

Environmental Rating Systems for Non-Residential Buildings—How Does Australia Compare with International Best Practice?



Priyadarsini Rajagopalan

Abstract Growing concerns over negative impacts associated with buildings have compelled governments across the world to introduce minimum requirements for energy efficiency. Energy and environmental performance rating tools and minimum energy performance standards have become widespread in the last two decades. This chapter reviews the status of environmental rating systems in the non-residential building sector in Australia and compares with other leading international rating systems with a focus on those relating to new building design and construction. The major non-residential rating system in Australia, Green Star, was introduced in 2003 by the Green Building Council of Australia and is broadly comparable to international tools such as LEED and BREEAM. While Green Star has been an important driver of improving energy efficiency in non-residential buildings in Australia, it has suffered from inconsistent commitment to climate action from both major Australian political parties. Even though Green Star has similar criteria and performance standards in comparison to LEED and BREEAM, the market penetration of this rating system falls behind other systems in terms of adoption rate. Proper government support and improvement of supply chains would certainly help the rating systems to penetrate the wider market.

1 Introduction

As the impacts of climate change have become more obvious, there is worldwide interest in saving the environment and natural resources. The built environment is one of the largest contributors to greenhouse gases as discussed in Chapter “[The built environment in Australia](#)”. Many countries have been making substantial efforts to reduce the impacts of climate change by adopting various mitigation strategies such as mandatory and voluntary energy labelling schemes [5, 12]. While local-level

P. Rajagopalan (✉)

Sustainable Building Innovation Laboratory, School of Property Construction and Project Management, RMIT University, Melbourne, VIC, Australia

e-mail: priyadarsini.rajagopalan@rmit.edu.au

mitigation efforts in Australia emerged during the 1990s and 2000s, it was not until the late 2000s that a national response to climate change was articulated [26]. Climate change is a long-term problem that requires stable but flexible policy implementation over time. However, Australia's commitment to climate action over the past three decades has been inconsistent and lacking in direction [36]. The climate policies of the two major Australian political parties have varied considerably over the years.

As introduced in Chapter “[The built environment and energy efficiency in Australia: current state of play and where to next](#)”, the Green Building Council of Australia (GBCA) was established in 2002 to lead the sustainable transformation of Australia's built environment. In 2003, GBCA launched the Green Star environmental rating system which has become the largest voluntary rating tool in Australia. Despite the size of the Green Star programme and the trend in the market towards greater energy efficiency, independent research exploring market adoption is limited [33]. Most of the self-reported literature published by GBCA comparing the certified floor-area serves as marketing material. For example, one recent report [14] shows the total number of buildings certified using the system but does not compare this with the total number of commercial buildings built during the time period or the total number of building stock, making results of limited value.

This chapter builds upon the introduction of non-residential energy efficiency approaches in Australia presented in Chapter “[The built environment and energy efficiency in Australia: current state of play and where to next](#)”. The chapter reviews the environmental rating systems in the non-residential building sector in detail, with particular emphasis on the Green Star rating system for new buildings and its uptake within the industry, and locates this within a discussion of international best practice.

2 Energy Efficiency Policies in the Australian Built Environment

Various policies and incentives have been implemented in Australia to promote the adoption of green buildings. Table 1 gives an overview of recent policies in relation to energy and environmental performance of non-residential buildings (see Chapter “[The built environment and energy efficiency in Australia: current state of play and where to next](#)” for further details). Following changes to the National Construction Code and the Australian government's ratification of the Kyoto Protocol, a number of other approaches have been introduced. In 2009, the Green Building Fund was launched to provide A\$90 million as financial incentives to assist building owners to improve the energy efficiency of their buildings. In 2010, the Commercial Building Disclosure policy came into place because of the Building Energy Efficiency Disclosure Act. The Commercial Building Disclosure scheme ensures that when a commercial building with a net lettable area of 2000 m² or more is sold or leased, the energy efficiency information of the building must be provided. By making it mandatory to disclose this information, it ensures that the renters or buyers can make

Table 1 Australian policies in relation to the commercial building sector

Policies	Year introduced
National Construction Code Energy Efficiency Requirements	2006 (updated 2012)
Energy Efficiency in Government Operations	2006
Ratification of Kyoto Protocol	2008
Green Building Fund	2009
Commercial Building Disclosure	2010
Introduction of Carbon Tax	2011
Abbot Government Repeal Carbon Tax	2013
Environmental Upgrade Agreements	2012 (NSW) 2013 (SA) 2015 (VIC)

an informed decision on the building with respect to the impact it has on the environment. In June 2016, there was a move to lower the mandatory disclosure threshold on commercial office buildings from 2000–1000 m² which expected to see an additional 1000 commercial buildings disclose their energy efficiency when they sell or lease their property [24]. It is expected that this will deliver more than A\$50 million in energy savings, and around 3.5 million tonnes of emission reductions over five years.

