From Platinum to Three Stars: Comparative Analysis of U.S. and China Green Building Rating Programs

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ABSTRACT

In 2011, the building sector in U.S. and China, the two largest global energy users and CO_2 emitters, consumed 40% and 25% of national total energy, respectively. Within the building energy efficiency realm, green buildings are emerging as a way to help reduce buildings' energy and environmental impacts. To promote the market transformation of green buildings and differentiate design and performance, U.S. and China have both developed national green building rating programs and supporting policies. The U.S. Green Building Council established the Leadership in Energy and Environmental Design (LEED) program in 1998 while the Chinese government established its Green Building Evaluation and Labeling (GBEL) program in 2008. This paper presents comparative analysis of the U.S. LEED and Chinese GBEL rating systems, processes, scoring systems, and enabling policies.

This paper finds that while both countries use green building design and operational rating systems with similar scoring categories, they differ in program administration, scoring requirements and allocation, and types of supporting policies. U.S. LEED is developed and administered by committees of building industry stakeholders and offers more flexibility in how certification levels can be met. The Chinese GBEL is entirely government-run with stricter requirements for achieving rating levels, but is expected to undergo changes with a revised rating system in late 2014. Analysis of how similarities and differences in rating systems and supporting policies have shaped the technical and market development of green buildings is presented. Subsequent challenges and policy implications for the future development of green buildings are discussed.

Introduction

As the world's two largest energy users and CO_2 emitters, China and the U.S. have placed increasing policy attention on energy efficiency. China, for example, adopted mandatory energy intensity per unit GDP reduction targets for 2006-2010 and 2011-2015, and set carbon per unit GDP reduction target of 40-45% from 2010 levels by 2020. With this growing emphasis on energy efficiency and climate change, green building has moved into the spotlight and gained the attention of architects, developers, and occupants in recent years. Much of the green building sector activity has centered on labeling programs, such as the Leadership in Energy and Environmental Design (LEED) in the U.S. and the Green Building Rating System in China.

The development of green buildings in the U.S. traces first emerged in the early 1990s when green building efforts in the residential sector emerged across the country in different cities. The U.S. Green Building Council (USGBC) was founded in 1993 and the Leadership in Energy and Environmental Design (LEED) version 1.0 pilot program launched in 1998. The

USGBC released a significantly improved LEED version 2.0 in 2000, including the rating scale and four levels of building certification, and has since grown into nine interrelated rating systems adopted by more than 140 countries and territories. The current LEED rating systems were originally slated for update in 2012, but the latest version was not released until November 2013 and is not considered in this paper because details were not released at the time of writing. Similar to the U.S., China's interest in green buildings also began in the 1990s with "research on Chinese green building system" listed as a key area for national science funding. However, the development of green building rating systems and labels did not start until a decade later with the adoption of the voluntary Green Building Evaluation Standards for residential and commercial buildings by the Ministry of Housing and Urban-Rural Development (MOHURD) on June 1, 2006. Technical supporting documents with more specific guidance for the planning, design, construction and management of green buildings was released in June 2007, establishing the voluntary Green Building Evaluation Standards and Labeling Program (Geng et al. 2012). A new version of the 2006 Green Building Evaluation standard is also expected in 2014 but a final version has not yet been released.

U.S. LEED Program

LEED Rating Systems

An important feature of the U.S. LEED systems is that they are developed in an open, consensus-based process in three steps. First, volunteer committees, subcommittees and working groups of USGBC members and staff develop the draft rating system. This is then reviewed and approved by the LEED Steering Committee and USGBC Board of Directors, and then approved by a vote by the USGBC membership. Table 1 shows the current status of different LEED rating systems. In sum, A total of more than 54,000 projects are currently participating in LEED with a total of 10.1 billion ft^2 (938 million m^2) of construction space. Of those, over 19,000 projects have been certified by LEED at some level with a total of 3.2 billion ft^2 (293 million m^2).

