

Building Energy Rating Schemes Around The World: What Do We Know?

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ABSTRACT

Building energy rating schemes and tools are used around the world to underpin labeling or disclosure programs, and as a mechanism to determine minimum energy performance standards for buildings. Importantly, building energy performance reporting and disclosure is just one part of a comprehensive policy package to achieve energy efficiency policy objectives. Because building energy rating systems support or interact with a variety of different policies and programs, they are vitally important to get right. Building rating schemes necessarily differ by jurisdiction, so there has been little work to compare rating scheme elements across jurisdictions to identify elements of such programs that render them particularly effective at achieving their ultimate policy objectives.

A recent project has attempted to document the state-of-play in the development, implementation, and use of building energy rating schemes. The main focus of the project was to assess how building energy rating schemes can be used to have the greatest impact on delivering building energy efficiency policy goals globally. Specifically, the project provided a framework for assessing what types of rating scheme characteristics result in the largest impact in altering tenant and owner behavior in terms of energy efficiency investments, rental and purchase decisions, and ongoing in-building behavior. This paper summarizes that report, additional research needs identified, and prospects for increased international cooperation in this area.

Introduction

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. The ultimate goal of building energy rating schemes is usually to help reduce energy consumption (or greenhouse gas emissions) in the building sector, though they also underpin other programs and policies, such as performance disclosure, minimum standards, or financial incentives.

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.

Given the growing international interest in building energy rating programs, the International Partnership for Energy Efficiency Cooperation (IPEEC) 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. In 2013, the BEET 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. The project focused on building rating schemes (which it defined as including both the rating tool as well as the programmatic elements that support the tool’s use). Throughout this article, 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 information technology platform that generates a building rating.

Diversity of Building Energy 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 differs 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.

Three 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. 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 the rating based on theoretical energy use (asset rating) or actual energy use (operational rating)?¹ Against what metric is a given building’s performance evaluated? What information does the rating’s label contain and how intuitive is it?

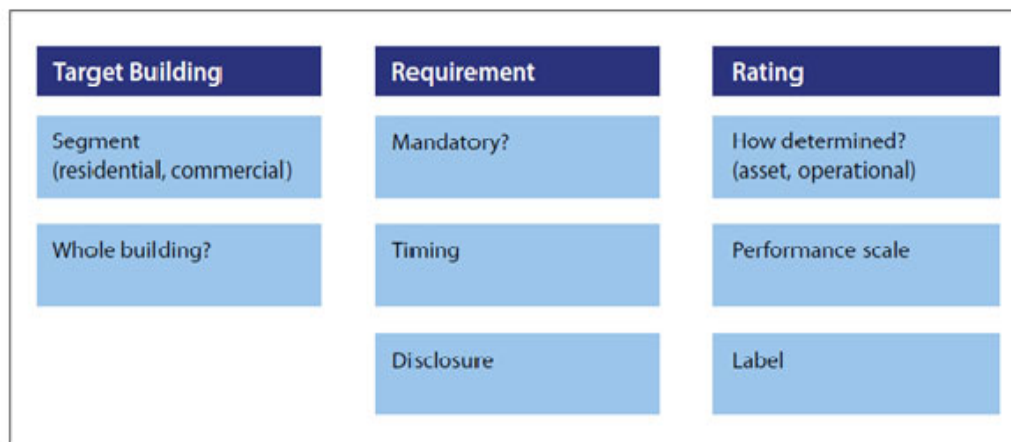


Figure 1. Overview of how building rating schemes differ.

¹ Both are described in more detail later in this paper.

As an illustration of the diversity of building rating regimes, Figure 2 provides an overview of building rating schemes in most IPEEC countries. The graphic summarizes the key information on the rating scheme, such as which building segment it targets, whether or not it is mandatory, and whether it uses as asset or operational rating. More detailed information on the schemes in most IPEEC countries is provided in the full IPEEC Building Rating report (IPEEC 2014).

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

(Res = Residential; SF = Single Family; MF = Multifamily)

Figure 2. Summary of IPEEC member building rating schemes.

Key Issues in Building Energy Rating Schemes

Two topics provoke significant debate among policy makers and rating experts in the design and implementation of building energy rating schemes. The first we have alluded to in the summary table of building energy rating schemes internationally: does the scheme use an asset or operational rating. The second topic focuses on whether the building is evaluated as a whole or broken down into the tenant/landlord portions. We discuss both in more detail below.

Asset vs. 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, as is described in Figure 3. 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. 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, while operational ratings focus on the use of that building.

	Asset Rating	Operational Rating
What is assessed?	<ul style="list-style-type: none"> • Building Envelope • Building Systems • Lighting 	<ul style="list-style-type: none"> • 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?	<ul style="list-style-type: none"> • Standardized assumptions about operating hours, temperatures, occupational density, plug loads 	<ul style="list-style-type: none"> • Normalized for weather and building type
Comparison	Officially rated vehicle fuel economy label	Actual vehicle fuel economy

Figure 3. Comparison of asset and operational ratings.

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 as 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 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 a 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 and replicable asset ratings on large, complex buildings would in most cases be more 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 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 building operations deficiencies 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 show where those improvements are needed. 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.

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 (i.e., building owners and operators). 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 by the European Union’s Energy Performance of Buildings Directive (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 (Jones Lang LaSalle et.al. 2012).

Whole Building vs. Separate Landlord/Tenant Ratings

Some rating schemes focus on “whole building” (all energy use going into a given building) ratings, while other scheme administrators have developed different rating tools for tenants and landlords. There are advantages to both approaches.

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. 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 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.”² 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

² 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.

Property Federation and the UK Better Buildings Partnership. This work has led to the 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.

Assessing Building Rating Schemes

The underlying objective of the project was to lay out an assessment framework for building energy rating schemes that met 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. This project developed the assessment framework, but did not attempt to use the framework to assess or evaluate individual schemes. Because the project was initiated through the IPEEC BEET, a large number of IPEEC member states have already provided input into the framework and this forum can be used for future collaborative efforts.

In developing a framework to assess different building rating schemes, we realized that to capture all key elements of building rating schemes in an objective manner, we had to look at building rating schemes from two perspectives: scheme design and implementation, and scheme indicators and impact. These are described in more detail below.

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.

There are three key elements to the proposed IPEEC scheme design and implementation 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 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?

Scheme 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. Our framework proposes to assess 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 (i.e., are we seeing tangible results in terms of reduced energy consumption from the building sector? Are investors paying more for more energy efficiency buildings? Are property owners investing more in energy efficiency measures?). While there is a fair amount of research on the link between building rating schemes and asset valuations, we found that there is unfortunately little data or research available as of yet on changes in participant behavior or macro level impacts on energy consumption.

Findings and Conclusions

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 recast of the Energy Performance of Buildings Directive (EPBD), 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.

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, as was demonstrated in a variety of studies including IDEAL-EPBD 2011, Backhaus et al 2011, and Concerted Action Energy Performance of Buildings 2012..

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.

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. 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, and have been summarized by the World Green Buildings Council (2013), Bio Intelligence Service (2013) and the US Department of Energy (2014). 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. 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 (IPEEC 2014). 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.

Finally, 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.

Next Steps

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. Some of the areas identified include:

- Measure energy savings impacts of rating policies and schemes around the world.
- Assess real impacts on property valuation from improved energy performance.
- Develop an international working group focused on knowledge sharing on building energy rating schemes.
- Develop a working group on landlord-tenant ratings.

These are discussed in more detail in the full IPEEC report (IPEEC 2014).

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