues to consider with public disclosure include: Are the ratings publicly available on a government registry or public website? Or are they only available to relevant stakeholders such as a potential acquirer or lessor of the property? Or, is there a phase-in about the level of public disclosure, as occurred in New York City, where benchmarking scores were not made public for commercial buildings in the first couple of years of mandatory compliance.

The last criteria is the rating itself. How is it calculated? Is it an asset rating or an operational rating? Or both? Asset ratings focus on the building components and their expected inherent properties while operational ratings focus on the ongoing energy use of the building, including the building itself, the needs of its tenants and its operations and maintenance. This is another particularly complex issue, which is discussed in more detail in Section 4.2.1 below.

Similarly, what is the performance scale that the rating is based on? Is the rating system based on an absolute reference or a relative reference to a portfolio of similar buildings? If a relative reference, how is that calculated? Is it compared to code or some other estimated reference?

Having enough reliable data to develop a rating for certain building types can be challenging—there is a trade-off between accuracy and broad applicability. As

an example, the ENERGY STAR score is only available for those types of commercial buildings for which there is adequate population data on which to base the scoring model. Tools designed to apply to all types of commercial buildings must include a significant number of assumptions, and finding the right balance between making the rating available for all buildings versus just a subset for which good data exist can be challenging.

Finally, how is the rating depicted on the label? How lengthy is the label? What other comparative information is provided? Are recommendations provided about potential improvements that can be made to the building? How much detail exists? Does the label list likely energy costs and savings?

Beyond these considerations, there are also a range of technical choices to be made as part of rating schemes and tools, many of which can impact how the rating affects certain policy choices. For example, if the rating is based on delivered (site) energy performance, that removes the benefit of on-site electric cogeneration, as the primary (source) energy benefits of the cogeneration may not be captured when just comparing delivered energy consumption. Other technical choices as part of the rating tool design can also impact decision-making; this issue is touched on in Section 5.3.

Asset ratings focus on rating the inherent properties of the building's components and systems, whereas operational ratings focus on the use of that building.

4.2 Issues in building energy rating schemes

The overview of the various dimensions of rating schemes highlighted two of the thorniest dimensions—asset versus operational rating, and ratings that assess the whole building versus ratings that separate landlord and tenant consumption. We provide a detailed discussion of these more challenging issues in the subsections below.

4.2.1 *Asset versus operational ratings*

There is much ongoing debate about the "best" way to assess building energy use and the role that asset and operational ratings have in that assessment process. Asset and operational ratings are not opposites and both are needed for different purposes. Asset ratings (sometimes called "calculated" or "modeled" ratings) focus on the theoretical energy use in a building as calculated under a set of defined, standardized conditions. Operational (or "measured") ratings focus on the actual energy use in a building based on energy bills and consumption. One way to think about the relationship between these two kinds of ratings is that asset ratings focus on rating the inherent properties of the building's components and systems, whereas operational ratings focus on the use of that building.

Asset ratings are useful for testing the energy performance implications of different design choices and documenting code compliance. They also are helpful from a business perspective to provide a way to assess the present value of future energy savings. Asset ratings also can provide guidelines for how much energy a given building should be using under standardized conditions. Some policy experts believe that asset ratings work best for new buildings or buildings in the design

Figure 9. Comparison of Asset and Operational Ratings

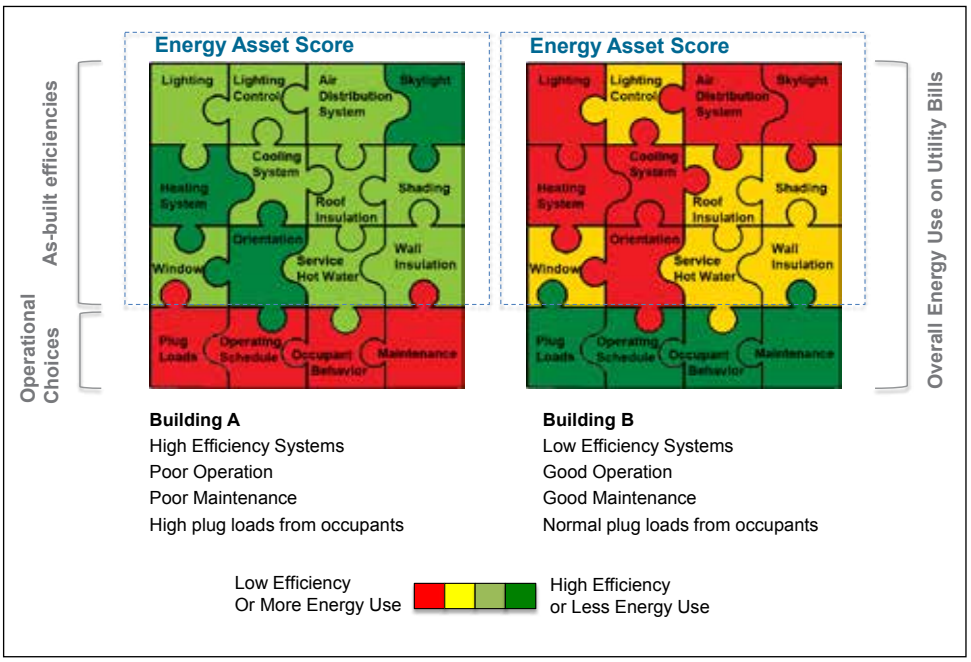
	Asset Rating	Operational Rating
What is assessed?	• Building Envelope • Building Systems • Lighting	• Metered energy consumption at building level (which may or may not include process or other energy intensive loads) • Actual operating hours, occupational density, plug load (i.e., tenant activity)
Assumptions?	Standardized assumptions about operating hours, temperatures, occupational density, plug loads	Normalized for weather and building type
Comparison	Officially rated vehicle fuel economy label	Actual vehicle fuel economy

phase, though this is not universal. Other policy experts tout the benefit of asset ratings because they remove the impact of occupant energy use decisions. This is important because potential tenants may use the building quite differently from an energy perspective than existing tenants. Thus, a rating focused on the building systems may be more valuable in the tenant's evaluation of the building.

Empirically-based operational ratings reflect everything that is going on in the building that affects energy use and can be valuable for getting management attention and obtaining the financial and human resources needed to improve energy management in a building. Operational ratings can be an important metric to assess the building over time—a "longitudinal" view of building performance. This can provide a view of trends and validation of whether policies or operational changes are having the intended impacts. Operational ratings can also be helpful in understanding relative levels of energy services and operations and maintenance efficiency in a given building. For buildings operations staff, operational ratings are crucial to their ability to communicate about energy efficiency to senior management.

In general, asset ratings seem to work very well for buildings that are not complex, where there can be great differences in occupant behavior and resulting total energy consumption, such as single family homes. These simpler, more homogeneous types of buildings can be easier to perform energy simulations without significant cost. When buildings get larger and more complex, it becomes more difficult to consistently calculate the energy performance through a calculated asset rating, which relies on energy modeling. Indeed, accurate asset ratings on large, complex buildings can be very expensive to perform relative to an operational rating. Experience in Denmark demonstrated this challenge, where they started by requiring an asset rating for all buildings, but later switched to operational ratings for large, complex buildings. While not a "rating" tool, a critical complementary practice for bridging the gap between design intent and energy efficient operation is effective building commissioning. The practice of commissioning a

Figure 10. How Asset Ratings Can Specify Areas of Improvement



Source: US Department of Energy Commercial Building Energy Asset Score, Program Overview and Technical Protocol (2012)

building can be a bridge between very efficient designs and their subsequent efficient operation, and can catch construction phase deficiencies that would otherwise result in potential poor operational efficiency that would result in poor operational ratings.

Effective asset and operational ratings can complement one another. A poor operational score usually shows that there is opportunity for improvement, but does not point out where to begin to make that improvement. A tailored asset rating, looking at what portions of the building's energy characteristics are efficient or lacking can direct building decision makers to those opportunities. Figure 10 shows how the US Asset Score is being designed to look at a variety of building characteristics (though not occupant or operational choices) and identify those areas that need attention.

Certain jurisdictions choose to use only one type of rating. In this case, they should be mindful of what information they may be missing and to clearly articulate that to end-users. Other jurisdictions choose to use multiple types of ratings. In this case, it is important to not only clearly communicate what the difference in those ratings is to avoid confusing end-users, but also to ensure the internal consistency of those ratings. Otherwise, confusion raised by differences in results because of the variation in underlying methodologies can lead to negative perceptions of both of the rating systems and a loss of credibility.

As an example, the UK uses both Energy Performance Certificates ("EPCs"; an asset rating for private buildings) and Display Energy Certificates ("DECs"; an operational rating applied to public buildings). EPCs are mandatory for commercial buildings at the time of sale and lease, while DECs are mandatory only for "public" buildings as defined

Best Practices for integrating asset and operational ratings

China's building energy labeling initiative is integrating asset and operational ratings along the phases of building development, with an asset rating used during construction and an operational rating used once the building has been in operation for at least one year and is at least 30% occupied. With the process relatively new and expensive, uptake to date has not yet been high, but having the asset and operational ratings presented for the same building on the same rating scale holds great potential.

by the EU EPBD. In a study conducted by real estate manager Jones Lang LaSalle and the UK Better Buildings Partnership, analyzing a set of more than 100 buildings of Better Buildings Partnership members totaling 2 million square meters of commercial office space, there was little correlation between the performance of a building using the EPC versus the DEC. On average, buildings that were rated an "E" on a scale of "A" (highest) to "G" (lowest) in terms of their asset rating, performed significantly better on operational ratings than those that were rated a "B" on average.

What is becoming clear in policy circles is that there needs to be more internal consistency, or at a minimum, a means for reconciliation, among the different rating tools that are being used in a given jurisdiction. One example that bears watching is China. China's Green Building Evaluation and Labeling program[11] is integrating asset and operational ratings along the phases of building development, with an asset rating used during construction and an operational rating used once the building has been in operation for at least one year and is at least 30% occupied. The second phase of this program, which came into effect in 2012, provides government incentives for qualifying buildings to support the government's target of 1 billion square meters of new green buildings by 2015. It is still relatively early days in the implementation to understand how the asset and operational ratings will be reconciled, but the initiative has strong potential.

4.2.2 Whole building versus tenant/landlord split

Some rating schemes focus on "whole building" (all energy use going into a given building) ratings, while other scheme administrators have developed different tools for tenants and landlords. There are advantages to both approaches. If we truly want to look at minimizing building energy consumption, it is critical to look at the whole building. Some scheme administrators argue that whole building rating is the only way to get an "apples to apples" comparison. In some cases where separate tenant and landlord ratings are applied, finding information about the total energy consumption in those buildings can be very difficult, as tenants and landlords often do not wish to share the information. This is a particularly thorny issue in buildings with multiple apartments or flats, though workarounds do exist, as has been seen in New York City where the local utility is making aggregated data available for a fee.

The counter-argument from advocates of separate tenant/landlord ratings is that separate ratings provide the best currently available information to the stakeholder who can take action based on the ratings. Their argument is that due to "split incentives" between those who must make investments and those who reap benefits, providing information about the energy use that a given decision-maker controls, and can change, is the most useful.

The EU EPBD specifically states that for units within a larger building, the

11. The energy rating portion of China's green building labeling program is based on the China Standard for building energy performance certification (JGJ/T288-1012). The broader Green Building Evaluation and Labeling program is widely known as "China Three Star."

certification may be based on either a common certification for the whole building, or on the assessment of representative units with the same energy-relevant characteristics in the building. Different EU member states have implemented this differently—many member states allow both whole building and apartment specific certificates (for residential buildings with numerous apartments or flats), and suggest that the most appropriate solution be chosen depending on available data.

The most advanced separate tenant/landlord ratings have evolved in Australia, which has a relatively new and homogeneous commercial building stock and clear definitions and expectations for "landlord provided services."[12] In that specific context, separate tenant and landlord ratings are working quite well. There have been substantial improvements in the landlord ratings for a number of the major commercial building owner firms in Australia since the introduction of the rating schemes, and increased interest since the Commercial Building Disclosure scheme was made mandatory in 2010.

More recently, there has been a push toward separate tenant and landlord ratings in the UK, driven by interest from the commercial building owner community led by the British Property Federation and the UK Better Buildings Partnership. This work has led to development of the "Landlord Energy Statement/Tenant Energy Review", or LES-TER. The UK Better Buildings Partnership is currently working on a new "Landlord Energy Rating", building off the work done in Australia through the NABERS Energy rating.

There is also increased interest in landlord and tenant ratings in the US; legislation has been proposed to create a new "Tenant Star" rating to complement the whole building ENERGY STAR scheme. It is expected that there will be additional developments in the near future.

4.3 Status of building rating schemes in IPEEC countries

As an illustration of the diversity of building rating regimes, we provide an overview of building rating schemes in IPEEC countries. Figure 11 summarizes the major schemes promulgated by the various governments, or those other schemes that have achieved significant market penetration in a given member country. The chart summarizes the applicable target building segment, whether it is mandatory or not, and the name of the overall rating scheme. More detailed information on these schemes is available in the Appendix.

The most mature schemes, in Europe, the US, and Australia, have all been in place for at least a decade and have substantial market awareness. In several other IPEEC jurisdictions, such as India and Mexico, rating schemes are relatively new and have not yet seen significant market penetration. As such, it is challenging cite

12. In jurisdictions with older building stock, including much of Europe and many US cities, there is a much wider range of what "landlord provided services" tenants expect, and older building systems and electrical wiring can make clean, comparable breakouts of "landlord" versus "tenant" energy uses quite challenging.