Table 1. LEED rating systems and projects as of August 2013

LEED Rating System	Date Launched	Certified Projects	Registered Projects
New Construction and Major Renovation	2000	9,200	18,800
Existing Buildings: O&M	2004	2,500	6,400
Core & Shell	2006	1,300	4,500
Commercial Interiors	2004	3,800	3,800
Schools	2007	600	1,400
Retail	Nov. 2010	400	500
Healthcare	2011	2	200
Homes	Feb. 2008	41,400	116,000
Neighborhoods	April 2010	103	

Source: USGBC 2013a.

LEED Rating and Certification Process

The LEED certification process begins with the project participant choosing a rating system for which to register. In some cases, a project will need to choose between multiple rating

systems for which that the project may qualify. Once the project is registered with the U.S. Green Building Certification Institute (GBCI) online and the associated fees paid, the project team can access software tools and establish communication with the GBCI. The GBCI administers the LEED certification program and is responsible for performing independent, third-party technical reviews and verification of LEED registered projects. After registration, the project team begins preparing for the project application by identifying LEED credits to pursue and assigning them to responsible team members. For each LEED credit, the responsible team members will need to collect information and perform calculations to demonstrate that the prerequisites and the chosen credits have been met. All necessary documentation is uploaded to the LEED Online website and submitted by the LEED Project Administrator.

The LEED certification and rating system is based on a scoring system of up to 100 base points, with 10 additional bonus points possible for Innovation in Design (or Operation) and Regional Priority credits. The bonus points provide incentives for project teams to pursue innovative strategies and/or address geographically specific environmental issues. The different rating levels are defined as Certified with 40-49 points, Silver with 50 -59 points, Gold with 60-79 points and Platinum with 80 points and above.

The number of points needed to achieve a specific LEED certification rating is the same across rating systems, but the credit prerequisites and categories for points vary by the rating system. The number of points awarded for a specific credit (i.e., the credit weighting) is determined on the basis of the relatively importance of the building-related environmental impact that a specific credit addresses. In other words, credits with the greatest value are those that most directly address the most important impacts to the building category. For each credit, two or more options for fulfilling the credit requirements are typically given in the rating system reference guide along with potential technologies and strategies. Table 2 shows a summary of the credit categories and possible points in each category is given for the recent LEED 2009 rating system for New Construction of commercial buildings (effective April 1, 2013).

Table 2. Summary of LEED for New (Commercial) Construction rating system credit categories

Category	Possible Points	Points share	Summary of Credits
Sustainable Sites	26	24%	Construction activity pollution prevention (required) Site selection, development density, brownfield redevelopment, alternative transportation Storm water, heat Island effect and light pollution reduction
Water Efficiency	10	9%	Water-use reduction (required) Water-efficient landscaping Innovative wastewater technologies
Energy and Atmosphere	35	32%	Fundamental commissioning of building energy systems (required) Minimum energy performance (required) Fundamental refrigerant management (required) Optimized energy performance On-site renewable energy and green power Measurement and verification
Materials and Resources	14	13%	Storage and collection of recyclables (required) Building reuse Construction waste management Materials reuse and recycled content

			Materials selection: regional, rapidly renewable, certified wood
Indoor Environmental Quality	15	14%	Minimum indoor air quality performance (required) Environmental tobacco smoke control (required) Outdoor air delivery monitoring and increased ventilation Low-emitting materials and indoor chemical and pollutant source control Controllability of systems, thermal comfort, and daylight and views
Innovation in Design	6	5%	Innovation in design LEED-accredited professional (AP)
Regional Priority	4	4%	Regional priority
Total Possible Points	110	100%	

Source: USGBC 2013b.

For LEED New Construction & Major Renovation rating system, the possible review paths include a design application review only, a construction application review only, or a combined review. For LEED for Existing Buildings, operating data and documentation need to be submitted for a designated performance period. For most prerequisites and credits[1], the performance period has to be a minimum of 3 continuous months of operation. The LEED for Existing Buildings certification application must also be submitted for review within 60 calendar days of the end of the performance period.