In 2011, the federal Labour government introduced a carbon pricing or “carbon tax” through the Clean Energy Act 2011 to reduce greenhouse gas emissions. The initiative was also intended to support economic growth through the development of clean energy technologies. At the time of implementation, the carbon price only applied to the top 500 carbon polluters in the country. The carbon tax generated intense political debate and faced significant challenges from the public and the federal opposition government. To compensate for the potential increase in fuel price, the governing federal Labour government funded a range of initiatives including energy efficiency measures and renewable energy target and provided direct financial rebates to most households to offset additional costs resulting from the tax. A change of federal government in 2014 resulted in the Liberal government repealing the carbon tax. Thus, Australia became world’s first developed nation to cancel carbon laws that put a price on greenhouse gas emissions.

3 International Development of Energy and Environmental Rating Systems

The last 20 years have seen an emergence of built environment energy and environmental programmes in different parts of the world including North America, European Union, South America and Asia [30]. A number of rating tools have been

developed in these jurisdictions to rate buildings for environmental credentials with different criteria that can be used at all phases of development including design, construction and operations. Points awarded for each category are generally weighted to calculate an overall score for sustainability. Developed in 1990, the Building Research Establishment Environmental Assessment Method (BREEAM) in the UK was the first tool adopted by the building industry. This was followed by the Leadership in Energy and Environmental Design (LEED) rating system developed by the Green Building Council of the USA in 1998. Subsequently, other rating systems have been developed in other parts of the world and their progress has been reviewed over the years. Janda [19] identified the worldwide status of energy standards for buildings with more focus on developed countries. A survey of 81 countries revealed that 61 countries had some form of mandatory and voluntary existing standards, 11 countries had proposed standards, and 9 countries did not have standards [19]. Bernadi et al. [4] carried out a survey of more than 70 schemes and selected six most studied and adopted schemes including BREEAM and LEED for in-depth analysis. The authors note that a systematic comparison of the schemes is difficult, sometimes even prohibitive. In a study comparing the issues and metrics of five representative assessment schemes around the world including BREEAM, LEED, Comprehensive Assessment System for Built Environment Efficiency (CASBEE), Building Environmental Assessment Method (BEAM) Plus and the Chinese scheme ESGB, Lee [21] states that BREEAM and LEED are the most comprehensive tools with widest scope and many other rating schemes are developed based on these two tools.

The European Union has been leading in the building energy efficiency agenda over the last 15 years. The first version of the Energy Performance Building Directive (EPBD), 2002/91/EC, was approved on 16 December 2002 and entered into force on the 4 January 2003, setting a series of energy performance requirements for existing and new buildings. The main aspects include establishment of a calculation methodology, minimum energy performance requirements, an Energy Performance Certificate and inspections of boilers and air conditioning. In the updated Directive 2010/31/EU, all new buildings shall be nearly zero energy buildings by the 31 December 2020; the same applies to all new public buildings after the 31 December 2018 [13]. BREEAM is the UK's environmentally sustainable certification tool similar to Green Star in Australia. The scheme is composed of ten categories, a percentage-weighting factor is assigned to each category, and the overall number of 112 available credits is proportionally assigned. However, a minimum achievement is required for the categories Energy and CO₂ emissions and Water and Waste. The rating scales that can be achieved by buildings are: outstanding ($\geq 85\%$ points achieved in assessment), excellent (≥ 70), very good (≥ 55), good (≥ 45) and pass (≥ 30).

In the USA, the Energy Star rating system, jointly operated by the Environmental Protection Agency (EPA), and the US Department of Energy (DOE) is equivalent to the National Australian Built Environment Rating System (NABERS—see Chapter “The built environment and energy efficiency in Australia: current state of play and where to next”) and includes only energy and indoor environmental quality as the criteria. The LEED system is a voluntary rating system similar to the Green

Star system and takes a broader approach to assess the environmental character of a building in comparison to Energy Star. Different schemes are designed for rating new and existing buildings. Each scheme has the same list of performance requirements set out in five categories, but the number of credits, prerequisites and available points vary considerably according to the building type. Depending on the credits accrued in each category, certification can range from platinum, gold, silver and the simple achievement of certification.