Figure 11. Comparison of Building Rating Schemes in IPEEC Countries

Country	Scheme	Mandatory?	Assessment type		Building Type					
			Asset	Opera-tional	New	Existing	Public	Non-Res	Res SF	Res MF
Australia	NABERS			●	●	●		●	●	
	Commercial Building Disclosure	Y		●		●		●		
	NatHERS	Y	●		●	●			●	
Brazil	PBE Edifíca		●		●		●	●	●	●
Canada	EnerGuide Rating System		●		●	●			●	●
	ENERGY STAR Portfolio Manager			●	●	●	●	●		●
	REALpac Energy Benchmarking Program			●		●	●	●		
China	China 3 Star Building Energy Efficiency Evaluation		●	●	●	●	●	●		●
European Union	Energy Performance Certificates (EPCs)	Y	●	●	●	●		●	●	●
	Display Energy Certificates (DECs)	Y		●			●			
France	Diagnostic de Performance Energetique (DPE)	Y	●	●	●	●	●	●	●	●
Germany	Energieausweis	Y	●	●	●	●	●	●	●	●
India	Star Rating for Buildings			●		●	●	●		
Italy	Certificazione Energetica	Y	●		●	●	●	●	●	●
Japan	CASBEE		●	●	●	●	●	●	●	●
Russia	Energy Passports		●		●	●	●	●	●	●
South Korea	Certificate of Building Energy Efficiency		●	●	●	●	●	●		●
United Kingdom	EPCs	Y	●		●	●		●	●	●
	DECs	Y		●		●	●			
USA	ENERGY STAR			●		●	●	●		●
	Home Energy Score		●		●	●			●	
	Commercial Building Energy Asset Score		●		●	●	●	●		●
	HERS		●		●	●			●	

Res = Residential; SF = Single Family; MF = Multi Family

examples or best practices from those jurisdictions.

4.4 Other relevant rating schemes

Before concluding this section, it is important to consider other relevant rating schemes. In addition to building energy rating programs, sustainability rating programs also often factor in the energy efficiency of a building into their ratings. Sustainability ratings mainly target commercial properties, although there are a few programs geared at the single-family residential segment. Most of these broader "green" or sustainability ratings are voluntary, such as the UK's BREEAM (Building Research Establishment Environmental Assessment Method), US Green Building Council's LEED (Leadership in Energy and Environmental Design) program, the Green Star scheme in Australia, and CASBEE (Comprehensive Assessment System for Building Environmental Efficiency) in Japan. There are also other industry-driven voluntary programs such as the Global Real Estate Sustainability Benchmark (GRESB), Green-rating.com, and the Greenprint Foundation.

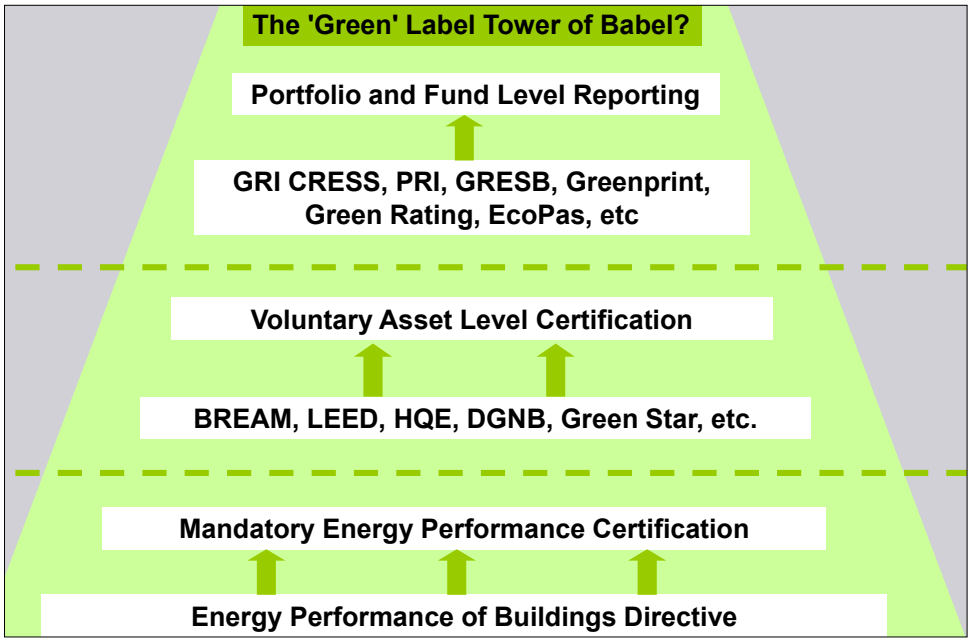
There is a growing trend toward assessing the overall sustainability of a building rather than the disparate components (including energy) that are considered important sustainability factors. Some policy makers believe that the different sustainability issues are interlinked and it is better to assess them in a coordinated manner. End-users—business customers in particular—are interested in sustainability labels (i.e., LEED Gold or five star Green ratings) for their own marketing and recruiting purposes. These end-users often have a "check the box" mentality—i.e., they are just looking for a sustainability label and they don't want to worry about any other details. One of the major concerns of policy makers focused on energy efficiency is that some sustainability rating schemes can result in a relatively high score without necessarily having achieved much in terms of reducing the energy intensity of the buildings.

One of the major concerns of policy makers focused on energy efficiency is that some sustainability rating schemes can result in a relatively high score without necessarily having achieved much in terms of reducing the energy intensity of the buildings.

For policy makers focused on energy ratings, this raises important questions: Is there value in having a stand-alone energy rating? If so, this value needs to be articulated more clearly, and energy rating programs need to be more clearly differentiated from sustainability programs. If not, policy makers need to ensure that energy performance ratings are an important component of sustainability ratings and that energy ratings are fed directly into the sustainability rating, as occurs in China's green building rating. Unlike the broader green rating schemes in some countries, where there is not a specific requirement for the energy performance to substantially exceed standard practice, China's Green Building Evaluation and Labeling program requires that all rated green buildings must meet stringent energy performance minimums (as well as more stringent requirements in several other environmental performance areas).

The EU considered moving toward a broader sustainability rating in the recent recast of the EPBD, but did not implement this change. The European Commission began a "public consultation" process in 2013 on "Sustainable Buildings," as a Commission Roadmap adopted in 2011 concluded that existing policies aimed toward energy efficiency needed to be complemented with policies for resource efficiency

Figure 12. Example of Multiple Commercial Building Reporting Requirements



Source: Hartenberger, Ursula, "Integration of Sustainability Indicators into the Valuation Process," May 29, 2013 Presentation

looking at a wider range of resource use and environmental impacts across the life-cycle of buildings. This process may result in a broadening of the current EPBD's focus on certification of energy performance to some broader sustainability certification.

Commercial building owners and managers support and are encouraging this trend. They are often frustrated by the multitude of reporting obligations of mandated building energy ratings and sustainability ratings (which are usually voluntary but essential for high caliber commercial buildings), and the ensuing data management required to comply with several different rating schemes simultaneously. This complexity is compounded by the need for companies to develop firm-level or portfolio level statistics, which is not easily achieved under a multitude of rating schemes. Certain organizations, such as GRESB and the Greenprint Performance Index, have emerged to address this need, but add yet another layer of rating activity, as summarized in the graphic above.

The real estate community finds the data collection and analysis to comply with different labels time-consuming, expensive and confusing, and is pushing to use one overall sustainability assessment. Direct costs of certification are significant but do not include the costs of IT systems to meet reporting requirements, training staff, allocating sufficient resources to collect and report the data. The global presence of some larger real estate firms, with properties in many jurisdictions around the world, is in some cases raising this topic in a variety of IPEEC jurisdictions.

5 Assessing Building Rating Scheme Design and Implementation

Having documented the extensive diversity of building rating schemes, we turn now to assessing those building rating schemes, trying to answer a deceptively simple question: How do we know that building energy rating schemes are effective?

We look at this in two steps, first assessing whether the scheme was designed and implemented in such a way to give policy makers, industry stakeholders, and scheme participants the tools, resources, and information they need. We then look at the impact that the scheme has on achieving energy efficiency policy goals. This section focuses on the first step, while Section 6 focuses on the impact assessment.

Note, as we stated in Section 2.2, our intent here is not to assess building rating schemes in this report, but rather to lay out an assessment framework that a large number of IPEEC member states have provided input on and which can be used for future collaborative efforts. We illustrate this discussion with examples of best practices from different jurisdictions but we have not yet attempted here to conduct a comprehensive review using the assessment framework.

5.1 Summary of existing assessments

There are numerous studies that have been conducted in the last five years assessing building rating schemes. The bibliography in Section 9 lists the studies that were reviewed as part of this survey. These documents have all been aggregated

Key Take-Aways

- Current assessments of building rating schemes are usually limited to **self-assessment or regional comparison**
- **Assessments do not consistently focus on scheme effectiveness**
- Proposed framework to assess scheme design and implementation can be **applied to all schemes and provides a framework for global comparison** and discussion
- Suite of **supporting programs underlying the building rating scheme** makes a big impact on rating scheme effectiveness

and made available at www.buildingrating.org/ipeec. These studies usually fall into three categories.

First are studies commissioned by a government as part of their process to assess different options for developing or refining their own building rating policies. While these studies tend to cover a broad array of different rating tools, the lens through which they are assessed is highly specific to the needs or goals of the organization and jurisdiction which commissioned the study. Many of these studies focus more on the specific characteristics of the rating tool and methodology rather than assessing the overall rating scheme.

Second are evaluations of a jurisdiction's rating scheme by that jurisdiction's government (or hired consultant), usually focused on assessing whether the rating scheme is achieving its goals and identifying ways it can be improved. For example, the US Environmental Protection Agency (EPA) regularly assesses its ENERGY STAR program, comparing the historical performance of buildings over time to estimate achieved energy savings. This assessment helps to confirm at least at a macro level, the energy ratings of the portfolio of buildings in the program. Similarly, the UK Energy Centre's assessment of the UK's Energy Performance Certificate scheme in the residential sector examined how the schemes had been implemented and made recommendations about improving the scheme for national policy makers.

Finally, there are independent assessments of one or more building rating schemes by a third party entity, usually a non-profit or research center. These studies usually have a specific focus, such as the Climate Policy Initiative's 2011 assessment of Germany's scheme and the IDEAL-EPBD's 2011 analysis of European Union building rating schemes, which both focused on the impact of these schemes on consumer behavior. The Northeast Energy Efficiency Partnership's 2013 analysis of different US rating schemes and the Building Performance Institute Europe's 2010 assessment of European Performance Building Directive implementation, were both broader with a focus on overall scheme effectiveness. *Implementing the EPBD* by the EPBD Concerted Action group provides a similarly broad perspective. These studies usually compare programs from a given region or that use similar rating approaches and do not attempt to compare rating schemes across regions or to compare schemes that use different rating approaches.

These studies serve to provide an overview of the breadth of building energy rating programs underway in different jurisdictions, a discussion of the pros and cons of certain rating tools, and deep assessments of certain rating schemes from different perspectives. What these studies do not provide is a systematic way to assess building rating schemes more globally, for example to ascertain how effective they are at meeting their ultimate objectives, or to compare building rating schemes against one another from a programmatic perspective. Part of this project has been geared at developing a framework to conduct such an analysis.

5.2 Proposed assessment framework

Our objective was to develop a framework that would allow for the diversity of building rating schemes. There are valid reasons for the differences in building rating schemes around the world. Building stock varies by climate and local expectations; landlord-tenant arrangements are different depending on locale; the ability of governments to enforce mandatory rating and disclosure policies depends on the political landscape; and, the ongoing procedures for regulation of the real estate sector often inform and influence the implementation of a building rating scheme.

Knowing that this broad diversity would make it complex to compare building rating schemes directly, we tried to focus on the broader programmatic elements of the building rating scheme to enable a more systematic and consistent evaluation approach.

There are three key elements to the assessment framework:

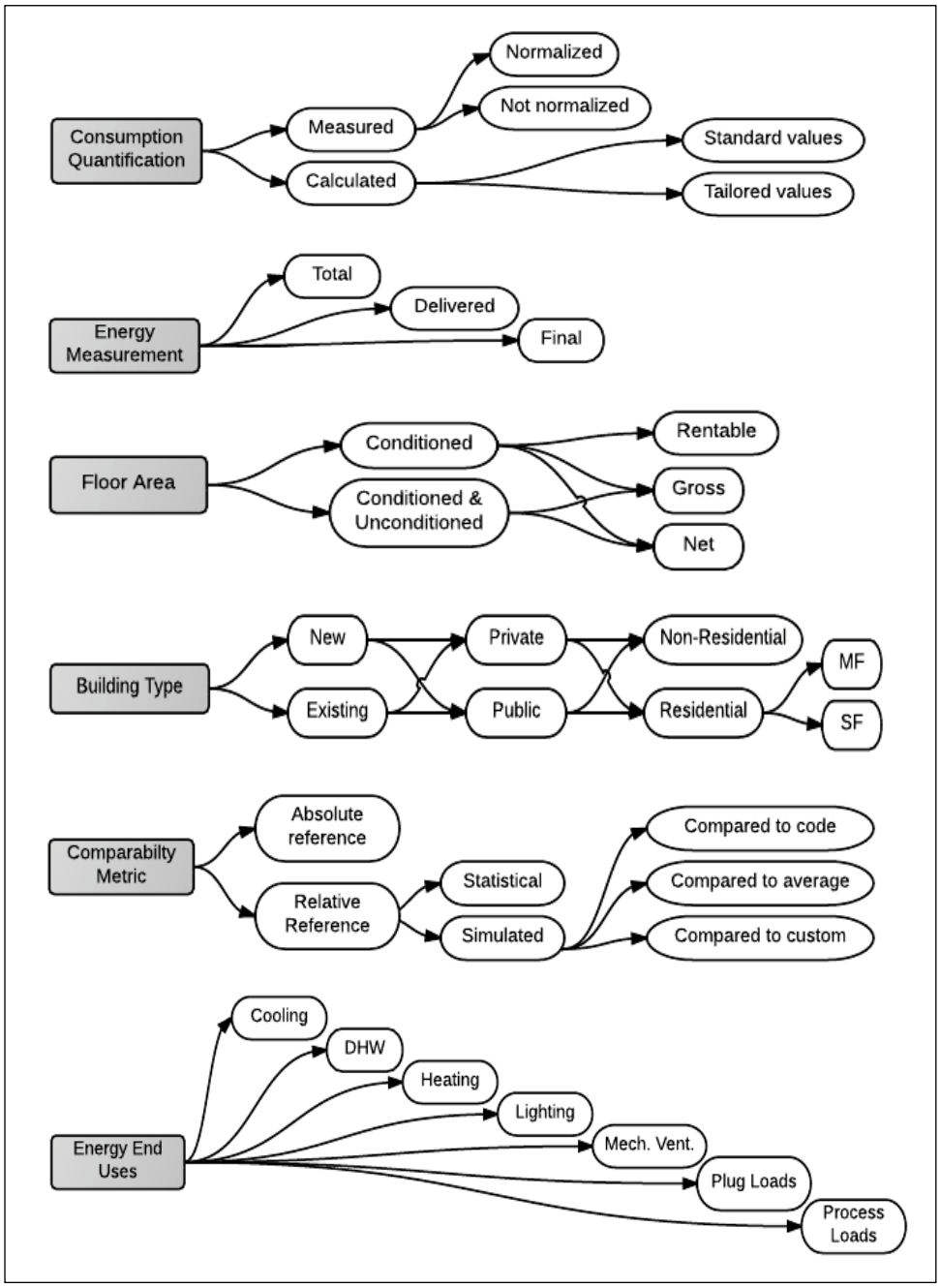
- **Robustness of the rating tool.** Does the tool work as intended? Is the tool output independently verified such that there is a strong comfort that it is accurate and replicable? Is the tool accepted and used by relevant industry stakeholders?
- **Resources harnessed for scheme implementation.** What are the labor, financial, and organizational needs to implement and support the tool? How are these needs being funded? What are implications for the cost-effectiveness from the user perspective? What are the trade-offs between the expense of the scheme and its validity?
- **Suite of needed supporting programs in place.** Has the necessary portfolio of supporting policies and programs (such as communication, enforcement, funding, stakeholder engagement) been put in place to enable the success of the overall policy?

