An Examination of the Recertification Processes of Building Certification Systems

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ABSTRACT

Building certification systems have facilitated the spread and adoption of green building practices. Today, a diverse collection of certification systems is being created and implemented around the globe. While these certification systems identify buildings that were designed to be energy efficient, a number of criticisms have called attention to the variation of actual energy performance from predicted energy performance of certified buildings, questioning their legitimacy. In this paper, we examined the post-certification processes that eleven building certification systems use to account for the operational performance of certified buildings. We found that most certification systems have decoupled new building certification from existing building certification, and problems arise when there is no routine process to transition from one to the other. We identify recertification as a best practice in facilitating this transition, thus ensuring the continual energy efficiency of certified buildings.

Introduction

Buildings account for 40% of the energy use in most countries (IEA 2010). As one of the largest consumers of energy, the building sector represents one of the most significant opportunities for energy use reduction. Over the past twenty years, one method by which this potential has been publicized and encouraged is through the creation of building certification systems that incorporate energy performance into their certification criteria. These systems attempt to create a benchmark by which buildings can be compared to average building stock and receive a rating based on how they perform. The intent of such a system is twofold. First, it provides a reference to industry professionals in order to determine how their building is performing compared to similar buildings. Second, it promotes green building design and practices. Thus, there is both an evaluative and educational aspect aimed at transforming industry norms. The goal is to encourage more environmentally sustainable building design and to create a higher market value for energy efficient buildings.

Building certification systems are being created and implemented around the globe. There are now over a dozen certification systems in existence in multiple countries. While some systems can be used internationally (e.g. Leadership in Energy and Environmental Design, or LEED), others are country-specific. Many of these certification systems differ with respect to the structure and methodology of the rating system itself, the institutional body that carries out the certification process, and whether certification is mandatory or voluntary by government standards. As a diverse array of certification schemes have been in existence for some time now, it is possible to evaluate which practices have been the most successful in reducing the energy consumption of buildings. Identifying best practices can inform the improvement of existing systems and the development of new systems.

While LEED has been largely successful with respect to its widespread adoption and popularity, its effect on the actual energy performance of new buildings has come under some criticism. A number of studies have shown conflicting results; some indicate that LEED-certified buildings perform remarkably better than average, while others indicate that certified buildings perform no better, or worse, than uncertified buildings. For certification schemes to be effective, the actual performance of buildings must be monitored. A 2010 IEA report on best practices in energy performance certification of buildings states that "quality control is key to the ongoing success of a certification scheme; thus, it is vital to establish a comprehensive quality assurance system and related disciplinary procedures before assessments begin." (IEA 2010, 34). In this paper, we surveyed the post-certification processes of eleven building certification systems around the globe. We have identified recertification, or the consistent and methodical renewal of the initial certification based on the continued performance of the building at the specified level, as a best practice to ensure the accuracy and maintenance of the certification level.

Prospective Performance vs. Actual Performance

A number of issues contribute to differences between the expected energy performance of newly constructed, certified buildings and their actual energy usage.

- First, building operation and occupant behavior have significant effects on energy usage. The divide between predicted and actual energy performance can be attributed to 1) incorrect usage of energy efficient features, and/or 2) inaccurate modeling of behaviors. A building may utilize innovative design and efficient technology, but if occupants or facilities managers are not operating these features properly, they become less effective. Occasionally, occupants may not use these features at all. In addition, occupant behavior frequently differs substantially from that assumed in predictions or modeling, leading actual energy usage to exceed predictions.
- Second, in the initial years of occupancy, complex technologies and systems often require adjustments in order to be operated effectively. The need for adjustments can go unnoticed for extended periods of time without close monitoring, creating channels through which additional energy is unnecessarily consumed.
- Third, there is often a lack of integration and coordination between different industry professionals on the same project team. If not integrated from the start of the design process, architects and engineers may have differing ideas in their design or implementation of the project, creating complications and inconsistencies. A lack of communication between the facility managers and the project team can exacerbate these problems, as these managers may be left unaware of how the building was intended to be operated.

