TRUE SUSTAINABILITY: A RUBRIC FOR EVALUATING INFRASTRUCTURE RATING SYSTEMS AND RESILIENCY

Abstract

The present sustainability marketplace, in the built environment, has stemmed from focus on the construction of buildings. The US Green Building Council (USGBC) LEED Rating system provides a useful platform for rating projects, but lacks credibility as it relates to maintenance and resiliency as measures of how sustainable a project is. The Institute for Sustainable Infrastructure (ISI) *envision* rating system seeks to provide a method of similarly rating the sustainability of infrastructure projects universally, is under development, and is out for public comment. In looking at the efforts of the ISI and others, a clear rubric needs to be applied to see if the system can meet all facets of what it means to be sustainable. This paper holds that there are three fundamental ratings of sustainability that need to be applied: Environmental Sustainability, Socio-Economic Sustainability, and Resilient Sustainability. Only by balancing and rating projects against all three of these factors, can a rating system truly be valuable for stating the level of sustainability that a project attains.

TRUE SUSTAINABILITY: A RUBRIC FOR EVALUATING INFRASTRUCTURE RATING SYSTEMS AND RESILIENCY

Towards True Sustainability

In our contemporary age, much is being written on sustainability and how to apply “green principles” to projects. The U.S. Green Building Council (USGBC) is a proven leader in the development of tools to aid in defining what is “green” within the context of construction projects, centered around buildings, through the use of their Leadership in Energy and Environmental Design (LEED) Rating System.(1) As cited in their various publications, the LEED rating systems, “are voluntary, consensus-based, and market-driven. Based on existing and proven technology, they evaluate environmental performance from a whole building perspective over a building’s life cycle, providing a definitive standard for what constitutes a green building in design, construction, and operation.”(2) From within this statement it is clear that LEED focuses on answering the demands of an effort being both sustainable from an environmental and socio-economic perspective. While the rating system thinks through lifecycle, its critical fault is that is doesn’t think through the sustainability of the built space from a perspective of resilience (involving security, protection, or other factors) never minding the maintenance access, technological upgrades, and preventive upkeep efforts/training that will need to occur. This remains true for the LEED system foray into the broader context of a neighborhood development that was developed out of, and subsequent to, its original iteration focusing on new construction.(3) This rating system delves into infrastructure issues, within, essentially, the residential housing/mixed use neighborhood construct. As stated in its system manual, “LEED for Neighborhood Development places emphasis on the site selection, design,
and construction elements that bring buildings and infrastructure together into a neighborhood and relate the neighborhood to its landscape as well as its local and regional context.”(4) As this indicates, the rating system focuses on the environmental aspect primarily, in conjunction with the socio-economic facets of the intended development effort (in light of the costing of the environmental efforts); absent is protective and resilience sustainability considerations. Contributing to the LEED for Neighborhood Development (LEED-ND) was the Congress for the New Urbanism (5), which counts among their members Andres Duany and Jeff Speck, who along with Elizabeth Plater-Zyberk, are the authors of the highly influential Suburban Nation: The Rise of Sprawl and the Decline of the American Dream.(6) This text, among others, advocates the use of “Smart Growth” principles and Duany/Speck go on to help codify these principles in their highly helpful handbook called simply “The Smart Growth Manual.”(7) Using two statements from Smart Growth America(8), this text provides a possible set of ten ways to achieve Smart Growth(9) but no “rating system” per se is presented, nor is there a standard Smart Growth grading/rating methodology, save the LEED-ND (this rating system doesn’t envision the inclusion of industrial projects or infrastructure support facilities, however). Duany and Speck call for the necessity of such sites as waste water treatment plants, energy production facilities, and solid waste management to be incorporated in regional planning,(10) but giving them a sustainability rating within a larger context is absent. Also, both LEED-ND and the proponents of Smart Growth, cite as a major principle increasing development density which can often be counter to promoting a resilient facility that needs to have stand off for a variety of reasons (Chemical, Biological, Radioactive, Nuclear, and Explosive (CBRNE) issues, Anti-terrorism protection, or other reasons).(11) Essentially, Smart Growth only takes into account resilient sustainability (as I will help define later in this paper) in a tertiary manner. The Institute for Sustainable Infrastructure (ISI, 12) is currently developing the envision rating system to help address infrastructure projects specifically. Out for public comment during the summer of 2011, the system again focuses on Environmental and Socio-Economic sustainability issues much like that of the LEED rating rubric. As stated by one of its contributing partners, “The ISI rating system is founded on the “triple bottom line” concept of sustainability, which includes environmental, economic and social considerations, and it is designed to identify the benefits of sustainable practice for owners, regulators and practitioners.”(13) As this system is not fully developed, it has the opportunity to start addressing resilient sustainability issues, in addition to the already established standards, if acted on soon. From this author’s review, envision will be a great leap forward in providing a universal sustainability rating system for infrastructure and other non-building projects.