We discuss each of these in more detail in the subsections below.

5.3 Robustness of building rating tool

First, we assess the technical robustness of the rating tool and the quality of the tool output. We recognize that different components of rating tool design (asset versus operational, the use of weather and other normalization, the definition of building area, to name just a few) are particular to each jurisdiction. As mentioned above, there are numerous reasons that a building rating tool may vary by jurisdiction, ranging from climatic differences to local real estate traditions and practices to differing policy objectives. We do not attempt to assess the benefits or disadvantages of these technical components of the rating tool, but rather just take them "as is." The Institute for Market Transformation's 2013 Report, How is Energy Efficiency Assessed, provides a useful discussion on many technical elements and is summarized in the graphic below.

Figure 13. Overview of IMT Classification

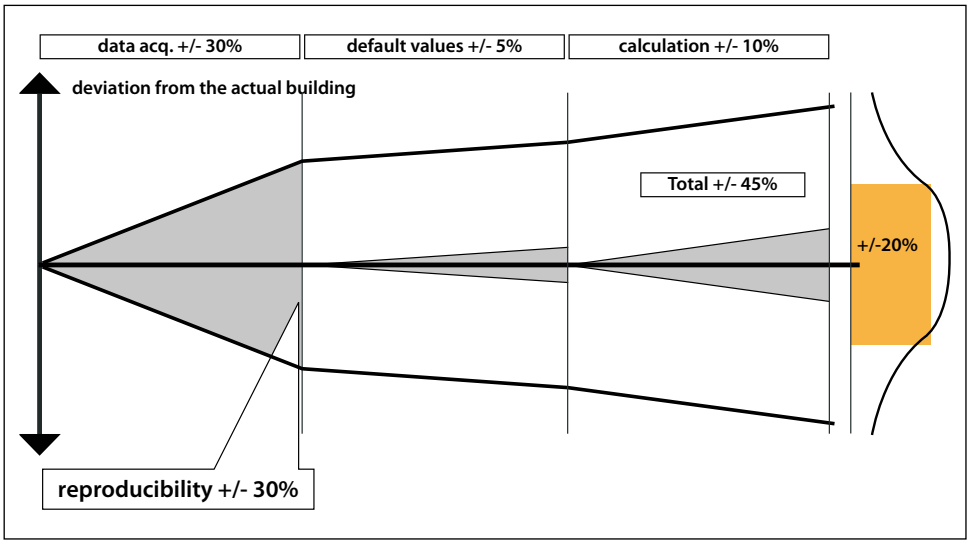


Source: Institute for Market Transformation, How is Energy Efficiency Assessed? (2013)

A rating tool's overall technical robustness can be assessed by looking at how it was developed, how it was validated, and how it is maintained. Have the tool outputs been validated by external entities? Is the tool regularly updated or calibrated? What kind of feedback loop exists from any quality control assessments to improving algorithms in the tool? Does the tool's assessment cover most of the significant building energy use? In addition, the scheme can be assessed on its success in growing a robust market and demand for building energy information. Is the tool itself open source with open standards, and has it encouraged the development of add-on products and services?

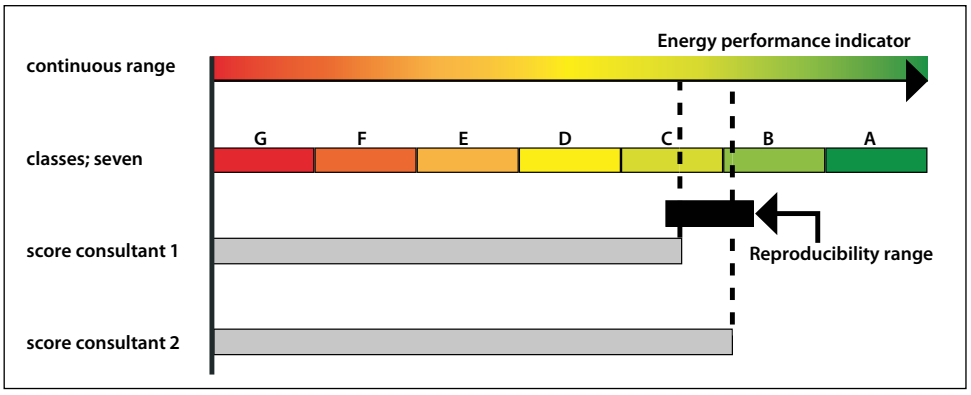
While a highly robust rating tool would have been validated during its development phase and be regularly updated and calibrated, we are not advocating that a tool needs to be overly complex to be robust. The robustness of the tool can be independently assessed by looking at the tool's output over time. Are tool results replicable, or repeatable, by different assessors? The ability to replicate results (sometimes referred to as "replicability" or "reproducibility") is an important concept for policy makers in ensuring that their tools are robust and reliable. The Building Performance Institute Europe advocated for strict limits on the deviation that assessors can have for the same building and provides a useful discussion on this topic in *Energy Performance Certificates across Europe: From Design to Implementation* (2010). As shown in the figure below, that report identified the potential error band at three different stages in the EPC rating (data acquisition, default values, and calculation), and showed how relatively small variations in each of those stages can compound the total variability of a rating.

Figure 14. Total Potential Error Band in EPC Rating



Source: BPIE, Energy Performance Certificates across Europe: From Design to Implementation (2010)

Figure 15. How the Ability to Reproduce Ratings Varies by Performance Scale



Source: BPIE, Energy Performance Certificates across Europe: From Design to Implementation (2010)

There are no easy solutions to the issue of ensuring replicable results. For example, Austria uses a building rating label with discrete categories because they believe that this improves the likelihood that ratings with be more replicable. However, this carries a different risk; a small variation can bump similar buildings into a completely different category of rating. The graphic below highlights the complexity of designing a system that optimizes the ability to replicate ratings. This issue raises a question of whether a small number of discrete scores (A through G, or 0 to 6 stars) is preferable to a more continuous scale like ENERGY STAR Portfolio Manager's 1 to 100 scale, or Germany's presentation of the full range of potential energy intensities.

5.4 Resources harnessed for scheme implementation

Second, we assess the labor, financial, and organizational needs to implement and support the tool and whether or not those have been provided and funded. Based on the scheme design, what government and private resources are needed to implement the program? Have all the required supporting programs been organized and funded? For example, who is in charge of developing an appropriately trained workforce? If there will be a central data repository, has the database been built or purchased? Who will be responsible for its upkeep? How will the scheme address low income properties that may not have the means to fund their own ratings?

Is there an administrative "home" within an agency that is responsible for ongoing support? This is particularly an issue during the early development of these programs, where it may need to evolve from a policy concept to an implementable and manageable initiative that has a long term administrative home. This transition requires buy-in and support from the agency that will be responsible for the initiative over the long term.

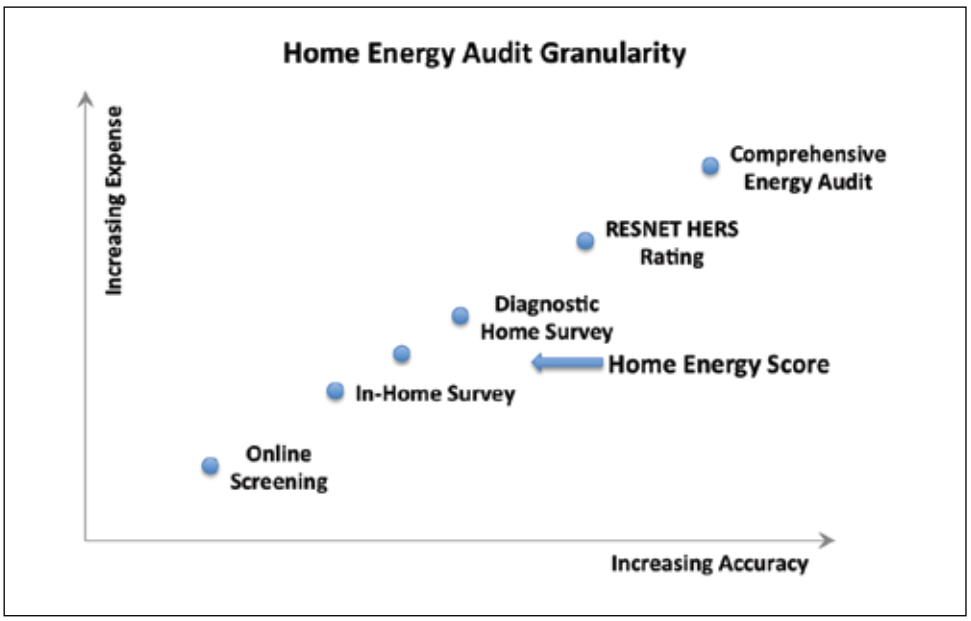
What will be the cost of implementation? How much will it cost the government on an annual basis to manage the initiative, including the array of support programs needed to enable building energy ratings? Is there funding in the budget or elsewhere to pay for this? If not, what are plans for funding the program implementation? This is particularly important in the current era of budget constraints across many parts of the world. The United Kingdom, Denmark, and Ireland charge a fee per rating to fund the administration of their programs, which provides them with sustainable funding and removes the threat of budget cuts.

How much will covered property owners have to pay to obtain a rating? Is that a cost that is reasonable for the various affected building segments? Have discussions been held with relevant stakeholders about the likely costs of building ratings? Indeed, there is a delicate trade-off between the tool's complexity (and potentially the cost of the rating) and the validity and quality of the tool's output. For example, following the recast of the EPBD, the French EPC scheme significantly expanded the number of inputs required for calculating the energy use in order to improve the accuracy of the ratings. This is resulting in higher costs to consumers for the rating,

Best Practices for Sustainable Funding Mechanism

Both the UK and Denmark charge a per rating fee to fund their assessment program, creating a sustainable funding mechanism free of government budget pressure.

Figure 16. Trade-off between Complexity and Expense for Residential Ratings



Source: US Department of Energy presentation at Building Technologies Office Program Peer Review (April 2013)

but at a level that French policy makers consider to be acceptable.

In the residential sector in particular, there is strong sensitivity to the cost of ratings, and there is a nascent movement to cap the costs of ratings and certification. This has resulted in a desire to improve the standardization of the rating process in residential homes to reduce costs. The US Department of Energy, while developing the Home Energy Score tool for rating single family residential buildings, gave significant thought to the appropriate "price-point" which would provide actionable information to consumers without being too expensive to reach substantial market penetration, as shown in Figure 16.

While rating tools can be designed in such a way that they are as accurate as possible, that may engender an overly complex rating process that is time-consuming for assessors and expensive for end-users. While the US's Portfolio Manager is seen as a particularly accessible tool to use and relatively inexpensive for end-users, some real estate practitioners have expressed concerns about its simplicity and the quality of its output, especially given the lack of third-party oversight or review of inputs into the rating tool. Some scheme administrators have intentionally begun with a simpler tool to gain experience and end-user familiarity, and added technical complexity as users have become comfortable with the process.

5.5 Suite of needed supporting programs in place

Having addressed the technical robustness of the rating tool and whether the scheme has pulled together the tools and resources needed for a successful deployment, we move on the final category: has a portfolio of the needed ancillary programs been put in place to support the scheme's implementation?

Figure 17. Overview to Successful Suite of Rating Scheme Supporting Programs

Administrative Effectiveness	Strategic stakeholder engagement	Effective communications and outreach
• Have appropriate support mechanisms been put in place to enable rating scheme effectiveness?	• Has partnership with key stakeholders (workforce, real estate sector, energy suppliers) enabled appropriately coordinated implementation?	• Is the rating label clear and intuitive? • Has public outreach campaign been developed and implemented?

Best Practices for scheme objective

The Greener Greater Building Program implemented in New York City in 2009 geared at getting the 2% of NYC's largest buildings, which total 50% of the city's built floor area, with a suite of legislative requirements including annual benchmarking, mandatory audits and retro-commissioning every 10 years, and local energy code upgrades. The program was accompanied by targeted training for assessors, outreach and communication to the real estate community, and a centralized data site for sharing the information publicly.

There are three main components to a successful building rating scheme program portfolio, as shown in Figure 17. Those three elements are: administrative effectiveness, strategic stakeholder engagement, and effective communications and outreach. We discuss each in more detail below.

5.5.1 *Administrative effectiveness*

We identified four key indicators of administrative effectiveness.