Multiple studies have examined these issues. A number have found instances where mechanical problems significantly altered the energy performance of buildings, demonstrating the importance of technical adjustments in the first years of occupancy. Baylon and Storm (2008) examined the performance of 24 LEED-certified buildings constructed between 2002 and 2005 in Washington, Oregon, and Idaho and found interesting cases of mechanical difficulties. Although LEED buildings had an observed performance of about 12% better than the performance of comparable buildings, they found one case where a CO_2 censor was incorrectly set so that outside air was adjusted to 100%. The mistake was not diagnosed until three years later, despite continuous commissioning. They note that some mechanical systems used in LEED buildings may work poorly without adequate training or follow-up. Turner (2006) examined eleven LEED-certified buildings in the Cascadia region of Northwestern United States and found that six were using less total energy than suggested by the original design model, but that one building's actual usage exceeded the design model by 300% because of HVAC and lighting control problems. Heller and Baylon (2008) conducted a case study of a grocery store in which the original design was altered to achieve a LEED Gold rating. In this case it took more than a year of on-site commissioning, billing analysis, and building tuning to get the systems set up as originally intended to achieve modeled savings. A number of measures had never been fully implemented after installation due to lack of understanding of contractors, service, and operations staff of the integrated functioning of the entire system.

Other studies have found that at the individual level, there is a wide variation in the performance of certified buildings. Mancini and Birt (2009) found that at a societal level, green buildings can contribute to substantial energy savings, but there are large inconsistencies at an individual level. In an examination of 100 LEED certified buildings, 28 to 35% used more energy per floor area than their conventional counterparts. They note that under LEED New Construction, energy performance credits are based on predicted performance rather than actual energy performance after it is completed and occupied, and highlight the importance of investigating the post-occupancy performance of buildings. Similarly, Turner and Frankel (2008) analyzed the performance of 121 LEED New Construction buildings and found that on average they performed better than non-LEED buildings, but that there was significant variation among individual buildings. One quarter of the buildings had an Energy Star rating below 50, meaning that they used more energy than average for comparable buildings. When compared to modeled energy performance, 30% of the buildings are doing better and 25% are doing worse. Hinge, Winston, and Stigge (2006) report on efforts in the UK, Germany, and the US to better understand why some buildings are operating efficiently and why for some the performance is different than expected. Their main findings indicate that efficient and complex equipment and controls can be difficult to operate and that complex building systems often need improvements and adjustments to be operated as designed. They also find that knowledge and intentions are routinely not shared between building operators and designers, contributing to the problem.

Recertification

Certification of a new building implies that it was designed to be environmentally sustainable, but the credibility of the certification depends upon whether the design leads to observable high performance. In order to verify the relationship between design and performance, follow-up of the building under operation is essential. In essence, it encompasses a new set of actors. While certification of a new building involves the architects, engineers, and those constructing the building, certification of an operational building involves facility managers and occupants. The methodology of the recertification process will be directly correlated with its success in ensuring energy efficiency. A certification can just as easily lose credibility as gain it through recertification if the process does not ensure legitimacy. In Table 1, we have assembled information on eleven certification systems and the type of post-certification follow-up, if any, required for each. We will discuss the recertification processes for four of the most prominent building certification systems, with an in-depth look at the BCA Green Mark Scheme in Singapore.

Leadership in Energy and Environmental Design (LEED)

LEED, like many building certification systems, has a separate rating system for newly constructed buildings and existing buildings. Under LEED Existing Buildings: Operation & Maintenance, buildings are certified based on actual operational data for a certain "performance period." Buildings can apply for recertification as frequently as each year, but must be recertified at minimum every five years. Failing that, the next application will be considered an initial application (USGBC 2011). This type of operational accountability is lacking in LEED Certification for New Construction. While LEED 2009 requires that projects commit to sharing their energy and water usage data with USGBC and/or GBCI for a period of at least five years, this information is for research purposes only and the data have no effect on the certification status of the building (GBCI 2011). Although LEED 2012 is still in development and the final draft will not be released until November 2012, current drafts show increased efforts to evaluate the performance of newly constructed buildings. In the Energy and Atmosphere category, commissioning and preparation of an Operations and Maintenance Plan is required. Additional points can be earned through enhanced commissioning. Water metering and energy metering are also required, as well as a commitment to sharing this data with USGBC/GBCI for a period of five years (USGBC 2011). While these changes will enhance the follow-up process of the performance of newly constructed buildings, the accountability for performance is still insufficient. A recertification process is needed specifically for buildings certified under New Construction. Buildings certified under New Construction can become certified under Existing Buildings: Operations & Maintenance, but this transition from one type of certification to another is completely voluntary and dependent on the initiative of the building owner. The follow-up required for new buildings through information sharing but lack of defined process through which they should apply for existing building certification creates ambiguity and muddles accountability.