In Australia, Green Star is a voluntary rating system that assesses the environmental performance of projects at all stages of the built environment life cycle. Ratings can be achieved at the planning phase for communities, during the design, construction or fit-out phase of buildings, or during the ongoing operational phase. Green Star assesses a project based on a number of credits in various categories. A rating is awarded based on the percentage of available points that a project gains, and an overall score is assigned based on which platinum, gold, silver or a simple certification is granted.

In terms of certification processes, Green Star and BREEAM have similar approach. The trained assessor assists the design team in developing and documenting the sustainable design initiatives to achieve the desired rating and submits the documentation to the authorities whose panel validates the assessment and issue the certificate. The Accredited Professionals are appointed to the design team early in the design process. The assessor assists the design team in developing and documenting the sustainable design initiatives to achieve the desired rating and submits the documentation. In order to maintain the Green Star and BREEAM Accredited Professional qualification, the assessors must earn points through continuous professional development every year. While LEED does not require training, there is a credit available if an Accredited Professional is used [3]. The role of the Accredited Professional is to help gather the evidence and advise the client. The evidence is then submitted to the US Green Building Council (USGBC) [37] which does the assessment and issues the certificate. While LEED is dominated by the American ASHRAE standards, BREEAM takes its cue from European and UK legislation [3]. A computational simulation study carried out to quantitatively benchmark the three schemes showed that the case study office building received a high energy rating score in the Green Star scheme, but a low energy rating in the BREEAM scheme and it failed to be certified in the LEED scheme [32]. Also, the HVAC system was found to be the most heavily weighted variable in the energy assessment of the three schemes [32].

4 Adoption Rate

The adoption of rating schemes depends on various factors such as the energy policies and supporting mechanisms in respective countries. Other than the high-end office blocks of Australia's central business districts, the pace of progress in the adoption of Green Star rating has been low [39]. Mid-tier office buildings found all

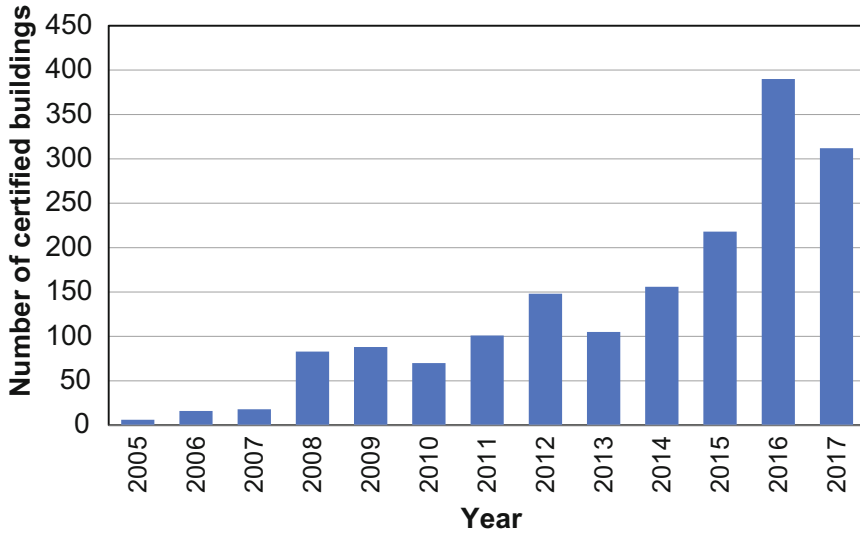


Fig. 1 Number of Green Star-certified buildings

across Australia including fringe areas, suburban centres and regional towns make up a significant proportion of Australia's overall commercial office building stock, but generally not Green Star rated. Figure 1 shows the adoption rate of Green Star buildings since 2005 using the data from ABS [1] and GBCA [15]. The GBCA website maps out the geographic location of the certified buildings. In 2005, there were four Green Star-rated buildings developed. This increased significantly to 83 buildings in 2008 moving to 400 buildings by 2016. Even though the numbers continue to grow and there are now 1712 certified buildings [15], they represent only a small percentage of total building stock. New South Wales has the largest number of certified buildings followed by Victoria and then Queensland and Western Australia.