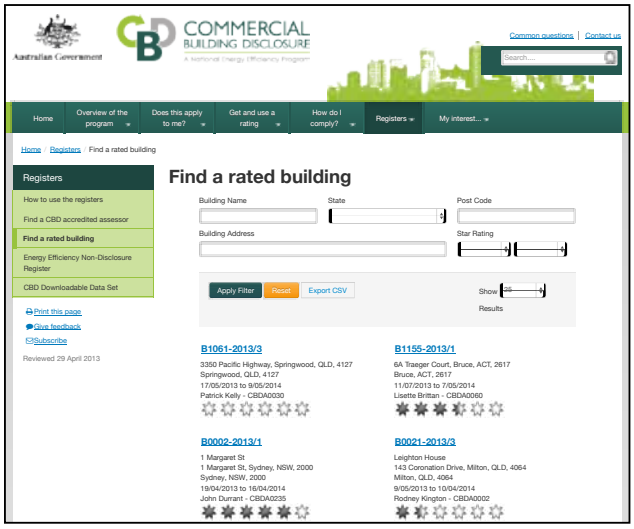
First, has the scheme objective been clearly delineated at the outset? Is it periodically reviewed and adjusted? This can be more complex that it appears on the surface, as was mentioned earlier in the paper. While policy makers want to develop a building rating scheme for a specific purpose (i.e. to reduce environmental emissions, or energy consumption), political realities sometimes require them to tout other ancillary program benefits such as job creation or improved building valuations to ensure that the policies are enacted. To the extent that those ancillary program benefits are not materializing, communications about the program needs to be carefully and strategically altered to ensure that the actual program benefits are being clearly communicated.

In addition, it is important to stay aware that the rating itself is not the end game: improving building stock is the ultimate objective. How does the building rating scheme fit into a broader picture of policy initiatives to improve the energy efficiency of targeted buildings?

Second, is there a **centralized registration and data collection effort** linked to the scheme? Does the entity responsible for registration and data collection have the resources and legal authority required to conduct this work? Has the registry and data collection effort been designed so that information required for national or regional statistics is easily accessible? Having a well-organized and centralized data collection effort is important for quality assurance, enforcement, transparency and overall program assessment. It can also have additional policy benefits by providing policy makers with a useful historical data set to analyze and use. Ireland is often cited as having a good national data registry, which is maintained on the Sustainable Energy Authority of Ireland (SEAI) website. That dataset includes information for building owners and users; building energy assessment calculation procedures and software; list of assessments; list of assessors; quality assurance procedures; and links to a help desk.

Third, has a scheme **oversight and enforcement program** been set up? Do building owners (and tenants if relevant) know about the oversight program? Is there a centralized registration and data collection system that enables oversight (i.e., do you have the data to know if building owners are complying?) Is there a reasonable timeframe to educate stakeholders about proper compliance before any penalties kick in? Are the penalties sufficiently large to encourage compliance? There may also be ways to combine "carrots" and "sticks" to encourage compliance. For example, high performance properties could have a certification that is valid longer than average or poor performing properties. Or, property taxes could be decreased for very good building rating performance.

Figure 18. Example of Central Registry in Australia



Source: http://cbd.gov.au/registers/find-a-rated-building

Fourth, is there a program in place to ensure that submitted data is as accurate as possible? This type of **quality assessment and control program** could entail anything from the verification of submitted data to a full-fledged third party oversight regime. It may entail standards not only on the ratings but on the qualifications, training and ethics of the assessor. Ensuring the quality of experts is a crucial issue for many experts and policy makers and can be complicated by the twin challenges of keeping costs low while having a large number of assessors.

For simple verification, is there spot-checking of data, analysis of data to identify outliers, or legal penalties for those that submit erroneous information in place? For

Ireland's Auditing System

In Ireland, the programme auditing process involves three types of control audits:

1. Weekly data review audits: high volume, desk-based audits on single building energy rating assessments highlighting inaccuracies or unusual patterns will lead to either a notification to the assessor or a more detailed review.

2. Desk review audits: medium volume, desk-based audits undertaken by a specialist who carries out a forensic review of assessments may lead to an assessor notification or to a further documentation and practice audit.

3. Documentation and practice audit: low volume, intensive audits carried out by assessor appointed by SEAI (Sustainable Energy Authority of Ireland) may include a practice or site assessment visit and could lead to disciplinary action in the form of penalty points, fines and eventual termination of registration as assessor from the system.

Source: IEA Policy Pathways, Energy Performance Certification of Buildings(2010)

schemes that entail significant third party activity, what are required education and qualifications for potential assessors? How thorough is the assessor training program? Do assessors have to get accredited? Is there an explicit process that assessors should follow such that ratings will be replicable? How is poor assessor performance dealt with? Can they lose their accreditation? Is there any other penalty for assessors who are consistently found to have inaccurate ratings? For example, several EU countries (notably Belgium, Czech Republic, Denmark, France and the UK), levy penalties on the assessor if significant accuracy problems emerge with a rating. Is there independent quality control of building ratings? If so, how does this work?

Best Practices for strategic stakeholder engangement

The Netherlands holds regular working groups composed of different relevant stakeholders in the field such as energy consultants, accreditation agencies, software developers, etc.

5.5.2 Strategic stakeholder engagement

After administrative effectiveness, the second element of the suite of required supporting programs is strong and strategic stakeholder engagement. Have policy makers reached out to the key stakeholder groups to ensure a successful deployment of the program? In the IPEEC workshop in May 2013, several participants commented on the need for an advisory committee from different stakeholder groups to give feedback on the overall rating scheme implementation plan. There are three main categories of stakeholders that are crucial to the success of a building rating program.

- **Real estate community.** Has the real estate community participated in the program design, and does the program design reflect the realities of that jurisdiction's real estate transaction process and timing. For example, in the UK, an early assessment of their EPC scheme showed that potential home buyers were not seeing the EPC until too late in the acquisition process to impact decisions or price negotiations. The 2008 assessment recommended changes to ensure that prospective home buyers had easy access to the EPC much earlier in the process.[13] In the US, both the City of Austin and the State of Kansas had similar timing issues that ultimately had to be addressed to improve the program.[14] Has the real estate community been educated about the scheme and its deployment? Are there representatives within the real estate community that will serve as advocates and supporters of the policy?
- **Workforce.** Have policy makers identified a potential workforce to serve as assessors and administrators of such a program? Have training programs been established to get that workforce ready? Is there full coordination among policy makers, accreditation programs, and training programs to ensure that the required workforce will be ready on a timely basis? If appropriate, have relevant labor union representatives been brought into the dialogue?
- **Energy suppliers and energy efficiency service companies.** Are there tailored and targeted efficiency programs that can help to implement

13. UK Energy Research Centre, "Implementation of Energy Performance Certificates in the Domestic Sector," May 2008.
14. Northeast Energy Efficiency Partnerships, "Building Energy Rating and Disclosure Policies: Update and Lessons from the Field," February 2013, p. 22.

recommended energy efficiency measures in a quick and high quality manner? Do financial incentives exist for such measures? Are there recommendations for qualified contractors in a given region? Is there a sufficient labor supply at these organizations? Many jurisdictions consider a lack of capable contractors to be one of the key challenges in implementing energy efficiency policy, as shown in Figure 20.

5.5.3 Effective communications and outreach

The third element is the communications and outreach effort around the building rating scheme. There are four key components to this, as summarized in Figure 21.

The first is the clarity and intuitiveness of the rating label itself. Does it make sense to consumers? Is it intuitive? In a survey conducted for the IDEAL EPBD project, among over 3,000 European homeowners, German respondents in particular reported having difficulty understanding the energy efficiency rating of their home, as shown on their EPC.[15] Germany's label uses a continuous scale as compared to other countries surveyed which used discrete scales, which may be partially responsible for the confusion. Additionally, while many other European countries' labels closely resemble the widely recognized EU appliance label, Germany's departs from that well-known scheme. Regardless, attention needs to be paid to

Figure 19. Example of French house listing with EPC

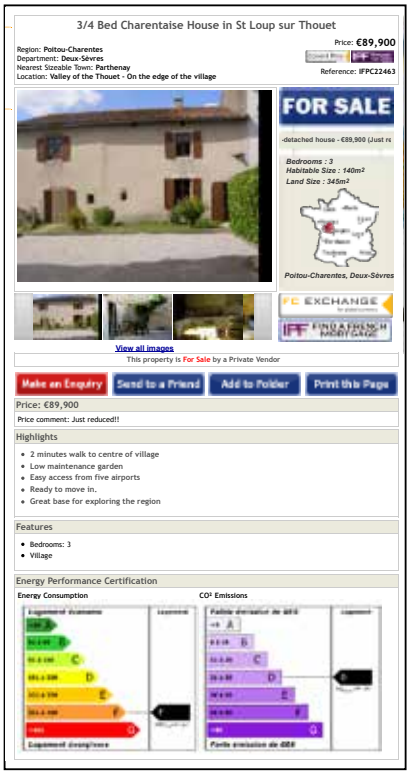
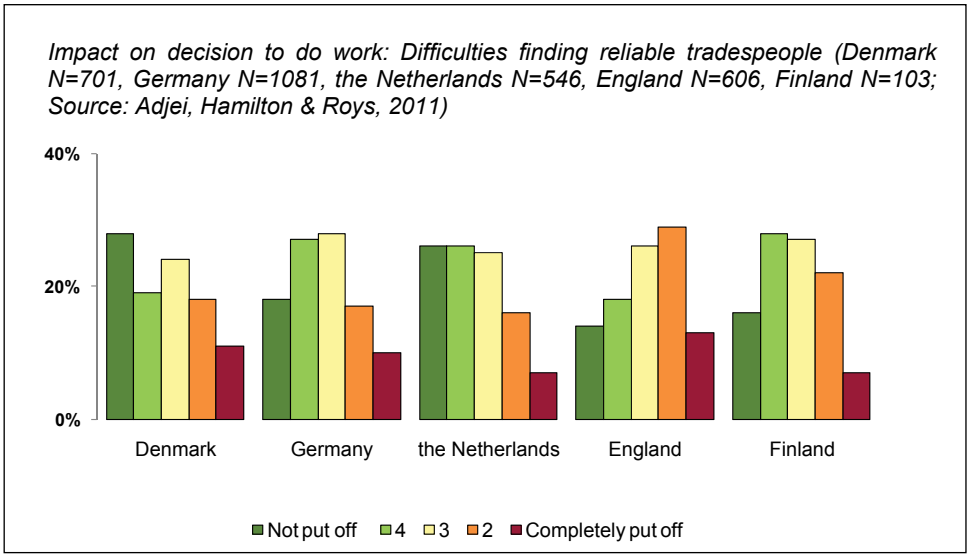


Figure 20. Trade-off between Complexity and Expense for Residential Ratings



Dark green—not put off by challenges in finding a contractor; red—completely put off project by problems finding a contractor. Source: IDEAL-EPBD, Key Findings & Policy Recommendations to improve the effectiveness of Energy Performance Certificates and the European Building Performance Directive (2010)

15. IDEAL EPBD, "Key Findings and policy recommendations to improve effectiveness of Energy Performance Certificates and the Energy Performance of Buildings Directive," p. 5

Figure 21. Overview of Effective Communications and Outreach Issues

Clarity and intuitiveness of label?	Does rating result in tangible, action-oriented recommendations for consumers?
• Does label make sense to consumers? • Is scale or comparison intuitive? (Ex. Germany) • Actual energy cost vs. calculated energy cost	• Either on label or elsewhere • IDEAL survey found high correlation between specific recommendations and likely action by consumer
Has a comprehensive public outreach and education campaign been implemented?	**Approach to deal with potential confusion with other rating schemes?**
• Linkage with information on incentives, programs, contractors • Dedicated website and hotline	• Same jurisdiction • Same region • Same country

the label design and it should be tested with groups of relevant stakeholders (i.e., laypeople, not policy experts or engineers) to assess its clarity and intuitiveness, as well as actual comprehension.[16] Regular evaluations are needed to get the label right. For example, in the US in the late 1970s, the automobile fuel economy label was evaluated on an annual basis to make it as effective as possible, and more recently extensive modifications were made to the label to address new technologies like hybrid and electric vehicles.

The second is whether the rating helps the building owner or tenant with tangible, action-oriented recommendations. In the IDEAL EPBD survey mentioned above, which is one of the few direct end-user surveys that exists, trust in the energy performance ratings was found to be much higher if the certificate or label contains specific recommendations about how to reduce energy consumption in that specific building.[17] This view was echoed by policy makers and public policy experts at IPEEC's May 2013 workshop on this topic. The extract from a UK EPC, shown below, highlights the top measures to improve energy performance on the first page of the certificate and provides more detail on subsequent pages. Other countries whose EPCs also contain recommendations include the Czech Republic, Denmark, France, Luxembourg, and Sweden.

The third is whether or not a comprehensive public outreach and education campaign has been put in place, linking information about the program, its requirements and deadlines, and resources available (such as financial incentives, training, recommendations for contractors, etc.). The most organized programs have dedicated websites and hotlines. Ireland and the Netherlands are both cited as having

16. In addition, the unexpected consequences of rating labels should also be considered. By creating three categories—"Best in class," "good," and "all the rest," policy makers may encourage average buildings to try harder to improve their performance.

17. IDEAL EPBD, "Key Findings and policy recommendations to improve effectiveness of Energy Performance Certificates and the Energy Performance of Buildings Directive," 2010, p. 5

particularly robust efforts in terms of comprehensive promotion efforts. In Ireland, several specific targeted publicity campaigns were aimed at the key players in the real estate sector to create awareness about the program. In addition, information about both residential and commercial ratings were centralized on the Sustainable Energy Authority of Ireland website. Other countries, such as Portugal, Denmark, Czech Republic, and Austria have specifically focused on targeting relevant professional groups, which has also proved effective.[18]

Finally, for those jurisdictions with multiple rating schemes for different building types, or schemes that vary by level of government (i.e., federal versus state versus city), is there a clearly thought through approach to minimize confusion about these different schemes? This is certainly an issue in the US, where there are programs at the federal level as well as at the state or city level. The programs vary in terms of whether they are voluntary or mandatory, which tools are used (especially for residential versus commercial buildings; currently all commercial building programs utilize EPA's ENERGY STAR Portfolio Manager), and for reporting requirements.

These three categories of supporting programs for building rating schemes—administrative effectiveness, strategic stakeholder engagement, and effective communications and outreach—are crucial building blocks to the successful deployment of a building rating program. Without most of these components in place, it is unlikely that the building rating scheme will have a significant level of success or impact.

