More than ever, the building industry in Singapore is becoming increasingly focused on environmental sustainability and buildability. Would greater environmental consciousness lead to a misplaced focus on paperchase, and an administratively cumbersome checklist of rating systems? Does the over-management and accreditation of these systems alienate the process of design and a more immersive understanding of sustainability? Are these evaluation systems aligned with the whole point of sustainable design?

This essay tracks the decade-long history of the Green Mark evaluation and rating system for environmentally sustainable buildings in Singapore, and advocates improvement in broader considerations of efficiency, scale, context, culture, and new forms of environmental stewardship and lifestyle changes. It also argues that the dialogue among the stakeholders in the building industry must shift to a new focus on smart and sustainable living, and a correspondingly nimble evaluative process, so that Singapore can continue not only to survive, but to thrive.

THE STORY SO FAR

In 2005, the Building and Construction Authority (BCA) of Singapore introduced its first Green Building Master Plan. This master plan saw the birth of the Green Mark scheme, which would be adopted by the industry in designing and creating environmentally sustainable buildings. At its inception, the scheme was modelled on other green rating standards like the Leadership in Energy & Environmental Design (LEED) programme in the United States, and the Building Research Establishment Environmental Assessment Methodology (BREEAM) programme in the United Kingdom. However, Singapore’s Green Mark scheme ventured towards a more contextually and climatically local format in order to impose standards on environmental conservation and preservation, in the face of an increasingly high energy-consumption building industry. It was catered towards a more equatorial climate, with standards deemed more achievable and contextually appropriate for Singapore – with its misplaced penchant for glossy glazed buildings in the hot tropical sun.

By the 2000s, the building and construction industry in Singapore had rapidly matured. With this newfound maturity came the need for a more urgent and responsible look at environmental preservation and energy consumption. This interest in building sustainably leant towards the populist green movement from Europe, which soon gained traction internationally. The building industry in
Singapore took this same cue, embracing terms such as “carbon footprint,” “energy efficiency,” and subsequently “renewable energy.” These became the new collective vocabulary of architects, engineers and even developers. Where there was hesitation in adopting the Green Mark guidelines, lucrative financial incentives would be introduced. Projects gunning for Green Mark Platinum—the pinnacle of the nascent local green rating label—would be rewarded with additional gross floor area (GFA) beyond a predetermined cap, along with the possibility of capped government funding for green aspects of the project cost. Where there was further reticence in its adoption; legislation was imposed—since 2012, it has been mandatory for buildings beyond two thousand square metres in floor area to be Green Mark certified.

Across different geographies and jurisdictions, statistics from the International Energy Agency (IEA), the United States Environmental Protection Agency (EPA), and the United Nations Environment Programme (UNEP) consistently show that buildings consume between 30 percent to 40 percent of the world’s energy consumption. Cognizant that buildings are the dominant culprit in the production of carbon dioxide, considered harmful to the natural environment, the Green Mark in Singapore undertook parallel strategies in reducing carbon emissions. This production of carbon dioxide takes place continuously during the conception of a building, its construction and its lifetime operation. As a result, local authorities reward high productivity in building and construction practices. Focusing on the inherent high energy consumption construction process of buildings and cities, BCA mandated a “Buildability Score” for all new building projects. The hope is to aim for a higher productivity in construction methods, because more efficient assembly processes would, in theory, reduce the overall embodied carbon footprint of buildings.

UNPACKING THE GREEN MARK RATING SYSTEM

In Green Mark version 4.1, the point-based rating criteria leads to a development being rated within four Green Mark classifications: Certified, Gold, Gold Plus or Platinum. The constituent criteria are grouped into five categories, in the following order: Energy Efficiency, Water Efficiency, Environmental Protection, Indoor Environmental Quality and Other Green Features.

The first set of criteria on Energy Efficiency deals mainly with the reduction of heat load in a building, and how efficiently the building is being cooled. In the rating system for both residential and non-residential buildings, this accounts for more than 50 percent of the overall score. Energy Efficiency accounts for 87 out of a possible 155 points, or 56 percent in residential buildings; and 116 points out of a possible total of 190, or 61 percent in non-residential buildings (BCA, 2013a; BCA, 2013b). The other sections include criteria such as the use of water-efficient fittings and judicious use of water for Water Efficiency, the use of sustainable products and provision of greenery under Environmental Protection, reduction of contaminants and health-related concerns under the Indoor Environmental Quality, and the use of additional green innovations, including renewable energy, as Other Green Features.
The completed BCA SkyLab, designed by the Sustainable Urban Solutions Studio, Surbana Jurong.