A formal application review is initiated once the completed application has been received, with slightly different application review processes for each rating system and review path. In general, a preliminary review is first conducted in which all documentation are examined for completeness and forms are designated as "approved" or "not approved." Each prerequisite and credit is also reviewed and designated as "anticipated," "pending," or "denied" and accompanied with technical advice from the review team. Once the preliminary review has been completed, the project team may either accept the results as final or choose to submit a response with additional documentation for an optional final review. After the final review process has been concluded, the project team can either accept or appeal the final decision within 25 days and with additional appeal fees. If certified, the LEED certified project receives a formal certification of recognition and information on how to order additional marketing material. The project team also has the option to have the project listed in the online LEED project directory and the U.S. Department of Energy's High Performance Buildings Database. For the LEED for Existing Buildings Operations and Maintenance rating, projects can apply for recertification as frequently as every year but must be recertified at least once every five years.

China's Green Building Rating Standards and Labeling Program

China's Rating Systems

China's national Green Building Evaluation Standard includes two different evaluation standards for residential and public (i.e., commercial and government-owned) buildings. In

[1] For the Energy and Atmosphere Prerequisite 2 and Credit 1, a longer performance period of at least 1 year is required.

addition to supporting the national standard, the GBEL program is intended to accelerate the market entry of environmentally sustainable green buildings from the top-down and to institutionalize green building evaluation as a common process. The voluntary GBEL program consists of a Green Building Design Label (GBDL) and the operational Green Building Label (GBL). Both labels utilize a three-star rating system, with three-stars awarded to the highest rated green buildings and one-star awarded to the lowest rated green buildings.

The GBDL helps pre-certify a green building and rates the building design from one to three stars according to the Green Building Evaluation Standard and is valid for two years. The green building design evaluation system is composed of three types of criteria for each of the six categories being evaluated: mandatory elements that must be included in the building, general elements, and preferred elements. One point is awarded for each item that is included in the building design. For example, mandatory energy-efficiency items for residential buildings include meeting energy-savings standard requirements for heating and HVAC design, and for installing built-in temperature controls and heat metering in buildings that have central heating or air conditioning. General energy-efficiency items include the use of highly efficient equipment, lighting, energy recovery units, and renewable energy technologies such as solar water heaters, solar photovoltaics (PV), and ground-source heat pump systems. Preferred items include more efficient heating and air conditioning and greater renewable energy integration (MOHURD 2007). This evaluation system is similar to LEED in that the mandatory elements are essentially prerequisites, the general elements are the credit categories, and the preferred elements are bonus credits that can be pursued to achieve a higher star rating.

The label star rating is determined by the minimum score for each of the six components, not the total score; therefore, a building must meet a minimum number of requirements in all six categories to qualify for a specific rating. This arrangement gives equal weight to all six categories and does not allow better performance in one category to offset poor performance in another. In essence, a Three-Star-rated green building must excel in all six of the evaluation components, including the preferred items. Table 3 and Table 4 show the minimum requirements and rating evaluation systems for residential and commercial buildings, respectively.

Table 3. Criteria for Green Building Design Label rating evaluation for residential buildings

Rating Level	**Mandatory Items Included (27)**	**General Items**						**Preferred Items**
		Land Use & Outdoor Environment	Energy Efficiency	Water Efficiency	Resource Efficiency	Indoor Environment	Operational Management	
		Total: 8	*Total: 6*	*Total: 6*	*Total: 7*	*Total: 6*	*Total: 7*	*Total: 9*
★	Yes	4	2	3	3	2	4	0
★★	Yes	5	3	4	4	3	5	3
★★★	Yes	6	4	5	5	4	6	5

Source: MOHURD 2007

Table 4. Criteria for Green Building Design Label rating evaluation for public buildings

Rating Level	Mandatory Items Included (26)	General Items						Preferred Items
		Land Use & Outdoor Environment	Energy Efficiency	Water Efficiency	Resource Efficiency	Indoor Environment	Operational Management	
		Total: 6	*Total:10*	*Total: 6*	*Total: 8*	*Total: 6*	*Total: 7*	*Total: 14*
★	Yes	3	4	3	5	3	4	0
★★	Yes	4	6	4	6	4	5	6
★★★	Yes	5	8	5	7	5	6	10

Source: MOHURD 2007

The operational GBL is a more comprehensive evaluation of pre-certified Green Buildings than the GBDL as it also considers quality control during the construction process. The GBL can be awarded only after a minimum of one year of building operation and is valid for three years (Song 2008). The GBL assessment process also requires an on-site visit; documentation of construction materials and their sources; property management plans for water, energy, and material conservation; and itemized financial documents such as bills of quantities (Zhang 2011). However, reporting of actual operational energy consumption is not required because the GBL focuses primarily on building design and successful implementation of the design in the construction process.