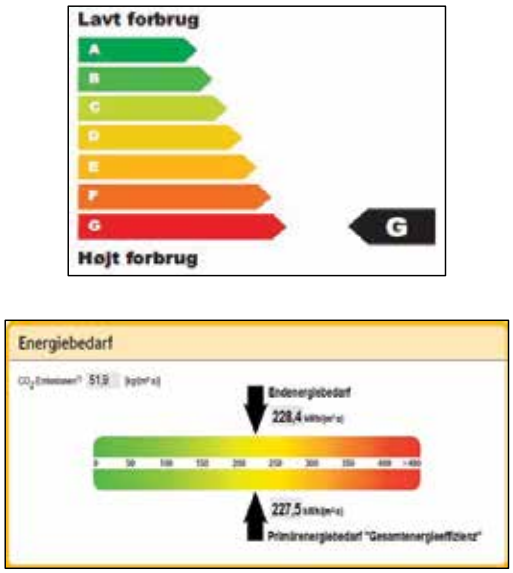
5.6 Putting it all together

By assessing a building rating scheme's design and implementation through a set of criteria that generally are viewed as having the most impact on the scheme's effectiveness, we are able to provide a standardized approach for policy makers to use in developing or refining their own building rating schemes. This approach can also be used by researchers who would like to compare rating schemes with diverse characteristics, as the assessment framework is agnostic as to the type of rating tool used, the technical assumptions used in estimating the building rating, the frequency that the rating is required, or how it is disclosed.

We now move on to the second phase of the assessment framework, focused on the impact of the building rating scheme.

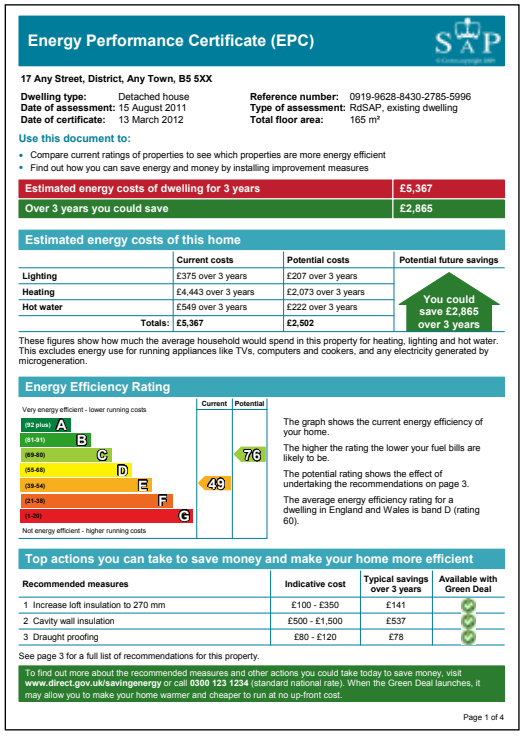
18. BPIE, "Energy Performance Certificates Across Europe," 2010.

Figure 22. Comparison of Danish and German EPC Labels



Source: IDEAL-EPBD, Key Findings & Policy Recommendations to improve the effectiveness of Energy Performance Certificates and the European Building Performance Directive (2010)

Figure 23. Example of UK EPC with Recommendations



Energy Performance Certificate (EPC)

17 Any Street, District, Any Town, B5 5XX

Dwelling type: Detached house
Date of assessment: 15 August 2011
Date of certificate: 13 March 2012
Reference number: 0919-9628-8430-2785-5996
Type of assessment: RdSAP, existing dwelling
Total floor area: 165 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years	**£5,367**
Over 3 years you could save	**£2,865**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£375 over 3 years	£207 over 3 years	You could save £2,865 over 3 years
Heating	£4,443 over 3 years	£2,073 over 3 years	
Hot water	£549 over 3 years	£222 over 3 years	
Totals:	£5,367	£2,502	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92 plus) A		
(81-91) B		
(69-80) C		76
(55-68) D		
(39-54) E	49	
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		

The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Increase loft insulation to 270 mm	£100 - £350	£141	
2 Cavity wall insulation	£500 - £1,500	£537	
3 Draught proofing	£80 - £120	£78	

See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit **www.direct.gov.uk/savingenergy** or call **0300 123 1234** (standard national rate). When the Green Deal launches, it may allow you to make your home warmer and cheaper to run at no up-front cost.

Page 1 of 4

Source: goo.gl/ozkPLi

6 Assessing Building Rating Scheme Indicators and Impacts

As noted in Section 3, the ultimate goal of ratings schemes is to help reduce energy consumption in the building sector by providing actionable information to key decision makers. How much do we know about whether schemes are achieving that goal?

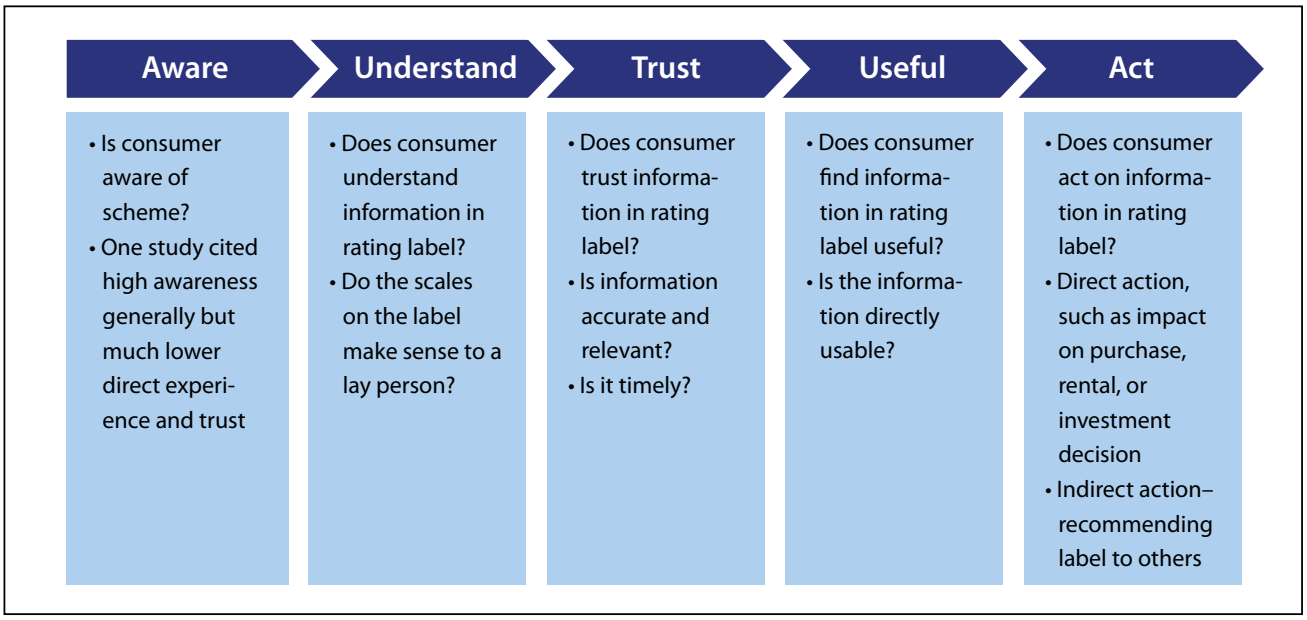
Section 5 focused on understanding and assessing the design and implementation of schemes—does the scheme have the tools and means to be effective?

This section focuses on determining how to assess whether or not building rating schemes are effective in reality. The framework we propose looks at several key performance indicators of building rating schemes as well as the overall impact seen from those schemes. The performance indicators we focused on were levels of customer awareness and levels of participation and compliance. To analyze impact, we recommend looking at: changes in building owner and tenant behavior, increased overall energy savings resulting from the building rating scheme and correlations between strong energy performance and increased building valuations. We discuss each of these in detail in the subsections below.

Key Take-Aways

- **Customer awareness and participation levels** are two important performance indicators to monitor building rating schemes, though data on both is still limited in many jurisdictions.
- **Impact of energy rating schemes** should be assessed by looking at **end results:** are market participants changing their behavior? Is energy being saved? Are higher performing buildings being rewarded in the market by higher rents, occupancy rates or valuations?
- However, there **is very little research on changes in market participant behavior and on total energy savings from rating schemes.** This is an area where significant additional research and analysis is required.
- More research exists on the **linkage between rating schemes and asset valuations.** While virtually all **studies indicate a positive relationship** between better energy performance and increased value, there are **considerable challenges in this analysis.**
- **Significant work remains** as building energy rating schemes evolve to address data quality and data accessibility issues to improve the quality of these analyses.

Figure 24. Consumer Awareness and Confidence



Note, as stated in Section 2.2, our intent in this report is not to provide an assessment by country or scheme here, but rather to provide the framework and methodology for conducting such an analysis in the future. The bulk of the research and data on building rating schemes to date has largely focused on the relationship between building energy ratings and asset valuations, so that is the largest and most substantive portion of this section.

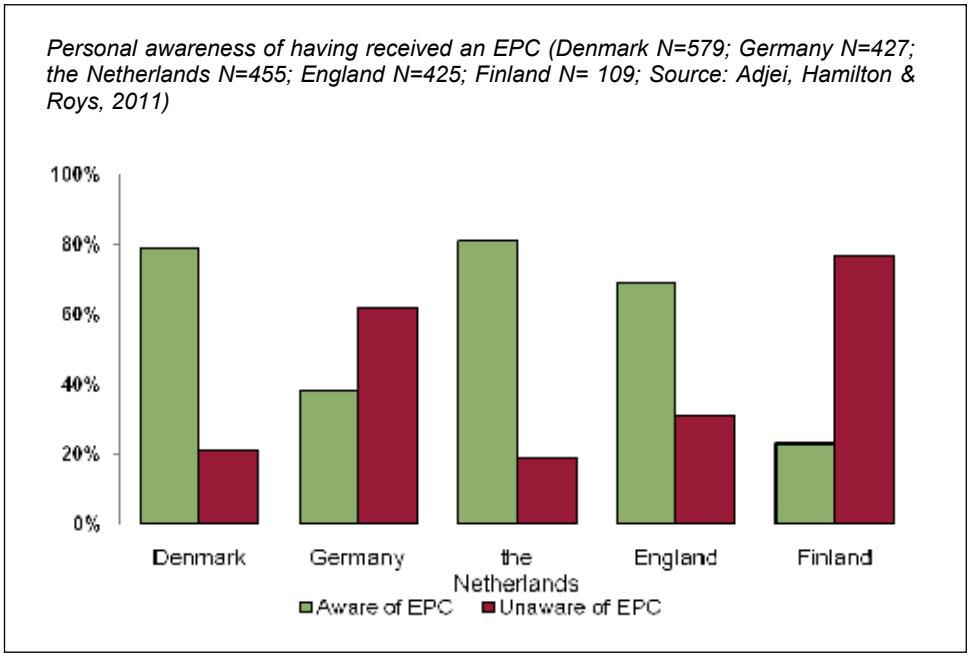
6.1 Key performance indicators

6.1.1 Consumer awareness, confidence and support

Consumer awareness of and confidence in the rating scheme is crucial to its success. However, confidence in and use of a new scheme takes time and must be earned. The graphic above outlines the five steps in increasingly higher penetration of consumer acceptance, ranging from the early levels of awareness to the ultimate stage of the information being so useful and trustworthy that end-users act on the information and even recommend it to others. A key success factor for building rating schemes, and enabled by the programmatic elements described in Section 5.5, is getting to the right hand side of the schematic above, where end-users find the program useful and act on it. Subsequent analyses could use these criteria of consumer awareness to develop targeted questions assessing consumer's awareness of and confidence in these schemes.

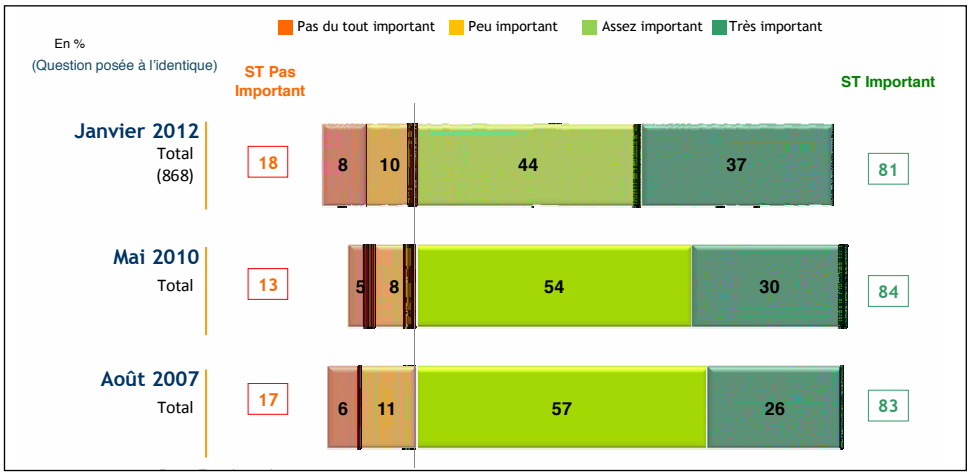
Statistics about consumer awareness and confidence are still fairly limited. The IDEAL EPBD survey is one of the more comprehensive sources of information on consumer attitudes to energy ratings. The survey, of 3,000 people throughout the EU, revealed that while relatively high levels (~90%) of the population had generally heard about the EPC program, personal awareness of having a received an EPC was much lower and varied more substantially by country ranging from a low of less

Figure 25. Personal Awareness of EPC



Source: IDEAL-EPBD, Key Findings & Policy Recommendations to Improve Effectiveness of Energy Performance Certificates & the Energy Performance of Buildings Directive (September 2011)

Figure 26. Changes in Perceived Level of Importance of EPCs in France



Note that survey respondents were asked the level of importance of EPCs over the course of five years. Dark Green is very important; light green is somewhat important; orange is not very important; and, red is not important at all. Source: Adème, *Perception du Diagnostic de Performance Enérgetique* (2012)

than 20% in Finland to a high of almost 80% in Denmark and the Netherlands, as shown in the graphic above.

This is a topic that merits additional research, especially over time, to be able to assess changes in customer awareness and use.

6.1.2 Compliance and participation rates

The second category of performance indicators to monitor is rates of program participation and compliance. In jurisdictions where there are mandatory programs and a strong centralized data collection system, compliance is usually above 60%. For example, the NEEP Study cited compliance rates of 75% in New York City, 65% in San Francisco, and 86% in Seattle.