A New Rubric for Sustainability

As shown above, rating systems for sustainability have heretofore focused primarily on “green-ness” from a environmental perspective first, and then from a socio-economic perspective (mainly to justify or support the primary goal of being sustainable from an environmental perspective). The viability of these rating systems have been enhanced over time as owners, project teams, and others have found implementation of environmentally sustainable elements to be economically sustainable because of marketing and the decreased cost of the technologies involved. What has been discounted, however, is the ability of a project to fully meet socio-economic sustainability without its marketing driver and the looming problem of rating resilient sustainability. To that end, a short description of these three inter-related aspects of
sustainability is in order: Environmental Sustainability, Socio-Economic Sustainability, and Resilient Sustainability.

**Environmental Sustainability**

Simply put this is the fundamental rubric that most are familiar with when it comes to systems that measure sustainability. The goal of environmental sustainability is to reduce greenhouse emissions and ensure that the planet earth and its environs are able to be sustainable for generations to come. The USGBC in particular has articulated this, perhaps best, in the way it lays out its categories for the LEED New Construction and Renovation rating system. “Each rating system is organized into 5 environmental categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. An additional category, Innovation in Design, addresses sustainable building expertise as well as design measures not covered under the 5 environmental categories.”(14) As a framework for determining the “green-ness” of a building, or other project in a building construct, this has proven to be a well regarded way to achieve the overall objective of the USGBC’s core objectives.(15) The focus on saving energy, encapsulated in “Energy and Atmosphere,” has been, and continues to be, highly attractive and a driver for innovation as well as economic under-girding of the rating system. But while altruistically doing well for the environment might be enough, the problem comes when the efforts of LEED Projects are undone after certification because it fails to meet expectations in economic terms (given that the system preaches life cycle costing), or is not resilient to the test of time, use, and or other acute phenomenon. Thus environmental sustainability is clearly not solely sufficient as a measure of how totally sustainable an effort is, and we need to consider two other, interconnected measures of how well can a project truly last.

**Socio-Economic Sustainability**

Socio-economic sustainability is the measure of how long an effort can survive within a context based upon cultural, financial and other norms. Projects in this vein, can be sustainable only so long as the society can adopt the norms and attitudes that are required to be environmentally sound or contend with the measures required for them to be resilient. For instance, adoption of reused grey water systems for commodes and/or urinal usage (in an attempt to save water) has not found favor in some applications because of the potential or real unsightly nature of the water reuse. But this is only a part of the socio-economic aspect, because this aspect also requires that a system not only be worthwhile economically as a first cost, or for the maintenance of the system over time, but also for the whole cost of maintenance, replacement, and human resource expenses. So, using again the example of grey water reuse, this system may not be seen attractive because of the additional cost of the hard plumbing required to enable the system to operate at the outset, even when measured against the cost savings gained from less water usage. This measure of sustainability should also be expanded to address the costs of the need to maintain an additional pump, possible filtration systems, and the education and cost of effort to label and ensure that reused grey-water systems are not retrofitted or modified and enter domestic treated water systems for buildings over time. The LEED rating systems have started addressing these concerns, but this measure of sustainability should also go beyond how this has
heretofore been described and measured. Also, LEED does not account for the inherent cost of changing social norms. There must be a measure that looks at how social and economic factors require certain project decisions to be made in order to be sustainable in light of this larger consideration.

**Resilient Sustainability**

Finally, there is a measure of sustainability that really is not comprehensively addressed in any rating system to date, resilient sustainability. This facet of sustainability has several subset areas that should be scored to determine if an effort/project has staying power: a) Energy/Commodity Security, b) Site Security/Protection, c) Facility Maintenance, d) Traffic, Inter-modality and Infrastructure Conflicts. It is clear that a project really cannot be called fully sustainable if it does not secure the energy/commodities involved from tampering and/or damage (e.g. energy spikes). Likewise, the project must secure the method of conveyance for the energy/commodities involved (e.g. pipeline tampering). Several examples can come to mind about how a structure can become simply unsustainable if the required commodities or energy is interrupted, among them are communication networks. Large costs and environmental impacts can come from requiring alternate electrical generating sources to avoid brownouts and blackouts, as a response to the inherent resilient sustainability issues involved. Site security/protection is another subset area. This subset includes security engineering (monitoring, cuing, and inspections), protective structures, structural protection, risk, standoff, and CBRNE susceptibility. Sites and projects that fail to protect against attack, fail to prevent damage, or simply fail to demonstrate sufficient security measures become problematic in that they increase risk/insurance costs and consequence management costs. Those projects that go the other way, and overbearingly implementing measures against these threats, often find themselves in conflict with goals to increase development density and other environmentally desirous sustainable features. Essentially, this subset attempts to get at the core of what being resilient is all about, but in a manner that can survive the unpredictable nature of potential threats and security concerns over the long term.