From 2008 to 2011, the number of building projects certified and rated by the GBEL program has increased rapidly as seen in Table 5 below. The vast majority of projects were awarded the design label, with slightly more awarded to commercial building projects than residential building projects. This number of projects and growth rate is very similar to that seen in the earlier years (2000-2004) of the LEED program.

Table 5. Comparison of certified projects and floorspace in US and China for LEED and GBEL

Year	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12
LEED projects US	2	6	17	44	111	180	297	517	938	2210	2938	3309	3653
LEED projects China	--	--	--	--	--	2	4	8	30	65	82	110	101
GBEL projects China	--	--	--	--	--	--	--	--	10	20	83	113	494
LEED floorspace US	0.1	0.2	0.4	1.0	2.2	4.3	7.5	12.9	24.7	65.2	116.5	164.1	201.4
LEED floorspace China	--	--	--	--	--	0.1	0.1	0.1	0.7	2.7	7.9	12.4	16.3
GBEL floorspace China	--	--	--	--	--	--	--	--	N/A	N/A	7.0	N/A	N/A

Note: All data are for certified projects. Floorspace units are million square meters. N/A = not available

China's Green Building Rating Certification Process

The GBEL program is administered by MOHURD's Building Energy Efficiency and Technology Division. Management responsibilities are divided between offices within two primary institutions, including the Office of Green Building Management under the Center for Science and Technology of Construction and the Green Building Development Research Center under the Chinese Society for Urban Studies. Only these two national offices are authorized to approve Three-Star Building Label rating applications while 21 local MOHURD offices are authorized to approve One-Star and Two-Star Rating applications (Li 2011).

The green building labeling application review process begins with the acceptance of an application and an initial review by the accepting authority to determine whether the application material and supporting documentation are adequate and complete. After this initial review, the application material is forwarded to appointed experts or qualifying office staff for a professional review of the details of the supporting documentation. If the application passes both rounds of review, the green building label management office will organize a meeting where experts selected from a database of more than 400 individuals will review and evaluate the application to determine the star rating (Li 2011). The rating is then reported to MOHURD, and the building is officially certified after a public review process.

Although it is a national rating system, China's GBEL offers some provincial flexibility because local assessment and certification authorities have the discretion to eliminate certain items in the standard that may not be compatible with local geographic or climate conditions. For example, Shenyang municipality in Northwest China requires all public buildings seeking the green building certification to consider using a ground-source heat pump for heating, but this requirement is not available or appropriate for other regions (Geng et al. 2012). The rigidity in measurement may also differ between provinces.

Comparison of U.S. and China's Green Building Rating Systems

Program Administration

Although both the U.S. and Chinese green building rating programs are voluntary, the U.S. LEED program is administered by the USGBC, a non-governmental body, whereas the China GBEL is administered entirely by central and provincial government agencies. In particular, the LEED rating systems are developed and updated in a consensus-based process through a committee of USGBC members from a diverse array of professional backgrounds, including architects, real estate agents, building owners, lawyers, environmentalists, and industry representatives. LEED project registration and certification is then administered by the Green Building Certification Institute, a third-party organization established with the support of the USGBC to provide independent oversight of professional credentialing and project certification. The development of the China GBEL evaluation standards as well as the label application and certification, in contrast, are all administered by government organizations within MOHURD's Building Energy Efficiency and Technology Division. In terms of the scope of the rating systems, the China GBEL program differentiates between residential and public buildings, but does not include rating systems unique to specific building types as LEED does. Both programs have different rating programs for design and construction versus operation, but reporting requirements for the operational rating differ. LEED requires a performance period of only 3 months for most LEED Existing Building Operations and Maintenance credits, but China's operational GBL requires 1 year of occupancy and performance for all credits. However, reporting of actual operational energy consumption is not required in the application for the Chinese green building operational rating. In China, only green buildings that have successfully been awarded the design rating label are eligible for the operational rating label; while the LEED New Construction and Existing Buildings programs are separate, standalone programs.