Both the UK and USA seem to have better success with the construction industry adopting environmental rating schemes faster. As at the end of 2014, overall green building adoption rate in the USA was 13.11% of total numbers of commercial buildings [20]. The top six markets in the US green building sector has total percentage of office buildings built using either LEED or Energy Star above 19%, with the highest being Atlanta with 29.03%. The results show Energy Star being the preferred method to use when certifying an office building. The Energy Star rating system has had better success, growing from 2 to 9.69% during the same period [20] and 10.3% in 2016. The Energy Star programme expanded slightly in 2016, with 10.3% of all commercial office buildings in the largest markets now certified, up from 9.9%. LEED rating system has grown from 0.14% in 2005 to 5.32% in 2014. At the end of 2016, LEED certifications represented 4.7% of the total number of commercial office buildings across the 30 largest US office markets, up from 4.6% the year before.

In 2016, more than 7500 commercial buildings earned the Energy Star, bringing the total certified numbers to 29,500. The percentage of commercial office space that has been certified as “green” or “efficient” now stands at 38% across 30 office markets in the USA. That percentage grew from less than 5% in 2005. Large geographic variation in the adoption of LEED and Energy Star certification remains. For both LEED and Energy Star certification, the top three markets in terms of green building adoption by percentage of square footage are Chicago, San Francisco and Atlanta, with Chicago taking the top position for the first time. It is important to look at the progress these states have had with their rating systems and compare it to Australia to determine how to improve the adoption rate of green buildings.

The UK BREEAM programme’s adoption rate has gone from 1.42% in 2003 to 5.9% in 2008 [7]. By 2012, 6739 commercial buildings were certified under BREEAM [2]. There are more than 2300 certified BREEAM projects in the UK. Around 7% of the nearly 7000 BREEAM-certified non-domestic buildings are in the retail sector, ranging from single units to entire shopping centres.

5 Cost

The cost of implementing certification is considered an important factor in the adoption rate. Like any other service, price is an unavoidable issue when putting the certification scheme into real practice on a large scale. When people pay the expert for the certificate, they will question themselves about the added value of that service [34]. The price of the certification is mainly dependent on the cost of the expert’s work; consultant fees usually prevail over the administration fees. Some countries have a part of the price fixed, which corresponds to the mandatory fees paid for the issuing of the certificate in the system. In new buildings, the price is highly influenced by the methodology used and the geometry of the building. For existing buildings, the experience of the expert is the most noticeable factor. BREEAM fees are determined irrespective of the project size, whereas LEED and Green Star fees increase with project size. For Green Star, the certification fee schedule varies depending on the type of project, project’s contract value and GBCA membership status. Historically, consulting costs to prepare the submission are in the order of A\$100,000, including the Environmentally Sustainable Design (ESD) consultant and additional work required for the architects and consultants [18].

As noted by Santos and Whittchen (2011) in Europe, differences between the prices of Energy Performance Certification in the member states are more evident in the case of non-residential buildings, ranging from a couple of thousand dollars for small and simple buildings, up to A\$30,000 per certificate for large and/or complex buildings. The price is often higher for the existing than for the new non-residential buildings, and the difference is more noticeable in the case of large and/or complex building.

Table 2 compares the cost of certification for the three rating systems. In order to compare the costs, a five star-certified building from GBCA website was selected for

Table 2 Comparison of certification cost

	Green star	LEED	BREEAM
Consultation cost (A\$)	Up to 100,000 for ESD consultant and additional work required for the architects and consultants	NA	Approximately 31,000 for large buildings
Registration fees (A\$)	Not applicable	1250 for members and 1700 for non-members	4000–6000
Certification fees (A\$)	12,500–40,000	Up to 30,000	4000–6000
Estimated certification cost for a building with GFA 11,500 m ² (A\$)	18,500 for GBCA members and 23,500 for non-members	9000	6000

analysis. The selected building with a gross building area of 11,500 square metres, valued A\$20 million. Standard certification fee for this building is A\$18,500 for GBCA members and A\$23,500 for non-members. Certification costs for a similar building using the LEED system are US\$6470 (A\$8998) and BREEAM system is around £3700 (A\$6000) which are significantly lower compared to Green Star.

BREEAM is such a part of UK building certification that it is largely embedded into the regulations through Building Research Establishment (BRE), but unlike LEED, it is no longer administered by a non-profit organization. This has led some in the industry to criticize the programme, as it tends to charge significantly higher fees than LEED for one-off assessments [11]. BREEAM has licensed assessors who examine the evidence against the credit criteria and report it to BREEAM's parent company, BRE. BRE then assess the report and issue the certificate if it meets their requirements. Assessment is a two-stage process, as design stage (using documentary evidence) and post-construction (using site records and visual inspection). LEED, on the other hand, does not collect the evidence, the design team does. They then send the data to the USGBC, who examine it and issue the certificate if it meets their demands [11]. Across Europe, the price of certificates varies, due to the different economic realities in each country, and different methodologies used by those countries.