A third subset of resilient sustainability, is the area of facility maintenance. This area includes the sustainability of staff training/skill sophistication and the costs involved in plant replacement/preventative maintenance efforts. A classic example of not thinking about resilient sustainability is the implementation of waterless urinals in facilities. While trying to save water, the cost of cartridges, the need to have a plumber (or at least a more skilled worker) replace said cartridges, and the inevitable odor that occurs when the throughput is higher than anticipated (or off of standard replacement cycles), in many settings results in waterless urinals being removed in a relatively short amount of time after installation. Simply put, techniques to save water or execute other desirous features may clearly be environmentally sustainable, and could be argued to be cost effective, may not be “resilient” enough because they create such burdens to it to make it unsustainable or fail to meet realistic ongoing maintenance capacity of the organization/facility. The last subset in the area of resilient sustainability relates to traffic, inter-modality, and infrastructure conflicts. Resilient sustainability gets at looking at the nature of acceptance/risk in delays of service, flow, or transport, looking at surge planning and crowding of infrastructure/transportation systems, and looks at the effect of stacking efficiencies and utility access. Stacking infrastructure in utility work, for instance, is often done to minimize surface
disturbance and to save money, but can create conflicts between various utility types (e.g. interference from electrical distribution onto network systems) and potentially result in multi-service vulnerabilities from attack.

A possible methodology emerges to measure and score projects concerning how sustainable and how resilient they truly are over the long term based on these subset areas. The distinct absence of the evaluation of these measures weakens rating systems that are currently accepted norms of sustainability, including LEED. Without a way to rate and measure the effectiveness of resiliency in a rating system creates conflicts making the goal of making a project environmentally sustainable more challenging than it ought to be or creating false environmental choices that result in solutions that are not economically or otherwise likely to survive for long. By having a rating system that enables resolution of these conflicts and includes the resilience of the solutions, gives it great power.

**Full Sustainability**

This then brings us to what full sustainability is: sustainability that optimizes and maximizes benefits of the three facets of environmental sustainability, socio-economic sustainability, and resilient sustainability. Ideal full sustainable solutions save water, energy and protect the environment, garner or will generate wide public acceptance that saves costs in the fullest sense, and is safe, secure, provides protection, and is easy to maintain over time. More often, fully sustainable systems will require teams to use innovation and make trade-offs to achieve results across the spectrum. Sometimes this may require sub-optimizing one category over another, but more often than not, finding better third ways (that are neutral in one aspect or another) but bringing a “more likely to succeed” solution to the fore. Clearly more work needs to be done on this topic to be able to construct the rating system that is envisioned, but it is critical that resilient aspects be incorporated and effort be made to round out where we are today to a fuller, total meaning of sustainability.

**Applying this Rubric to Sustainability Rating Systems**

Only by balancing and rating projects against all three of these factors (environmental, socio-economic, and resilience), can a rating system truly be valuable for stating the level of sustainability that an infrastructure effort attains. In this sense, future systems need to find ways to grade and measure the relative full sustainability of a project or effort. The highly successful methods of LEED and the apparent approach of envision, provide templates/methods to do such scoring. What now needs to be done is develop a credit/scoring schema to round out the socio-economic aspects of sustainability, and fully create a rating schema for resilient sustainability. There is a pressing need for this effort, as Executive Order 13514 is putting the Federal Government into a quandary as it relates to resiliency.(17) Language such as “ensuring that planning for new Federal facilities or new leases includes consideration of sites that are pedestrian friendly, near existing employment centers, and accessible to public transit, and emphasizes existing central cities and, in rural communities, existing or planned town centers” is but one example that is at direct odds with the requirements in the Unified Facilities Criteria.(18). This presents an opportunity to develop a system of measuring sustainability that accounts for resilience as a key component in any analysis. By working towards a fuller sense of
sustainability, any rating system can become the key tool to providing lasting solutions to today’s many engineering, infrastructure and building problems.

**Vita**

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**End Notes**


(4) Ibid, pp. xii.


(8) Smart Growth America, Online at [http://www.smartgrowthamerica.org/](http://www.smartgrowthamerica.org/)


Institute for Sustainable Infrastructure, http://www.sustainableinfrastructure.org/

Website of the American Society of Civil Engineers (ASCE), Institute for Sustainable Infrastructure, online at http://www.asce.org/Sustainability/Institute-for-Sustainable-Infrastructure/, accessed on 13 July 2011.


UFC 4-010-01, Minimum Antiterrorism (AT) Standards for Buildings, Online at www.wbdg.org