Rating Systems

In terms of the specific rating systems, LEED has similarities and differences with China's GBDL program. A key similarity between the two programs is the use of credit-based systems with some flexibility for what credits or measures building developers want to pursue, along with mandatory requirements that must be met for certification. For rating new construction design, both LEED and GBDL also use similar rating criteria focusing on land, energy, water, resource/material efficiency, and indoor environmental quality. A comparison of the relative weighting of each evaluation criteria category is shown in Figure 1.

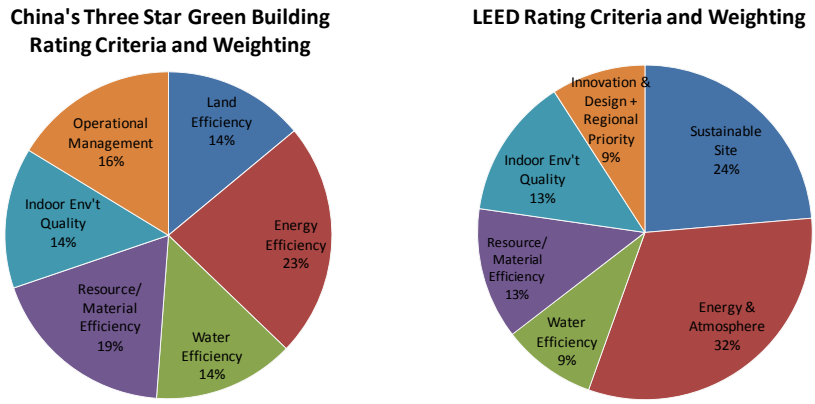

Figure 1. Comparison of China's Green Building Design Label and LEED rating criteria and weight factors.

Note: Graph of China Three-Star Green Building rating is based on point allocation for public buildings and does not include preferential items, which are not allocated to one of the six categories. LEED rating is based on 2009 LEED for New (Commercial) Construction rating system.

The figure shows that China's GBDL has more equal weight distribution in terms of the total points possible across the six categories of options, although energy efficiency and resource and material efficiency are given slightly higher share of total available credits than the other four categories. LEED also gives energy and atmosphere category the highest share in terms of total point allocation, but the sustainable site category has the second greatest weighting before resource and material efficiency. Within each category of credits or options, the emphasis of available credits or options also differ between the two rating systems due to different national conditions. In the area of water efficiency, LEED credits promote water conservation planning, wastewater recycling and water resource conservation whereas the GBDL options focus on consumption of rainwater, reclaimed wastewater and reclaimed sea water (Geng et al. 2012). In addition, the Chinese rating also has a unique requirement of reduction in the total land used for building construction because of high population density, whereas the Sustainable Sites credits in LEED focuses on other environmental considerations such as alternative transportation, heat island effects and site development. For credits or options related to energy, the Chinese GBDL rating clearly prioritizes energy efficiency with the bulk of options dedicated to efficient equipment and to energy conservation measures and design. In contrast, LEED for New Construction emphasizes energy performance but also emphasizes other non-efficiency related

items such as renewable energy and green power, refrigerant management and performance measurement and verification.

Another key difference between LEED and the GBDL is in how a building's specific rating level is determined. Under China's GBDL, the final rating is determined by meeting the minimum rating or credits within each category, whereas a LEED rating is determined by the total points summed over all categories. Thus, a Three Star-rated building under the GBDL will have to meet the minimum requirements in all categories, whereas a similarly rated LEED building has more flexibility in receiving the highest Platinum rating by possibly excelling in several areas but performing poorly in one or two areas. For example, a Three Star-rated commercial building must meet 8 out of the 10 available options for the energy efficiency category under the Chinese GBDL program whereas a commercial building could theoretically be certified as LEED Platinum if it achieved all or nearly all of the points in all categories except the Energy and Atmosphere category but achieved very few points in the Energy and Atmosphere category.