Energy Star

Energy Star certification depends exclusively on the actual energy performance of a building. A building's score is calculated from eleven full consecutive calendar months of energy usage data from all active energy meters, normalized to an energy performance scale rated from 1-100. Buildings receive Energy Star certification if they have a score of 75 or higher, meaning that they are in the top 25 percent for energy efficiency in the U.S. relative to similar buildings. They also must be professionally verified to meet current indoor environmental standards. Energy Star certification contains a timeframe of validity as it is intended to reward the energy performance of a building within a specific year. The certification decal contains the year in which the certification was awarded, and although it can be displayed indefinitely, general understanding is that it applies to the year in which it was awarded. Recipients must apply for recertification annually to keep the Energy Star certification current.

In 2004 the US Environmental Protection Agency (EPA) expanded Energy Star to include the "Design to Earn the Energy Star" certification. This certificate is rewarded solely on the estimated energy consumption of a building based on energy use predictions. Similar to

LEED, it is meant to encourage energy-efficient design. However, as the EPA explicitly states that certification does not guarantee the performance of the operating building, it is intended to be understood as the first step in a two-step process. The second step would be actual verification of energy performance through Energy Star certification. The meaning behind each type of certification and the path to follow through the two step process is clearly conveyed to potential recipients so there are no assumptions of performance guarantees based on design alone.

Building Research Establishment Environmental Assessment Method (BREEAM)

BREEAM, a certification scheme developed in the UK, has a separate certification system for new and existing buildings titled BREEAM New Construction and BREEAM-In-Use. Buildings are certified under BREEAM-In-Use based on operational performance over a period of one year. The process involves a client and auditor, who both must complete training to be qualified. The client enters data through an online assessment tool, while the auditor completes an on-site verification and assessment. The recertification process involves annual data confirmation and completion of an on-site assessment by the auditor every three years (Bre Global 2011). Recertification must be completed if the initial certification is to be maintained. Buildings are certified through BREEAM New Construction at the design and construction phases of the building project. If a building is certified under the two highest certification levels, "Outstanding" or "Excellent", they must apply for BREEAM-In-Use within three years or they will be decertified one level. Thus, energy performance verification of the highest performing BREEAM recipients is upheld. This type of requirement and subsequent disciplinary action for failure to comply creates a clear process by which buildings transition from initial certification to continual, operational certification.

Building and Construction Authority (BCA) Green Mark Scheme

For this study, we researched the BCA Green Mark Scheme in Singapore. Singapore presents a unique case as it encompasses a small area of the same tropical climate and landscape. Thus, it contains a relatively homogeneous building stock that presents a prime sample to observe as there are no climatic variations that would create differing energy needs. Energy efficiency is one of the most important aspects of the Green Mark Scheme, as buildings must be air-conditioned year round in the tropical climate to ensure occupant comfort. Under the Green Mark Scheme, buildings must be recertified every three years based on the building's performance during that time period. The recertification process entails certification under the Green Mark for Existing Buildings Certification Scheme, based on the past three years' energy usage record. A BCA officer conducts a physical assessment of the building's equipment and monitors. The Green Mark Scheme began in 2005, therefore in recent years a number of buildings have had to partake in the recertification process. In upcoming years, the number of buildings up for recertification will increase substantially. There are now over 700 certified buildings, and in 2013 over 300 will be up for recertification (BCA 2011). As the Green Mark Scheme is still new and the majority of the projects have been completed in recent years, collated figures have not been assembled for the number of buildings that have been successful in attaining recertification. The time and scope of this project did not allow for research beyond a limited number of surveys and interviews. However, we believe that further research should be pursued as an increasing number of buildings apply for recertification.

We conducted four surveys of facility managers; one of a Green Mark certified building and three of Green Mark Platinum certified buildings. In addition, we conducted an interview with a BCA officer, a facility manager of a Green Mark Platinum building, and two facility managers of a development company representing over 50 Green Mark certified buildings. Based on the results, we found that the recertification process strengthened energy management practices. Facility managers are required to monitor energy and water usage on a regular basis, and in many cases we found that they used energy and water use as key performance indicators for their building. Managers checked that the energy performance was in compliance with their certification as often as a monthly basis, ensuring that any technical problems were quickly identified and resolved. In all of our cases, facility managers listed recertification as a high priority. It is clear that recertification is a legitimate concern for managers, indicating the success of this follow-up process.