There is limited information on compliance in the European Union because many jurisdictions simply do not have a centralized data collection system in place to enable them to produce these statistics. Compliance and enforcement were seen as weak in the first round of the EPBD. Indeed, even in 2011, many EU member states still did not verify compliance. In the new round of EPBD ("recast EPBD"), the EU included two new requirements on member states: 1) that penalties be put in place for non-compliance; and 2) that an independent system of control over the certificates and compliance be put in place.[19] In a recent Australian cross jurisdiction comparison on building rating schemes, they found that compliance rates appear to be higher in jurisdictions where there is a real financial penalty for not complying.[20]

There is little public information about participation rates in voluntary programs. Indeed, calculating a participation rate for a voluntary program is a little tricky. Should the denominator of the equation be set to all types of eligible buildings, only target buildings, only buildings above a certain size? Moreover, given the voluntary nature of the program, policy makers may not be as focused on ensuring that documentation is correct and up-to-date. Again, this is an area that would merit additional research and analysis going forward.

6.2 Impacts on market participant behavior and resulting energy savings

The intent of most building-focused energy efficiency policy is to influence decision makers so that they decrease the energy consumed in buildings. Energy ratings are a tool to provide information to those decision makers to give them the rationale they need to change behavior or to make needed investments to improve the efficiency of their building. Eventually, we would expect that the energy consumption in the building sector - all else remaining the same - would reduce over time following the successful implementation of an effective and broad-based rating scheme. That change could be measured in two ways.

19. Concerted Action Energy Performance of Buildings, "Implementing the Energy Performance Building Directive—2012", June 2013.

20. George Wilkenfeld and Associates," Research on International Residential Building Disclosure Schemes to Inform Residential Building Disclosure Policy in Australia," June 2012.

Figure 27. Impact on Behavior

	Consumer	Investor
Residential	• Decision making—to rent or buy efficient space • Investment—invest in EE measures?	• Buy more efficient properties • Improve less efficient properties
Commercial	• Decision making—to lease or buy efficient space • Investment—invest in EE measures	• Buy more efficient properties • Improve less efficient properties

First, changes in market participant behavior should be seen in reductions in energy consumption, both in individual buildings, and for the buildings sector as a whole in a given country or region. However, analyzing the contribution of energy savings that come from building rating schemes is quite complex as many different programs and external factors (in particular the evolution of technology) may contribute to overall energy consumption levels and savings. Some researchers currently claim there is little evidence of the impact that labeling programs have on changing energy performance. While most of these programs are relatively new, the data that does exist is positive. For example, the regular evaluations of the ENERGY STAR program and the California Public Utilities Commission Statewide Benchmarking evaluation report, as well as the EPBD IDEAL report on several European countries, have all shown there are positive energy savings impacts.

The topic of measured energy savings impacts certainly merits additional research and analysis such that policy makers can have a better informed perspective on the energy savings impact of these programs, and that all stakeholders can feel confident that energy rating programs are accomplishing their objectives. Many schemes (particularly mandatory rating schemes) are relatively new, and as noted above, separating out the impacts of rating initiatives when they are part of a broader policy package can be challenging. Little work has been done to date on developing methodologies to address this.

Second, what impact do rating schemes have on actual behavior for both end-users as well as investors? Ideally, we would like to be able to understand this for both residential and commercial properties, as well as for consumers and also investors in real estate, as shown in the quadrant above. However, this is an area where there has been limited research, and most of that has focused on the residential sector.

The research that has been conducted has seen little direct impact of building ratings on end-user behavior. There has been a little shift in end-user's decisions about which properties to buy, preferring (all else being equal) to purchase a more efficient home. There appears to be minimal impact of building ratings so far on decisions about energy efficiency upgrades or investments. The US DOE has recently initiated the development of an "Impact Evaluation Handbook" to provide a standard methodology to

measure the impact of benchmarking and disclosure policies.[21] However, this is a topic that also merits additional research and analysis as building rating programs become more established and more reliable data is available.

6.3 Impact on asset valuations

Unlike the previous topic of impacts on market participant behavior and how that translates to energy savings, the impacts of energy and sustainability ratings on asset valuation have been researched extensively over the past decade. In this section of the report, we review the empirical studies performed to date, some of the challenges identified through that work, and summarize the findings. Though there has been a relatively large body of research on impacts on asset valuations, there remain challenges in conducting this research and analysis, which could be an opportunity for international collaboration among energy policy makers.

6.3.1 Background

Understanding how markets value real estate and buildings is a complicated science, though, given the aggregate financial value of buildings worldwide, this science is quite advanced. This is particularly important to the design of energy efficiency policy. While reducing energy consumption in buildings can reduce operational expenses, that has a relatively minimal overall impact on the profitability of a building. Increasing the building's value, whether monetized through its sale or higher rents and/or occupancy rates, will have a faster impact on mobilizing the real estate sector than small changes to the bottom line.

Increasing the building's value, whether monetized through its sale or higher rents and/or occupancy rates, will have a faster impact on mobilizing the real estate sector than small changes to the bottom line.

Relative to trading of corporate stocks or other marketable securities, real estate transactions occur infrequently. Every building is different in some way from other buildings, especially in its location, which also differentiates this class of assets from regularly traded securities like corporate stocks.[22] This differentiation and lack of frequent trading means that property pricing is different than that for other asset classes and has resulted in a group of specialized, qualified property appraisers, who advise on the valuation of property. The various factors that go into property appraisal are complex and evolve over time, though standards have been developed to ensure that different appraisers of the same property can reasonably arrive at similar valuations.[23]

The most common definition of property value is "market value"—the estimated price at which a building will transact in the market place between a willing buyer and a willing seller.[24] This also applies to the rental amounts that building occupiers or tenants are willing to pay to lease a building or apartment, which

21. "Benchmarking and Disclosure Program Evaluation & Data Quality Assurance Resources," October 2, 2013, Presentation by US DOE.

22. Note that we are not focused on Real Estate Investment Trusts (REITs) which do trade more like regular securities.

23. See RICS Valuation—Professional Standards January 2014 (Red Book), available at http://www.rics.org/us/shop/categorylisting/?segments=redbook, and International Valuation Standards (IVS), available at: http://ivsonline.org/.

24. International Valuation Standards (IVS), available at: http://ivsonline.org/.

serves as a source of cash flows on the basis of which a building can be valued. Occupancy rates in rental buildings, which can be increased in buildings perceived as "sustainable"[25] or particularly energy efficient, can have an even more significant impact on valuations.

Building energy ratings are intended to provide information about the energy performance of a building relative to its peers or to a hypothetical standard to the parties in a transaction. In the absence of information about a building's energy performance, the added value of a well-insulated house or very efficient office building would not be reflected in its market value. However, the information will only produce a market effect (i.e., a change in its transaction value) if energy performance is considered a sufficiently important attribute by buyers or renters.[26]

This is important for several reasons. First, if a building with better energy performance costs more to build (which is not necessarily the case) or just requires more work to design, investors will want to know that they will recoup this higher investment. Likewise, should a property require renovations, investors will assess whether adding energy efficient measures to the retrofit will result in an appropriate return on their investment. However, an increasing group of real estate owners and managers are already starting to think of energy efficiency investments in terms of "better preserving their value going into the future ("future-proofing") in the face of changing demand and regulatory requirements."[27]

Understanding how energy and sustainability characteristics of buildings can impact property valuation has begun to attract significantly more attention among both policy makers and the real estate industry. With the growth in interest in building energy efficiency and green buildings over the past decade, there has been a good deal of research into the impacts of energy ratings or broader green/sustainability characteristics on market value, which we summarize in the next section.

6.3.2 Empirical studies to date

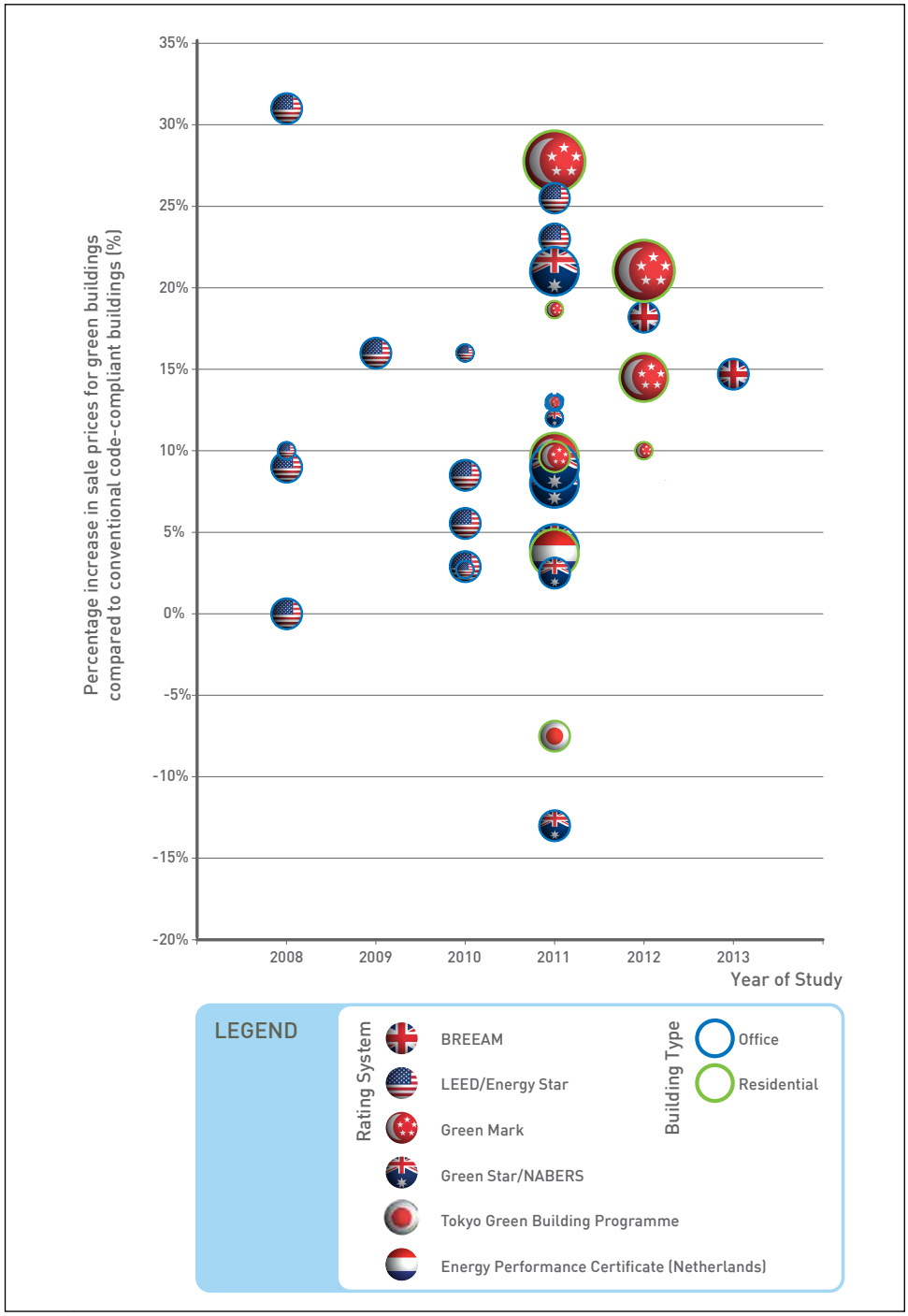
A large number of studies on transaction prices, market valuation, and increased rental value from energy and green certifications have been conducted over the past five years. These studies have been inventoried and summarized comprehensively in two recent reports: "The Business Case for Green Building," published in 2013 by the World Green Building Council (WGBC), and "Energy Performance Certificates in Buildings and their Impact on Transaction Prices and Rents in Selected EU Countries," prepared by Bio Intelligence Service for the European Commission, also published in 2013.

25. Note that while this report has mainly focused on energy certifications, in this section we have to broaden our scope to include sustainability certifications, given that so much of the analysis on asset valuations has included sustainability valuations. Any references in this section to "green" or "sustainable" buildings is referring to buildings that are certified, for example, through the LEED, BREEAM, or CASBEE programs.

26. Note that the use of discounted cash flow analysis, which is commonly used for asset valuations in the real estate sector, makes it even more challenging for the impact of energy efficiency or sustainability impacts, which sometimes do not materialize until the outer years, to be sufficiently impactful.

27. Bio Intelligence Service for the European Commission, "Energy Performance Certificates in Buildings and their Impact on Transaction Prices and Rents in Selected EU Countries," , April 2013, p. 26.

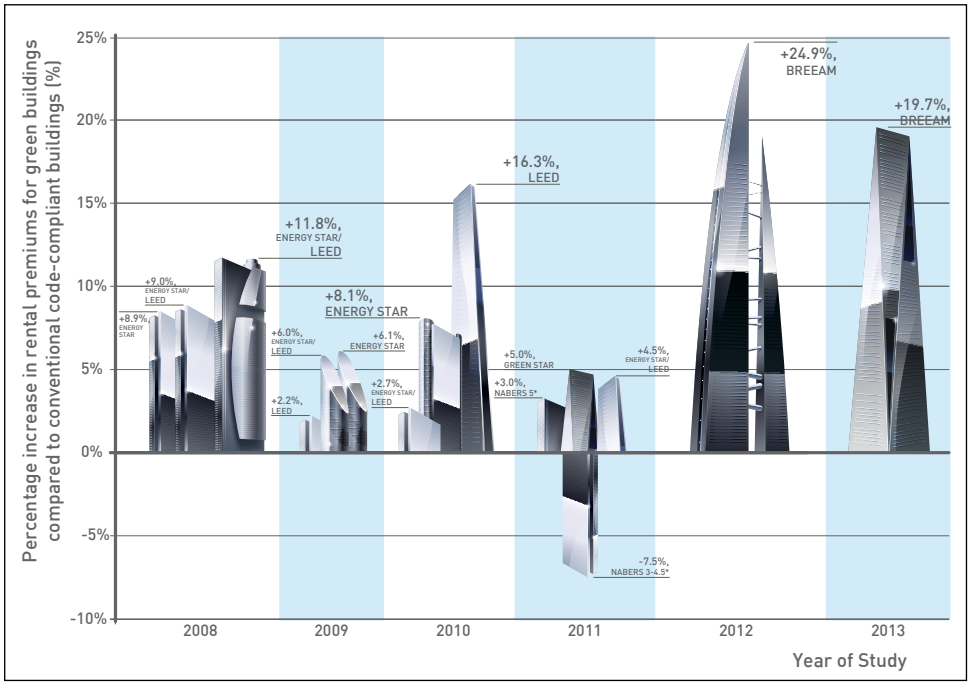
Figure 28. Examples of Increased Sales Prices



Source: World Green Building Council, *The Business Case for Green Building* (2013)

Both of these reports summarize the literature conducted to date on the topic of valuation impacts of green and/or energy efficient buildings. The European Commission report focuses more specifically on the impacts from energy ratings, while the WGBC report mixes both "green" and energy ratings. A full list of the different research consulted for this report, including empirical assessments of the linkage between building ratings and asset valuations, can be found in the Appendix in Section 8.2.