Barriers and Enabling Policies for U.S. and Chinese Green Buildings

In addition to differences in the rating systems used for green building, the U.S. and China green building industries face different barriers and policy landscapes though there are some similarities. There are certain barriers that are characteristic of both the U.S. and China. For example, in both countries government bodies that supervise health, fire safety, land, and other public operations can be slow to revise codes to accommodate green building (regulatory barrier). In both the U.S. and China, green buildings generally cost more to design and build due to greater system integration and the need for more building controls and measurement points. This higher upfront cost is often a big financial and risk barrier for architectural and design firms to do an integrated design for a new green building. Lastly, in both countries, the building industry has many established practices that discourage various stakeholders from trying new or different approaches. Subcontractors in the construction process often view green technology as inherently risky and therefore worry about the liability of installing such technologies in projects they are ultimately responsible for.

China also faces some barriers that are either unique or more pronounced than in the U.S. First, the lack of a green building professional accreditation process similar to the LEED Accredited Professionals process limits green building workforce capacity development in China (informational barrier). While there are a growing number of institutes of building research around the country, education on green design is not yet widespread among university architecture and engineering programs. Second, financial barriers are perhaps even more pronounced in China than in the U.S. since the industry is in an earlier phase of development. Developers cite higher incremental cost as one of the biggest barriers to investment in green buildings. Lastly, more oversight is needed in the green building industry in China to improve the quality of construction (such that it follows design requirements) and building materials (such that they perform as claimed).

In the U.S. and China, five common policy mechanisms have been used to address these barriers and to help promote the development of the green building industry. Table 6 compares and summarizes the enabling policies adopted by the U.S. and China across these five major

areas of policy support. Within building codes and labeling, neither the U.S. nor China has laid out a plan with explicitly scheduled improvements in building codes and labeling programs to promote higher penetration of increasingly efficient and green buildings over time. Yet, both countries have comprehensive codes and labeling systems, with frequency of updates for these systems varying between the two countries. In the U.S., it is up to individual states to implement building efficiency codes, which are largely based off of codes developed and frequently updated by professional societies (such as ASHRAE and IECC). In China, national level building efficiency codes are established by government committees and the codes are not updated as frequently as in the U.S.

Table 6. U.S. and China green building policy comparison

Policy	U.S.	China
Building codes and labeling plans	*Codes:* States implement codes largely based on model codes developed by professional societies. Compliance levels vary widely *Labeling:* LEED system established in 2000 is popular and growing steadily, requirements updated regularly. Latest version released November 2013.	*Codes:* National level building efficiency codes for residential and commercial buildings. Compliance occurs at design stage *Labeling:* GBEL system established in 2007 with uptake slow at first but now growing more rapidly, update for GBEL expected in 2014
Government-led targets and demonstrations	Municipal and federal level LEED building mandates helped galvanize early LEED activity	12th Five Year Plans has requirements that 80% of new large public buildings will need to have GBEL rating; many cities have more aggressive targets
Education and awareness programs	LEED education and professional development key to success; LEED committee leads come from industry and professional societies improving quality, applicability, and popularity of LEED standards	GBEL process is entirely government driven, with missed opportunities to involve other stakeholders; workforce development and education is lacking
Fiscal policy	Grants and tax credits available at local level; evidence of rent and sale price premiums for LEED buildings	Tiered incentives available for 2-star and 3-star GBEL buildings; higher upfront cost of green buildings remains a barrier
Integrated design promotion	Early promotion and integrated design incentives provided by the state of California	None