Compared to the Energy Efficiency category, these other four categories have a far lower weighting. Notably, the allocation of points on Environmental Protection is far outweighed by Energy Efficiency. For example, the rating system rewards up to fifteen points for designing an efficient building envelope system, but only one point for the restoration, conservation or relocation of existing trees on site (BCA, 2013a).

**EMPHASIS ON TECHNOLOGY**

The criteria and weighting of the Green Mark rating system are motivated heavily by technological solutions, and made appropriate for industry practices today. However, there are risks of misinterpreting the good intentions of the Green Mark rating system if architects and engineers take it merely at face value. The heavy emphasis on Energy Efficiency in the ratings may mislead the architect and engineer to assume that most buildings should indeed be designed with full glass facades and air-conditioning. The primary goal of Environmental Protection in the design of the building thus appears only to maximise improvements in Energy Efficiency.

This incorrect impression risks causing fundamental aspects of environmental sustainability to be ignored. Passive design measures such as the preservation of natural sites, or appropriate orientation of the building away from the East-West solar path, tend to be glossed over. Design features such as large overhangs and voids for cross-ventilation long existing in vernacular methods of tropical building design are forgotten. The strategies and tenets of good architectural design such as appropriate site planning and interior layout, building orientation and building massing, appropriate architectural form and materials, and natural ventilation have given way to expensive engineering solutions.

The real-world challenges of compacted project schedules and aggressively commercial briefs are pushing building designers and engineers towards the path of least resistance. Technology becomes the default problem-solver, or worse, the stop-gap measure for larger and more deep-rooted problems. For example, fashionable full-height glass walls in the design of building facades require the highest-performance, and often costliest, glass specifications in order to mitigate heat transfer into the building. Building structural systems are routinely over-engineered to cater for extreme loads beyond normal usage, and air-conditioning systems are designed to cater for two to three times of typical cooling requirements.

In the rating system, a maximum of eight points can be garnered for using building materials and interior finishes rated for sustainability, compared to the sole point gained for conserving on-site trees. A myopic and languid architect would be encouraged to choose the convenience of specifying multiple “green” building products, and new building technologies to make the cut. Most would avoid point-deficient implementations such as a design for the reduction of car use, or the more long-term compost recycling strategies under the broader
The accompanying Visitor’s Lounge is one of Singapore’s first structures constructed from Cross-Laminated Timber, a structural material sourced from renewable forests.

Protection of Environmental Protection that can contribute to a more systemic lifestyle change, or a deeper protection of the surrounding ecosystem.

While the phenomenon is hardly confined to the Green Mark rating system alone, the flipside of rating systems all over the world is the danger of treating them as checklists. These ratings become a convenient habit for architects to ignore the larger, fundamental challenges of designing a building and implementing long-term solutions. As long as the Green Mark rating system privileges quick and costly technological solutions, this trend will presumably continue.

A NEW GREEN MARK

Yet, there is much encouragement in recent developments. In the past decade the BCA has implemented two revisions to its original Green Master Plan from 2005. Anchoring the third Green Building Master Plan is Green Mark Version 5, slated for a September 2016 release. This version has been previewed at the Singapore-held International Green Building Conference 2015 in September, and has been made available online by BCA as a “pilot” document. This new version has seriously reconsidered the issues discussed above, and has placed a far greater emphasis on environmental conservation and preservation, in an important section titled “urban harmony.” In evolving this new version of Green Mark, BCA has made commendable efforts in constantly consulting more than a hundred architects, engineers and other building consultants. The result is the formulation of tropical climate’s most comprehensive and balanced criteria for assessment as yet.

The authors of the new Green Mark have actively involved industry experts in their task forces, and gained a wide spectrum of views on how its rating system can be refined. Early signs are encouraging, with more attention being placed on appropriate, intelligent and well-considered passive design. Criteria involving the introduction of technologies and new building products have also been considered for appropriateness in specific building types, and specific environments.

