Sliding scale: A case study in metric selection

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ABSTRACT:

A sustainable built environment will require significant innovations to the conventional mode of building design and delivery. Metrics-based rating systems by their nature steer a project development because of their narrowly bounded definition of "success". However, the reductive nature of any single measurement or system constrains innovation, particularly the high-level re-thinking that will ultimately be required for the conceptual and technological leaps to achieve "true" or functional sustainability. This paper presents a case study of the challenges inherent in selecting and implementing an appropriate rating system for the design and delivery of an office park currently under construction near Amsterdam. It specifically looks at BREEAM, LEED-NC and GreenCalc+. This paper offers a brief discussion of what these three systems measure, and how each proved insufficient at capturing the innovation and high ambition of this project. It offers further discussion of why the team chose to define a unique set of metrics to benchmark the project over the course of its design and delivery. This paper attempts to succinctly problematize what is, in fact, a measurement challenge facing any piece of the built environment viewed over its lifetime of changes and adaptations.

CONFERENCE THEME: On Measurement
KEYWORDS: metrics, rating systems, LEED, BREEAM

INTRODUCTION

Sustainable architecture's overarching goal is to provide a built environment which can be constructed, inhabited, and deconstructed in a dynamically stable relationship with the natural environment. Contemporary design and construction faces the challenge that the intersection of the built and natural environments is at times unstable or unsustainable at both local and global levels. This unsustainability manifests itself in various ways, from quantifiable impacts like resource scarcity, waste accumulation, natural habitat reduction, and human health risks to more subjective or qualitative impacts like diminished community, reduced access to natural areas, and disconnection from natural rhythms. Each of these manifestations has a host of quantitative and qualitative indicators, useful in determining improvement or worsening of these impacts. This paper contends that a truly sustainable built environment will require significant innovations to the conventional mode of building design and delivery; environmental impacts from the built environment will not disappear, but will be manageable by healthy ecosystems.

Within the last decade there has been growing clarity on the impacts the built environment has on the natural, and increasing momentum among designers (and others) to lessen or better manage this impact. However, lexical disagreements, principal-agency problems, and demonstrable causality challenges abound within the realm of sustainable design. Clearly something must be done, but exactly what are we aiming to achieve? Who is responsible to take action? How far must one stray from conventional practice to be sustainable? Many of these questions are outside the scope of this paper, but the struggle to answer these questions in order to formulate a sustainable mode of action forms the background to the discussion presented herein.

Ahead of clear answers to these potentially unanswerable questions, there have arisen a number of metrics-based rating systems intended to assess progress toward sustainability. Because these are designed to measure departure from convention, metrics-based rating systems are not obliged to articulate an end goal or target; there is no clear picture of what a, say, "LEED Platinum world" would be, or argument that this would be a sustainable one over time.

Through examination of a case study office park development in Holland, this paper attempts to articulate the challenge in selecting or developing a metrics-based rating system for a project of high ambition and prolonged build out, and attempts to show the limitations of using a temporally discrete rating system. The metrics-based ratings systems considered for this project were BREEAM NL, LEED NC, and GreenCalc+. The paper begins to suggest, through this example, a framework for a project-specific metrics-based approach for assessing and communicating movement toward a series of project-specific but high-level goals. The focus of this paper is on unpacking the selection of a rating system; it tries to understand what attitudes are embodied by these systems, whether they might constrain or enhance innovation, and how they might work to measure a project's improvement over time.

1.METRICS-BASED RATING SYSTEM LOGIC

As discussed above, definitions of sustainability of the built environment vary, and beyond semantic distinctions, there exist a plurality of logics illustrated by diverse concepts of sustainability (Guy and Farmer 2001); these manifest in differing images and approaches to sustainability from the natural to the cultural to the technological (Williamson, Radford, Bennetts 2003). The "technical image" of sustainability put forth by Williamson, Radford and Bennetts

> forefronts hard 'facts', and particularly the 'environmental facts' of the constituents of air, lighting and noise levels, resource consumption, etc., along with equally measurable economics. Success can also be measured: reduced energy consumption, reduced embodied energy in materials, internal temperatures and lighting levels within desired levels, reduced initial and operating costs (Williamson, Radford, Bennetts 2003, 32).

Similarly, Guy and Farmer's "Ecotechnic Logic" is

> based on a technorational, policy-oriented discourse which represents a belief in incremental, technoeconomic change and that science and technology can provide the solutions to environmental problems (Guy and Farmer 2001 141-142).