An area where the U.S. and China share some common ground is government-led targets and demonstrations. In the U.S., federal and state government agencies were early adopters of LEED standards, accounting for over 40% of LEED certifications in the early years of the program (Payne & Harris 2004). Gradually, their adoption led to a larger market transformation (more experienced architects and builders, lower costs, fewer barriers) so that green building practices could be adopted more widely. LEED has grown much faster in the past four years than in the previous eight years and there are currently 14 federal agencies or departments, 30 state governments, and 400+ local governments with LEED initiatives. China is embarking on a similar approach in its 12th Five Year Plan for development for 2011 to 2015, requiring the GBDL for 80% of all new public buildings and setting a 2015 target of 1 billion square meters of certified green building floorspace in hopes that this government-led approach will stimulate

activity in the wider market. This 1 billion square meter target is quite ambitious in comparison with the total amount of LEED certified floorspace through 2012 in the U.S., which was 234 million square meters. In addition, some cities such as Shenzhen, Nanjing, Suzhou and Chongqing have set more aggressive local targets for higher green building share (ranging from 30-80%) of new construction for 2015 and 2020.

Although their approaches to government-led targets are similar, approaches to fiscal policy that supports green building investment significantly differ between U.S. and China. In the U.S., small grants and property tax credits are used to spur LEED activity, while in China, incentives are offered on a per square meter basis to get developers interested in designing and constructing Two-star and Three-star buildings. Yet, this difference in approach may be due to the fact that first-cost premiums are much more of a barrier for the younger Chinese industry, whereas in the U.S., although cost premiums exist, evidence for higher rental and sale prices of LEED-certified buildings is accumulating quickly. LEED certified buildings can achieve anywhere from 5-17% higher rents and from 11-25% higher sales prices, according to one meta-analysis of several studies (Watson 2011).

Education and awareness levels on green building practices also vary between the U.S. and China. The USGBC's larger programmatic efforts in education and professional development for LEED were key to LEED's increasing popularity over the years. Additionally, committee leads for LEED rating system development and revisions are largely from industry, which keeps the LEED requirements relevant and applicable to current best practices in the green building industry. The GBEL rating development process in China is government-driven and likely to have delayed industry awareness and acceptance and slowed market uptake, suggesting more professional involvement in the rating development process can help spur greater interest in using the GBEL rating system.

Conclusions

With growing global and national emphasis on energy efficiency and climate change, the market for green buildings is growing in both U.S. and China, albeit at different speeds and supported by rating systems with similar goals but different approaches. The U.S. LEED program was developed 10 years earlier by the U.S. Green Building Council, a non-governmental body, in a consensus-based process with industry stakeholders. Since 2008, an independent, third-party organization (GBCI) has been responsible for administering all LEED registration and certification as well as LEED professional accreditation. In contrast, the China GBEL program is developed and administered entirely by central and local government offices of MOHURD. These differences in program administration have affected the level of awareness and acceptance of the two labeling programs in their respective countries, with informational, institutional, and capacity limitations still major barriers for the GBEL program.

The U.S. LEED and Chinese GBEL rating systems share many common characteristics including the use of separate rating systems for new design versus building operations, residential versus commercial buildings, and mandatory versus credit-based score items. There are some differences in the scope of rating systems, with LEED having more specific rating systems differentiated by building types than the GBEL program. More importantly, China GBEL offers less flexibility for developers to achieve a specific rating since a project must meet

minimum requirements across all credit categories instead of only a total score, as is the case for LEED. These differences can be traced back to differences between the two countries' building sectors, but also have important policy and market development implications.

In terms of future growth potential, U.S. government-led green building mandates at the federal and municipal level helped galvanize green building activity in the U.S. in the early 2000s. The sector continues to grow rapidly with the support of a wide network of LEED-accredited professionals, complementary local policies, and an increasing body of evidence that green buildings can command higher rent and sale prices. China's green building industry, on the other hand, is still young and poised to enter a critical growth period. In addition to ambitious national green building targets for 2015, many cities are establishing their own targets, requiring anywhere from 30% to 80% of new construction to be GBEL-certified. But developers are still slow to take interest in green building, deterred by the cost premium for building green and implementation problems for the national financial incentives. It remains to be seen, whether China can hit its target for green building, but if it does, it will easily become the world's largest green building market.

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