The ten-year-old Green Mark scheme is barely emerging from its adolescence, but it has greatly matured in its reach and its depth in addressing the needs of the industry, and the urban and natural environment at large. Its progress is a testament to the success of continual and open dialogue between government agencies, design professionals, industry experts as well as end-users. The outcome reflects an acceptance towards further refinement and improvement of the guidelines.

POSSIBLE GREEN FUTURES

Sustainable architecture, and by extension sustainable urbanism, cannot be achieved only through green rating systems. Efforts must be made in the design of appropriate buildings for their context, climate,
The features of the BCA SkyLab which allow for the testing of new building technologies in facade, cooling and lighting.
and culture. Architects are beginning to realise the follies of their urge towards gleaming glass towers and spectacular forms, and engineers are realising the imprudence of designing giant ice boxes. In his article “Thermodynamic Narratives,” architect and writer William Braham writes: “Modern buildings are both wasteful machines that can be made more efficient, and instruments of the massive, metropolitan system driven by the power of high-quality fuels. A comprehensive method of environmental design must reconcile the techniques of efficient building design. Over the coming century, we will be challenged to return to the renewable resource base of the 18th century city with the knowledge, technologies and expectations of the 21st century metropolis.” The new green rating system can go a long way in influencing the way architects approach environmentally responsible design.

Stephen Cairns and Jane M. Jacobs advocate technology that participates in the process of environmental mitigation in the context of urbanisation in the 21st century. Their provocatively-titled book, Buildings Must Die: A Perverse View of Architecture, examines the possible ways of embracing and harnessing the spalling, moulding, and general decay of a building. The case studies in the book analyse how the ravaging effects of urban pollution can be combated in a sequestering process. The unbuilt B_mu museum in Bangkok by architects R&Sie(n) is an exemplary example of the process of sequestering. The museum’s design is composed of “a stack of rectilinear gallery spaces wrapped in a drooping shroud coated with an electromagnetic material that would attract particles from the polluted city air, much (like) the way the screen of a computer monitor attracts dust.” The skin of the building in effect becomes an extensive receptacle for elements of smog in the air, and acts as a sacrificial filter for its inhabitants. Despite not being realized yet, this case study demonstrates that technology can indeed be employed as a critical solution for sustaining the future of buildings and cities. It exceeds the boundaries of certified technology of any legislated green rating system.

Where new sustainable building technology is concerned, BCA has commissioned the design and construction of BCA SkyLab, a high-rise rotatable test laboratory where new building materials and technologies can be “plugged-and-played,” and subsequently tested for their performance. As such, the facade of the laboratory, its air-conditioning system, and its lighting system can be tested with the latest, most energy-efficient products. Designed by this author and his teammates at the Sustainable Urban Solutions studio of the local multidisciplinary firm Surbana Jurong, the BCA SkyLab’s ability to rotate allows for the testing of new building technologies along any given directional orientation. In all likelihood any future experimentation will have to take into account the building’s orientation before any consideration of its new technologies. This seminal building underlines the BCA’s new prioritization of passive design before active design, introduced in the new Green Mark guidelines, and mirrored in this live experimentation laboratory.

**SINGAPORE’S GREEN FUTURE**

What can Singapore’s green future be? Can it be a future with buildings designed more intelligently and appropriately for our climate? Can architectural design be carefully considered for optimal passive design, and expensive high-technology employed only as a secondary measure? It can be a future where recycle bins are more ubiquitous than rubbish bins; and buildings are able to convert energy from the sun, the wind, and even its occupants to fully satisfy its own energy requirements. (Rifkin, 2011) More than that, it can be a future where society has a stronger consciousness of its own consumption power and waste disposal habits. It can be a future where energy is sourced purely from renewable supply, as opposed to fossil fuels. Singaporeans can commit to changes in lifestyles, and take a genuine interest in extending the life span of consumer products and even buildings.

Over the last ten years, the discourse on buildings and the city in Singapore has shifted away from style and aesthetics to environmental sustainability. In the next ten years, discussions will continue to expand to include the integration of physical and information architecture. Singapore will have to embrace a rapidly evolving environmental and technological landscape, and the policies and evaluation systems created by the government and stakeholders must adequately aid this transformative process.

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