Conclusion

Building certification systems have been an important component in the spread and development of green building. However, their effect on the energy efficiency of buildings is severely limited in the absence of post-certification follow-up. Buildings are continually changing as equipment ages and occupant behavior changes. Management practices have a substantial effect on the energy performance of buildings. If building certification systems are to retain their meaning, they must be continually and systematically be renewed in order to reflect these changes. Recertification is vital to the continuing success of building certification systems.

Through this study, we came to three conclusions.

- First, research has shown that initial new building certification is simply not sufficient to guarantee the energy efficiency of a building. Previous research and case studies have shown the discrepancies that can exist between the supposed energy performance of certified buildings and actual performance.
- Second, many building certification systems have a separate certification for new and existing buildings. When there is no clear transition between new building certification and existing building certification, there are often issues with the legitimacy of the certification as actual performance differs from that anticipated through certification. It is important to have a transparent, structured, and routine process to shift from new certification to operational certification, as well as a clear conveyance of what each certification means in terms of building performance.
- Third, through the case of Green Mark, we have examined how recertification facilitates the transition of new building certification to continual existing building recertification. New buildings certified in the earliest years of Green Mark are now being treated as existing buildings as they are going through the recertification process. Green Mark recipients are consistent in dedication to recertification. In addition, recertification has helped solidify good energy management practices.

Table 1. Global Building Certification Schemes

Certification Scheme	Location	Starting Date	Type of Follow-Up Required	Regulation Status	Separate Rating Systems for New and Existing Buildings?
Leadership in Energy and Environmental Design (LEED)	USA, International	2000	Must share energy and water usage data with USGBC for a period of 5 years for research purposes only; projects will not be decertified based on performance	Voluntary	Yes
Energy Star	USA	1995	Certification is valid for one year. Recipients are encouraged to re-apply annually.	Voluntary	Yes
Green Globes	Canada, USA	2000	None; Reassessment recommended	Voluntary	Yes
Building Research Establishment Environmental Assessment Method (BREEAM)	UK, with schemes for Norway, Netherlands, Spain, Sweden, and International	1990	Buildings that receive Outstanding and Excellent ratings must apply for "BREEAM In-Use" within three years or will be de-certified one level	Voluntary	Yes
Energy Performance of Buildings Directive (EPBD)	European Union	2002	Certificate of Energy Performance must be renewed at minimum every 10 years. Regular inspection of boilers and AC units.	Mandatory	No
Minergie	Switzerland	1998	None. Certificate is valid until an energy-related modification is made.	Voluntary	No
National Australian Building Environmental Rating Scheme (NABERS)	Australia	1998 (Previously called Australian Building Greenhouse Rating System)	Meant for existing buildings. Evaluates the performance of the building over the last 12 months. Annual assessment conducted.	Voluntary	No
Building and Construction Authority (BCA) Green Mark Scheme	Singapore	2005	On-site assessment after completion; re-certification required after 3 years based on performance data	Mandatory for new buildings since 2008	Yes

Certification Scheme	Location	Starting Date	Type of Follow-Up Required	Regulation Status	Separate Rating Systems for New and Existing Buildings?
Comprehensive Assessment System for Building Environment Efficiency (CASBEE)	Japan	2005	None	Voluntary	Yes
Green Building Index (GBI)	Malaysia	2009	Completion and Verification Assessment after 12 months time or when building is 50% occupied; re-certification needed after 3 years	Voluntary	Yes
The Pearls Rating System for Estidama	United Arab Emirates	2010	On-site assessment required, Pearls operational rating still under development	Required for new buildings since 2010	No

Sources: http://estidama.org/pearl-rating-system-v10.aspx?lang=en-US, *www.breeam.org*, *http://bca.gov.sg/GreenMark/green_mark_criteria.html*, http://training.eebd.org/Page.aspx?id=63&ui=en&lang=en, http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager_intro, http://www.greenbuildingindex.org/how-GBI-works.html, http://www.greenglobes.com/about.asp, http://www.ibec.or.jp/CASBEE/english/overviewE.htm, http://www.nabers.com.au/, http://www.minergie.ch/basics.html, USGBC. 2011. "Supplemental Guidance to the Minimum Program Requirements: Revision 2". *U.S. Green Building Council, Inc.*

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