Figure 29. Examples of Increased Rental Premiums



Source: World Green Building Council, *The Business Case for Green Building* (2013)

As an overview of the findings of the various studies that have been done on valuation, Figures 28 and 29 from the WGBC report highlight the general trend of increased sales prices for "green" buildings, as well as increased rental premiums found in the studies.

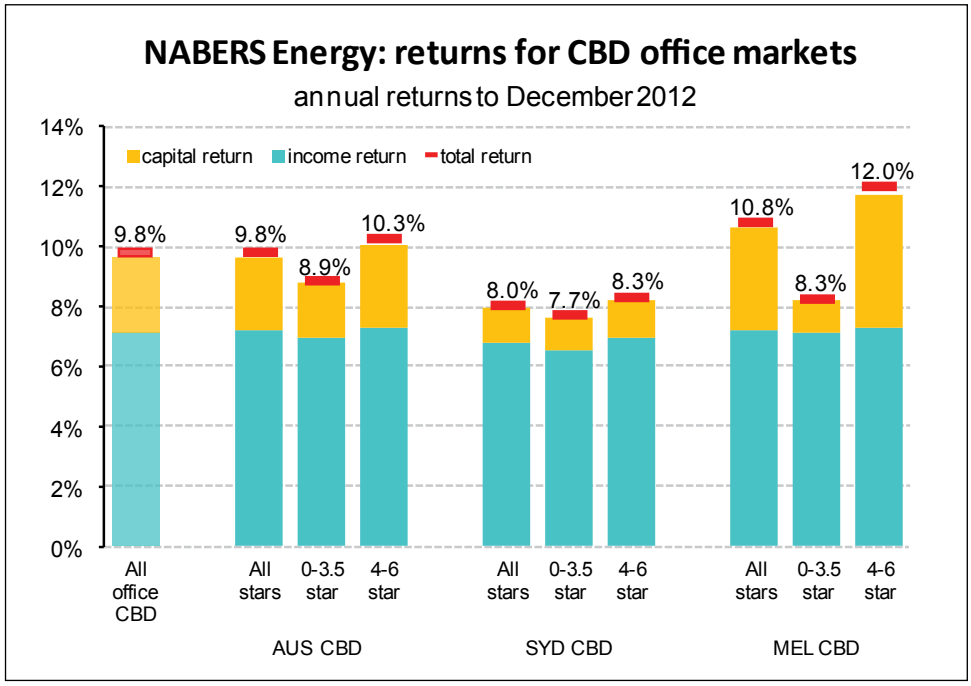
Likewise, researchers working on the Bio Intelligence report in addition to their overview of previous research conducted their own analysis and state that "the analysis of property transactions and listings…. overwhelmingly points to energy efficiency being rewarded by the market."[28]

Some newer work, not yet included in the other summary reports above, has taken significant data collected on the commercial property markets in Australian cities and combined that property financial information with building energy and green rating attributes. This information is now much more widely available in Australia since the introduction of mandatory commercial building reporting as required by the government's Commercial Building Disclosure law.

This data, collected and analyzed as part of the IPD Green Property Index, has looked at nearly 400 building assets with market valuation of about Aus$54 billion. Note that this represents 90% of all office space in Australia, and 40% of the total real estate, as tracked by IPD, making the Australian analysis particularly robust. In Figure 30, the total annual return (including both capital return, and income return) for buildings with 0 to 3.5 NABERS Energy stars is substantially less than the returns for buildings with 4 to 6 stars. This trend holds true for all offices in Australia, as well as for the Central Business Districts of Sydney and Melbourne, the two largest

28. Bio Intelligence Service for the European Commission, "Energy Performance Certificates in Buildings and their Impact on Transaction Prices and Rents in Selected EU Countries," April 2013, p. 12.

Figure 30. Results from Australian Asset Valuation Research



Source: IPD, Overview of IPD Green Property Index (May 29, 2013)

markets. IPD has recently started to apply its approach to the European property markets through its EcoPAS benchmark, but that work is at an earlier phase.

Australia has also done some leading work looking into impacts of ratings on residential house prices. A detailed study[29] was done on house prices in the Australian Capital Territory, which in 1999 became the first Australian jurisdiction to introduce mandatory energy disclosure for all houses on the market. The study concluded there is a statistically significant relationship between a house's sales price and its energy efficiency rating.

6.3.3 Challenges

There are a variety of challenges in trying to assess the impact of building energy ratings on asset valuations. Clean data sets improve the robustness and comparability of econometric analysis. Building energy rating schemes are still relatively early in their development, and data sets pulling together quantitative results from those schemes are still relatively new and uneven, depending on the jurisdiction.

As a result, there are three major challenges to conducting quantitative analysis on whether building energy ratings influence property values:

- factors that could "mask" impact of building ratings;
- comparing data sets in a way that reflects an "apples to apples" comparison; and,

29. Australia Department of the Environment, Water, Heritage and the Arts, *Energy Efficiency Ratings and House Prices in the ACT*, 2008.

- developing a clean data set.

The first main challenge in this analysis is that other, non-energy-related issues may mask real trends. Energy efficiency is only a small component contributing to a building's value. For example, location, layout, and age are all vastly more important to determining a building's financial value as compared to its energy performance. These factors may be correlated in complex ways: newer buildings in a central business district may attract high energy needs tenants, increasing the energy use of that building, while older buildings often have facades better designed for daylighting, reducing electricity use but perhaps at the expense of heating fuel use. Some building energy or sustainability ratings are valid for long periods of time (sometimes as long as 10 years), which can render their relevance to valuation less significant. Analysis controlling for these other, more important, variables is crucial to developing any reasonable conclusions about the impact of energy efficiency.

Few analyses (except the recent Bio Intelligence Service Report) adjust for the effectiveness of scheme implementation. This is a real problem, given that customer distrust of a scheme will reduce the importance that they place on building energy rating schemes and the weight that these ratings have on building values over time. The Bio Intelligence Service Report makes an important contribution in factoring in scheme effectiveness and hopefully this will become a more common input in subsequent analyses.

The second category of challenge in conducting this analysis is that many researchers, policy makers, and real estate industry specialists want to compare the results of one analysis against that of others, as shown for example in Figure 28 above. However, this may not be appropriate if the two (or more) studies are not comparable. Some studies use valuation data based on actual transactions while others use valuation data based on tax appraisals. The resulting valuations will necessarily be different as the appraisal method is just an estimate of what the market might bear, whereas the transaction method provides actual data. Some studies focus on building energy ratings while others focus on sustainability ratings, which include an energy component, and others mix the two. Even comparing energy ratings within the EU is not appropriate given that national rating systems within the EU vary and are not directly comparable.

This becomes even more problematic when studies are compared for different jurisdictions, for example comparing an assessment of LEED rated office buildings in the US to UK office buildings rated with an EPC. Additionally, some analyses compare rated buildings to non-rated buildings while other analyses focus on comparing lower-rated buildings to higher-rated buildings. Some researchers compare the percentage premiums of these studies against one another. The results from all of these studies are interesting and provide useful input to policy makers and real estate industry professionals alike. However, they are not directly comparable and should not be "averaged" or directly compared without a thorough discussion of the differences underlying the analyses.

Finally, the third (and no less significant) challenge relates to data sets. As mentioned above, econometric research requires relatively "clean" datasets in order for results from that analysis to be robust. In an ideal world, studies would only compare buildings of similar types—office buildings to other office buildings, single family residential homes to other single family residential homes, or large residential buildings with multiple apartments or flats to other large similar buildings. Similarly, analysis would either focus on impacts in the rental market or impacts in the sales market. The location of buildings often introduces complexity into the analysis because there is usually a significant difference between results in urban versus rural or suburban areas. Moreover, specific real estate trends, such as robust demand for buildings in one specific area (such as a central business district), can impact comparisons of results from that area to other nearby areas, potentially masking the true impact of building energy rating schemes. However, because econometric studies require a minimum sample size in order to be considered statistically significant, and because take-up of relatively recently introduced schemes is often still at a low level, researchers often have no choice but to mix building types, transaction types, and to make comparisons across several regions, all of which can have an impact on the accuracy of the analysis' results.

On a related note, there are numerous challenges that researchers face in conducting this analysis. Data on building energy rating schemes is often not stored centrally or in a standardized format, which further complicates the analytical process. Building performance data is not linked to property transaction data, creating a more onerous analytical process. This is an even bigger challenge in non-OECD countries. If the building rating scheme does not have a robust quality assessment program in place, the data can be subject to numerous errors, further biasing the results of the analysis.

Virtually all of the studies conducted on this topic all show a positive impact between good performance on energy or sustainability ratings and resulting asset valuations.

6.3.4 Findings

There is no question that sustainability and energy performance are differentiating factors for buildings and can be segmented as an attribute for valuation studies. Despite our caveats about the complexity of the analysis required to study this issue, virtually all of the studies conducted on this topic all show a positive impact between good performance on energy or sustainability ratings and resulting asset valuations.

However, many experts are skeptical about the magnitude cited in some studies. Some of those concerns may be driven by the challenges inherent in this analysis, as discussed above. This is also driven by concerns about extrapolating from another region where conditions (mandatory nature and robustness of rating scheme, dynamism of real estate market, etc.) are not directly applicable to other markets. Another concern is that rating systems reward effort and intermediate accomplishments and therefore may obscure the true linkage between asset value and the highest levels or energy efficiency. Overall, the latest results from Australia are robust and suggest there is some increasing value for higher rated energy performance, but more extensive analysis is needed in a broad array of markets before

any major conclusions can be drawn about the actual premium entailed in better energy performance.

The investment community also has major concerns about data quality, data, and information flows and consistency in building rating schemes. They do not use the actual building rating or score in their analysis but instead use the underlying data set to conduct their own analysis. Indeed, a recommendation from a recent property valuation report was that data related to building certification should be made more accessible.[30] It would be useful to involve the investment community early on in the development of new building rating schemes or reforms of existing ones so that they can provide input on issues of data quality and what data or scores might be relevant to their needs in terms of asset valuation.

That said, investors prioritizing "sustainable" or "responsible" investments have increasingly turned to "green" real estate as a good investment, despite these concerns. Investors seem to view this as a risk mitigation strategy and a proxy for good management. Thus, in the short run, sustainability or energy certifications schemes are serving as a reasonable placeholder for providing additional information to investors and tenants to make a choice about real estate investments until methodologies evolve that are more consistent with traditional real estate valuation and appraisal best practices. This transition is starting as sustainability criteria are being incorporated into industry texts on valuation, such as RICS' Red Book.

Finally, in our discussions with real estate managers and owners, we heard the terms "green premium" and "brown discounts," often used, and they merit some discussion here. Green premium refers to the "bump" seen in asset values that have a strong energy (or sustainability) performance that is reflected in the building's financial value. Based on industry feedback, this is usually seen in markets where building energy or sustainability ratings are still relatively new. As the markets mature, for the commercial property segment in particular, the green premium appears to become the norm and the more noticeable trend is the "brown discount" that underperforming buildings tend to see once higher energy performance becomes the norm.

Thus, while recent analysis seems to indicate a positive relationship between energy performance and increases in asset valuations, drawing any firm conclusions about the range of potential premiums is premature given the complexity of the analysis required and the relative nascent state of building energy ratings. The more transparency that policy makers can encourage in terms of providing access to data, making data sets publicly available, and publishing their own analysis, the more accurate the evaluations of relationships between building energy ratings and asset valuations are likely to become over time.

6.4 Putting it all together

Assessing the actual success and impact of building rating schemes is of crucial importance to policy makers as they work to develop new rating schemes and refine

30. RICS Research, *Is Sustainability Reflected in Commercial Property Prices: An Analysis of the Evidence Base*, January 2010.

existing ones. Currently, the best performance indicators for rating schemes are assessing customer awareness and participation levels, though data on both is still limited in many jurisdictions. Ideally, policy makers will start to be more consistent about collecting and disseminating this information.

The impact of energy rating schemes can be assessed by analyzing the ultimate results from those schemes. Are market participants changing their behavior? Is energy being saved? Are higher performing buildings being rewarded in the market by higher rents, occupancy rates or valuations?

There is very little research on changes in market participant behavior and on total energy savings from rating schemes. This is an area where significant additional research and analysis is required.

More research exists on the linkage between rating schemes and asset valuations. While virtually all studies indicate a positive relationship between better energy performance and increased value, there are still some considerable challenges in conducting this analysis. Significant work remains as building energy rating schemes evolve to address data quality and data accessibility issues to improve the quality of these analyses.

7 The Path Forward: Concluding Thoughts

7.1 Key findings

Building energy rating schemes are evolving rapidly. In IPEEC member countries with longer experience with building energy rating schemes, several of these programs are undergoing some revisions to improve their efficacy and impact, or adding new schemes to expand tools for decision makers. For example, with the implementation of the EPBD recast, European Union members are being required to improve the quality assessment and enforcement mechanisms of their programs. In the US, an asset rating tool is being introduced to complement ENERGY STAR Portfolio Manager, a popular operational building energy rating. At the same time, other IPEEC member countries, such as China and India, are in earlier phases of policy and program development, having introduced such schemes in the last couple of years. These newer rating schemes do not yet have significant data by which to assess their performance and have not had substantial independent evaluation of their effectiveness.

Building energy rating programs should not be viewed as the ultimate goal by policy makers... Building rating programs have the greatest impact when integrated into a strategic and coordinated energy efficiency policy framework.

One clear finding of our research was that building energy rating programs should not be viewed as the ultimate goal by policy makers. Rather, these programs are one (albeit an important one) of several policy levers that policy makers can use to drive ultimate energy efficiency (or climate change) goals. Building rating programs have the greatest impact when integrated into a strategic and coordinated energy efficiency policy framework including other key elements such as policy requirements to improve efficiency, code enforcement, financial incentives, and a robust outreach and communications effort. In order for a comprehensive policy framework to be most effective, it needs to address all phases of the building life-cycle: design, construction, and operation. Ratings and performance measurement are a critical piece, but will not make a major impact unless they support other policy initiatives.