Even though the cost of certification is significant as its own, it is only up to 0.6% of the total building cost. The cost of construction can vary significantly. Generally, a 4 or 5 star Green Star rating can be achieved with no additional cost, provided there is good ESD integration from the start [9]. Additional large pieces of infrastructure, such as photovoltaics, cogeneration, blackwater treatment, added to achieve credits can significantly increase project costs and are often required for a 6 Star rating [18]. In a survey of building professionals [23], 49% of participants surveyed believe there is a problem with the affordability of green buildings, and the ratings are aimed at high-end projects. In the USA, after surveying LEED policy administrators, Retzlaff [31] found the majority of respondents believed public awareness and education

played a vital role in communities adopting LEED-certified buildings. It is widely acknowledged that cost is a key variable that drives the market for high-performance buildings; therefore, it is important for the government to adopt cost competitive market transformation strategies such as competitive price for high-end materials, equipment and systems.

6 Incentives

Incentives serve as an instrument that can ultimately drive sustainable development in the building sector. Financial incentives include direct grants, tax incentives, rebates and discounted development application fees which are the most common green building incentives provided by the government [27]. Non-financial incentives include floor-to-area density considerations, technical assistance, expedited permitting, business planning assistance, marketing assistance, regulatory relief, guarantee programmes and dedicated green management teams in building and planning departments [8]. Non-financial incentives such as expedited permitting or technical assistance save owners' time by mitigating risk and process issues. Governments mostly favour the provision of non-financial incentives because no direct costs are involved [29].

Sauer and Siddiqi [35] compared the impact of three different incentives (financial and administrative incentives, and density bonus) provided at the county level on the production rates of LEED-certified multi-unit residential buildings in the USA and found that density bonus (i.e. zoning ordinances), which allows projects to achieve a higher unit density, leads to the production of more LEED-certified multi-unit residential buildings. Administrative incentives such as expedited permitting have a more significant impact on the adoption of green building by owners than financial incentives, such as tax credits [8].

In 2009, the Australian Government allocated A\$90 million towards the Green Building Fund, which was a one-off funding scheme. This fund was set up to assist commercial building owners to improve the energy efficiency of their buildings. In 2010, Low Carbon Australia Limited (LCAL) was set up for the public charitable purpose of preserving and enhancing Australia's natural environment by helping Australian business, government and households take action to increase energy efficiency and reduce carbon emissions [22]. The energy efficiency investment portfolio has since moved to The Clean Energy Finance Corporation that promotes energy efficiency and cost-effective carbon reductions. LCAL acts as a financial provider to help develop Environmental Upgrade Agreements (EUAs). An EUA is a tripartite agreement between a building owner, local council and a finance provider where the finance is levied at a special charge by the local council. Under an EUA, lenders provide finance to a building owner for environmental upgrades, with the local council then collecting the repayments through its rates system and passing them on to the lender [10]. These agreements are designed to promote environmental friendly retrofits and upgrades of existing buildings. They were introduced in New South

Wales in 2011, South Australia in 2012 and recently introduced in Victoria in 2015 as part of the Sustainable Melbourne Fund [16].

The type of incentives offered in the top six green building markets in the USA includes tax credits or incentives, greater floor–area ratio density, and expedited and reduced permit fees [25]. These incentives are also seen in other states including Virginia, Maine, New Mexico, Arizona and Washington. In the UK, taxes on non-domestic energy use were introduced by the Climate Change Levy (CCL) in 2001 and the Carbon Reduction Commitment Energy Efficiency Scheme (CRCEES) in 2010. The imposition of the CCL was accompanied by incentives for companies to invest in energy efficiency such as Enhanced Capital Allowances (ECAs) allowing businesses to invest in designated energy-saving plant and machinery, and voluntary Climate Change Agreements (CCAs) allowing eligible energy-intensive industries to receive up to 90% reduction in the CCL if they signed up to stretching energy efficiency targets agreed with government. In addition, feed-in tariffs which took effect in 2010 applies to small-scale generation of electricity using eligible renewable technologies [38].