A second, but equally important finding, is the importance of ancillary programs supporting rating schemes. Such ancillary programs include (though are not limited to) quality assessments, assessor training, public outreach, and maintaining an up-to-date and accurate data repository of building ratings and compliance. The existence of these ancillary programs have a significant impact on scheme effectiveness, and are vital to the success of building rating scheme implementation.

Another building efficiency initiative that is sometimes included as part of rating schemes, or otherwise complements building ratings, is providing some sort of recommendations about how the building energy performance can be improved. In European energy certification schemes, providing these recommendations is

often a part of the scheme, while in other jurisdictions separate "energy audits" are a complementary activity. As more jurisdictions move toward mandatory ratings and/or periodic energy audits, the line between ratings and simple audits is beginning to blur.

This project has reviewed current activity with building energy ratings schemes in IPEEC countries, and several other important issues were found. There is a significant level of diversity among rating schemes, leading to the following conclusions:

- This wide diversity of rating schemes makes comparing relative building performance, and scheme effectiveness, among countries difficult; however, key elements of building rating schemes can be used as a framework to understand and compare descriptive elements of rating schemes.
- Different types of ratings have strengths and weaknesses, though policy makers need to be careful that all rating approaches in a given jurisdiction are coordinated and internally consistent.
- There are potential benefits to having ratings for tenants and landlords be calculated separately but this is complex to implement in many jurisdictions.
- The growing popularity of broader sustainability ratings needs to be carefully evaluated as policy makers develop and refine their building energy rating programs.

The existence of ancillary programs have a significant impact on scheme effectiveness, and are vital to the success of building rating scheme implementation.

Many policy makers and real estate industry participants have been looking at correlations between a building's energy performance and its financial valuation as a proxy for the impact that building energy rating schemes are having. Considering energy performance of a building in its financial valuation is of crucial importance to changing consumer and investor behavior toward energy efficiency. Virtually all quantitative studies indicate a positive relationship between better energy performance and increased valuations. Drawing conclusions about the exact percentage premiums for enhanced building energy performance is premature at this stage. Some other findings about the impacts of energy ratings on valuation include:

- There are considerable challenges in analyzing the impact that building energy (and sustainability) ratings have on building valuations.
- Significant work remains as building energy rating schemes evolve to address data quality and accessibility issues to improve the quality of these analyses.

Rating scheme effectiveness can be assessed in a variety of ways. While summary statistics, providing data on compliance rates or average building performance, provides a snapshot of the rating scheme, this data does not help to assess the ultimate impact of the program: how much do they help in reducing energy consumption in buildings? As part of this project, an assessment framework has been proposed to attempt to move toward better understanding these impacts. However, additional work is needed on developing appropriate methodologies for this analysis

as separating out the impact of building rating programs on overall building sector energy savings is challenging.

Finally, as noted above, the growing popularity of broader, multi-attribute sustainability ratings is helping to drive interest and attention in green buildings, though in some cases these broader rating schemes may dilute the focus on energy performance. This is seen in the popularity and market penetration of "green" rated buildings (such as LEED, Green Star, and BREEAM) worldwide. However, because those rating programs also include a number of non-energy related elements, they can also distract and dilute focus on energy. Energy efficiency focused policy makers must carefully consider how to leverage the popularity of such "green" ratings without having energy performance just become one among a long list of checklist items.

The next two sections highlight topics that we identified through our research and our discussion with experts in the field as knowledge gaps and potential areas for additional international collaboration.

Virtually all quantitative studies indicate a positive relationship between better energy performance and increased valuations.

7.2 Topics recommended for additional research and analysis

During the course of our research and analysis, we identified several topics that were outside the scope of this report that need additional research and analysis. We list topics below so that others in this field, potentially individual governments and/or other interested parties, might pursue research and analysis related to these topics in the coming years.

Measured energy savings impacts of rating policies and schemes around the world. Many schemes (particularly mandatory rating schemes) are relatively new and separating out the impacts of rating initiatives when part of a broader policy package can be challenging. Little work has been done to date on developing methodologies to address this. At a minimum, good data and a few years of continuity are required for robust analyses. We would expect this to be a substantive topic for longitudinal analysis within one regime as well as cross-jurisdictional comparisons once data collection efforts have been successful for a couple of years.

This analysis will require several inputs that could be considered research projects on their own:

- **Assessing participation rates.** Some mandatory schemes have in place robust and centralized data collection efforts which enable them to produce timely and accurate statistics on compliance. However, many others do not, making international comparisons of compliance difficult. In addition, in many places building rating schemes remain voluntary. How does one assess participation rates and impacts when programs are voluntary?
- **Impact of rating schemes on changing behavior.** What aspects of rating schemes have the most impact on changing behavior of property owners,

tenants and investors? The EPBD IDEAL report began to review this for some European countries, and the Climate Policy Institute report on Germany and the California Public Utilities Commission Statewide Benchmarking evaluation report addressed this issue for their jurisdiction. However, a more detailed analysis of this topic is clearly warranted.

- **Quantification of impact.** Once policy makers better understand compliance levels and impacts on behavior, what analytical approaches would best represent the overall impact that rating schemes have on energy savings? How can impacts from rating schemes be isolated from other building energy efficiency policy initiatives or other effects that influence energy use including rapid technological change? What data is needed for this type of analysis?
- **Comparability and compatibility of building rating schemes.** Can the results of different schemes (both within a country and among countries) be compared? Is there a way to make these outputs more comparable to understand the relative efficiency of buildings in different economies and regions?

Real impacts on property valuation from improved energy performance. A relatively small number of leading researchers are showing substantial valuation benefits from energy efficiency and green buildings, though separating out the energy efficiency contribution relative to broader, multi-category green ratings is often missing. The recent EU report cited in Section 5 of this report was the most comprehensive to date, but more research is needed on the isolated impact of energy ratings using larger and cleaner data sets. This may be a good topic to be jointly undertaken by appraisal and underwriting professionals such that best practices from real estate valuation can be incorporated. An additional useful output of such research might be recommendations to policy makers regarding data collection and availability.

Impacts and effectiveness of whole building versus separate landlord/tenant ratings. Some jurisdictions have developed separate ratings addressing only the portion of the building energy use that a given stakeholder can impact, such as the energy uses within an apartment or other tenant space, or the building central services under the control of a landlord. Understanding how much more effective these targeted ratings are relative to whole building rating schemes needs further study.

Comparison of the impact of publicly owned and managed rating programs versus privately managed rating programs. Does ownership and/or management of the rating program and/or tool matter to the effectiveness of the rating scheme overall? How have other jurisdictions managed potential conflicts of interest and oversight of privately managed programs?

How to best normalize for high intensity properties. In some jurisdictions there are challenges with normalizing ratings for buildings with significant

Energy efficiency focused policy makers must carefully consider how to leverage the popularity of "green" ratings without having energy performance just become one among a long list of checklist items.

electronic or process loads such as data centers, or much higher intensity of use due to occupant density, or dramatically longer operating hours. There is a need to better understand how different rating schemes account for these differences in their normalization.

7.3 Potential areas for IPEEC BEET initiatives

In addition to the topics identified in the previous subsection, this international research and analysis also enabled us to identify topics that are ripe for international collaboration, potentially coordinated through the IPEEC.

Development of an international working group focused on knowledge sharing on building energy rating schemes. Develop a basis for knowledge sharing regarding the more technical elements of rating schemes to enable the sharing of best practices among and within countries and also to allow better comparability and compatibility of building rating schemes. Topics that might be covered by such a group include:

- **Develop a template for developing common data and calculation methodologies.** Build upon current EU initiative looking into "voluntary common EU certification scheme for the energy performance of non-residential buildings," which will develop standards and systems for a common scheme that could be used in larger non-residential buildings throughout Europe. The current EU project could provide a template for how at least common data and calculation methodologies might be developed.
- **Leveraging existing standardized terminology on building.** International ISO standards exist on topics related to building ratings. There may be ways to leverage certain terms and issues already agreed to in consensus standards.
- **International database to facilitate sharing information.** Get feedback on the type of data and information that would be useful. Develop a platform to share information on rating algorithms, strategies for ensuring data accuracy, monitoring and verification approaches, open-source software, etc.
- **Considering some sort of multi-country evaluation or capability review that assesses building energy rating schemes from a qualitative approach.** Conducting systematic reviews of scheme effectiveness could help inform scheme implementers as well as policy makers considering new or improved rating schemes. Probably best performed by a non-profit or otherwise unbiased entity. The framework proposed in Section 6 of this report can be used as a starting point.

Develop a working group on landlord-tenant ratings. Use as a forum for international sharing of what works and does not work with landlord and tenant ratings to minimize duplication of efforts in this area which has a lot of current activity. Topics that might be addressed include:

- **Information access—**How to access tenant data in the most effective way while still addressing privacy concerns.
- **How to deal with heterogeneous landlord-tenant arrangements.** The most successful tenant-landlord ratings have emerged from Australia, which has relatively new and homogeneous commercial building stock and expectations around landlord-provided services. How can this translate into jurisdictions with a more diverse building stock and less consistency in tenant-landlord arrangements?
- **Implications for addressing poor ratings and recommendations given split incentive.** Are there ways that the building rating can specify recommendations that factor in the split incentive between landlords and tenants? What lease provisions have been used successfully to address these issues? Are there other potential solutions?

Other miscellaneous topics that would be best dealt with in an international forum:

- How to deal with growing popularity of sustainability ratings, and ensuring that energy performance is robustly assessed and weighed in those ratings?
- Building off the US DOE effort currently underway to develop an impact analysis approach for sub-national rating and disclosure schemes, consider developing a similar international handbook for measuring and reporting indicators and impacts, including how to ensure that data sets are available and accurate for analysis and the extent to which rating systems can feed into national measurement and verification objectives?
- How to develop more internal consistency among tools used in the same jurisdictions, especially those that use both operational and asset ratings?

8 Appendix Detailed table of building rating schemes in IPEEC countries

Country	Scheme	Mandatory?	Assessment type		Building Type					
			Asset	Opera-tional	New	Existing	Public	Non-Res	Res SF	Res MF
Australia	NABERS			●	●	●		●	●	
	Commercial Building Disclosure	Y		●		●		●		
	NatHERS	Y	●		●	●			●	
Brazil	PBE Edifíca		●		●		●	●	●	●
Canada	EnerGuide Rating System		●		●	●			●	●
	ENERGY STAR Portfolio Manager			●	●	●	●	●		●
	REALpac Energy Benchmarking Program			●		●	●	●		
China	China 3 Star Building Energy Efficiency Evaluation		●	●	●	●	●	●		●
European Union	Energy Performance Certificates (EPCs)	Y	●	●	●	●		●	●	●
	Display Energy Certificates (DECs)	Y		●			●			
France	Diagnostic de Performance Energetique (DPE)	Y	●	●	●	●	●	●	●	●
Germany	Energieausweis	Y	●	●	●	●	●	●	●	●
India	Star Rating for Buildings			●		●	●	●		
Italy	Certificazione Energetica	Y	●		●	●	●	●	●	●
Japan	CASBEE		●	●	●	●	●	●	●	●
Russia	Energy Passports		●		●	●	●	●	●	●
South Korea	Certificate of Building Energy Efficiency		●	●	●	●	●	●		●
United Kingdom	EPCs	Y	●		●	●		●	●	●
	DECs	Y		●		●	●			
USA	ENERGY STAR			●		●	●	●		●
	Home Energy Score		●		●	●			●	
	Commercial Building Energy Asset Score		●		●	●	●	●		●
	HERS		●		●	●			●	

Tool	Website for More Details	Scheme	Country
NABERS Energy	http://www.nabers.gov.au/public/WebPages/Home.aspx	NABERS	Australia
NABERS Energy	http://www.cbd.gov.au/	Commercial Building Disclosure	
Various	http://ee.ret.gov.au/energy-efficiency/homes/nationwide-house-energy-rating-scheme-nathers	NatHERS	
RTQ-C	http://cb3e.ufsc.br/	PBE Edifíca	Brazil
Hot2000	http://www.nrcan.gc.ca/energy/efficiency/housing/new-homes/energuide/5035	EnerGuide Rating System	Canada
Portfolio Manager	http://www.nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/3691	ENERGY STAR Portfolio Manager	
REALpac Benchmarking Methodology	http://www.realpac.ca/?page=RPEBP1Intro	REALpac Energy Benchmarking Program	
Various	http://www.buildingrating.org/sites/default/files/documents/Building%20Energy%20Performance%20Rating%20Workshop%2028Oct2013.pdf	China 3 Star Building Energy Efficiency Evaluation	China
Various	http://www.epbd-ca.eu/themes/certification-schemes	Energy Performance Certificates (EPCs)	European Union
Various		Display Energy Certificates (DECs)	
Various	http://www.rt-batiment.fr/batiments-existants/dpe/presentation.html	Diagnostic de Performance Energetique (DPE)	France
Various	http://www.bmvi.de//DE/BauenUndWohnen/EnergieeffizienteGebaeude/Energieausweis/energieausweis_node.html	Energieausweis	Germany
BEE rating tool	http://www.beeindia.in/content.php?page=schemes/schemes.php?id=3	Star Rating for Buildings	India
Various	https://www.certificazione-energetica-edifici.enea.it/abruzzo/	Certificazione Energetica	Italy
CASBEE	http://www.ibec.or.jp/CASBEE/english/	CASBEE	Japan
Various	http://www.abok.ru/for_spec/articles.php?nid=4777	Energy Passports	Russia
ECO_2	http://www.kemco.or.kr/new_eng/pg02/pg02010100.asp	Certificate of Building Energy Efficiency	South Korea
Various	https://www.gov.uk/government/policies/improving-the-energy-efficiency-of-buildings-and-using-planning-to-protect-the-environment/supporting-pages/energy-performance-of-buildings	EPCs	United Kingdom
Various		DECs	
Portfolio Manager	http://www.energystar.gov/buildings/	ENERGY STAR	USA
Home Energy Scoring Tool	http://energy.gov/eere/buildings/home-energy-score	Home Energy Score	
Asset Scoring Tool	http://energy.gov/node/772861/assetscore_tool.html	Commercial Building Energy Asset Score	
HERS	http://www.hersindex.com/	HERS	

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