7 Discussion

Green Star compares well in terms of scoring criteria and methodology as well as performance standards in comparison to LEED and BREEAM which are considered international best practice tools. However, the adoption rate of Green Star has not grown significantly compared to the other two rating tools. It is to be noted that both countries have larger population compared to Australia and their rating tools have been developed for longer time period compared to Australia. One of the reasons for lower uptake could be Australia's relatively low energy prices which diminishes the financial incentive to act especially for private buildings. Government policies have played a substantial role in promoting energy efficiency improvements. Supporting measures are needed to ensure that rating schemes impact on the targeted market. The impact can be increased by incorporating other complementary measures, including energy requirements in building codes and financial incentives. Both Australia and Europe have similar policies regarding the disclosure of energy ratings in large commercial buildings. The European Energy Performance Certificate, however, extends to all buildings that are for sale or lease. The recent inclusion of building with floor–area from 1000 to 2000 m² hopes to push the small-size building market.

In the USA, local and state governments utilize various incentives to encourage the use of LEED. These include tax incentives, expedited and reduced fees, and relaxation on building area density or building heights. Many financial and non-financial incentives including tax incentives, expedited and reduced permits, and lenience for building density or building heights are available in the USA. These incentives have been seen to be successful in promoting green buildings in the private sector [25]. The adoption of energy benchmarking laws is rapidly advancing across US cities,

counties and states. In total, 23 cities, Montgomery County, and the state of California have now enacted laws requiring large privately owned commercial buildings to annually measure and benchmark their energy consumption, as well as to publish the resulting scores [6]. Evidence from the 30 largest US commercial real estate markets suggests that these benchmarking and transparency laws may contribute to increased adoption of environmental building certification [6]. However, these programmes could be in jeopardy under the “America First” budget plan by the Trump administration. The lack of new policies and incentives throughout Australia points to a sceptical and non-committed attitude adopted by the government which is clearly seen by the elimination of the carbon tax. Some states in Australia are beginning to adopt financial incentives to promote the retrofit of commercial buildings through the Environmental Upgrades Agreement. This was adopted in New South Wales in 2012 with South Australia following in 2013 and Victoria in 2015. As these incentives are in their infancy, it is yet to be seen if they have an impact on the adoption rate.

There are several barriers that may affect the construction industry’s uptake of energy efficiency measures. They include cost, information gaps (as relevant information is not always available at the right time to the right people), split incentives, skills shortages and delay in project commencement due to regulatory activities. Mandatory implementation can increase the impact considerably, but may be difficult to implement for budgetary or political reasons [30]. While there have been many energy efficiency improvements, some markets have proved resistant to change. Market diffusion activities including information and training, financial incentives, and financing will help to develop strategies to address these barriers.

As per the Green Building Adoption Index published by CBRE [6], the uptake of green building practices in the 30 largest US cities continues to be significant, but the growth shows abatement. It may indicate that the most sophisticated owners of the high-end buildings have pursued and achieved certification. Oyedokun [28] notes this as an indication of a low or complete lack of financial motivation for further expansion of the green building sector and reports that rather than green premium, issues around corporate social responsibility and energy efficiency legislation have been the main drivers for the green building market. It is to be also noted that most of the statistics do not cover buildings that achieve a high performance but do not pay for the certification. In addition, standards that were considered innovative once are common practices nowadays.

8 Conclusion

Much progress has been achieved in energy-efficient and environmentally sustainable buildings over the last two decades, and various rating schemes have evolved in different countries. Even though Green Star rating system in Australia is similar in rating criteria and performance standards in comparison to other rating systems in the USA and the UK, the market penetration of this rating system falls behind others in terms of adoption rate. The success of any rating scheme will depend on how cost-

effectively it can be achieved. In order to achieve further advancements, the rating scheme should progress with time and contribute quantifiably to the environmental targets of the country. Both external and internal incentives are important instruments for promoting green building. However, it is not clear which one is more effective. Commercial building owners may not be motivated to achieve rating because the costs are not transferable to buyers who are actually reaping the benefits. A collaborative effort by the government and private sector and agreement on appropriate incentives is significant towards promoting participation of the private sector. Stringent regulations and increasing the minimum requirements to drive the bottom of the market in conjunction with more education and awareness within various stakeholders of the construction industry are imperative for better adoption. Also, it is very important to appraise the effectiveness of current government incentives.

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Assoc. Prof. Priyadarsini Rajagopalan, B.Tech. Arch. Eng., M.Bld.Sc., Ph.D. is an associate professor with expertise in building energy efficiency and energy benchmarking, indoor environmental performance and urban microclimate.