The eco-technic logic is typified by the metrics-based rating systems of BREEAM , LEED, and GreenCalc+. Each system breaks the challenge of sustainability into categories (energy, water, materials, etc.), and sets up a system by which to measure a departure from a conventional approach according to a set of pre-determined metrics. These systems attempt to shed light on the many questions facing by building designers, questions echoed in those arising from their clients in the real estate market,

> Measurement and assessment is at the forefront of the private sector commercial real estate industry today. As corporate boards, pension boards and other senior management have declared their commitment to looking closely at sustainable issues in their real estate, portfolio managers, corporate real estate executives, and facility and property managers are struggling to determine what level of sustainable performance they should strive for, how sustainable their properties are today, and what they need to do to better measure, monitor, and manage sustainability going forward. (Muldavin 2010, 26).

Metrics-based rating systems give the appearance of an answer to these questions. Indeed, this is the fundamental utility of metric based rating systems: they allow for clear definition of performance and objectivity in assessing outcomes. Requirements and thresholds vary among rating systems, as discussed briefly below, but the fundamental alignment remains the same: sustainability will be achieved, over time, through "incremental, technoeconomic change".

Widespread adoption of increasingly stringent metrics-based rating systems would theoretically allow for accomplishment of specific quantifiable goals given enough time. However, the systems by their nature steer a project's development toward a narrowly bounded definition of "success" through specific technology application, or achievement of particular quantitative performance thresholds. The incentive in these systems is toward accomplishment of the credit target and no further – call it "micro-innovation". High-performance beyond this – call it "macro-innovation" – is only mildly rewarded, regardless of how much closer one lands to the rating system's ostensible end goal.

While metrics-based rating systems are ill-suited to measuring ambition grounded in another logic of sustainability, such as the eco-aesthetic, eco-cultural, or eco-medical (Guy and Farmer 2001), they serve the purpose of demonstrating cost-savings due to the resource conservation aspects of some sustainable strategies. Indeed, there has been a greater conflation of sustainability with cost-saving during the last years of economic recession. As construction and operational budgets have gotten tighter, quantitative and numerical impact assessments using easily understood and comparable metrics (e.g. tons of CO2 averted, gallons of water saved, kW of energy reduced) have increasingly been used to inform economic decisions about first and lifetime costs. The very second paragraph of the LEED Reference Guide for Green Building Design and Construction states

> Green building practices can substantially reduce or eliminate negative environmental impacts through high-performance, market-leading design, construction, and operations practices. As an added benefit, green operations and management reduce operating costs, enhance building marketability, increase workers' productivity, and reduce potential liability resulting from indoor air quality problems (LEED Reference Guide 2009, xi).

Promising though the match between current rating system logic and market valuation may be, sustainability is not yet deeply integrated into investment decision-making, with decisions made largely through basic calculations of simple payback or return on investment. Muldavin points out that while progress has been made in this area,

> Most investors, and many tenants, today understand that sustainable properties can generate health and productivity benefits, recruiting and retention advantages, and reduce risks, but struggle to integrate benefits beyond cost savings into their valuations and underwriting. The failure by property investors to appropriately incorporate revenue and risk considerations into sustainable investment decisions has led to underinvestment in sustainability (Muldavin 2010, 1)

The insufficiency of current metrics-based rating systems to measure these benefits creates an opportunity to provide a means to track these and other benefits of sustainable design.

2. ASSESSMENT AND INNOVATION ACROSS THREE METRIC-BASED RATING SYSTEMS

A rating system can be seen as a collection of reductive metrics; it has breadth compared to achievement of a single metric because of its multivalent nature, but still does not reward high-level rethinking or macro-innovation. Put another way, the challenge put forth by a rating system is to achieve a large number of mildly challenging targets, rather than overcome any single significant challenge. There is no incentive, through rating systems scoring, to achieve quickly the sort of sustainability that the rating system aims to provide in the long term – its incentive structure is in fact set up to provide *only* the incremental change that it is designed to measure.

It is important for this discussion to review the categories of assessment and mechanism to reward innovation in rating systems. In general, while metrics-based rating systems help to channel micro-innovation toward accomplishing a specific, finite task, the inherently reductive nature of metrics and the specific thresholds in place in rating systems can constrain macro-innovation and higher levels of performance.

	BREEAM-NL weighting	LEED-NC credits	GreenCalc
Management	12	8	GreenCalc+'s assessment mechanism is not checklist based, and cannot be compared using these point categories. It uses an LCA approach to assess *all* environmental impacts from energy use, water consumption, and material consumption over the lifetime of the building.
Health and Well Being	15	13	
Energy	19	28	
Transportation	8	17	
Water	6	10	
Materials	12.5	12	
Waste	7.5	2	
Land Use and Ecology	10	4	
Pollution	10	7	
Innovation / Regional	10	9	

Figure 1: Rating system credit allocations (BREEAM-NL 2010, LEED-NC 2009, and GreenCalc+ 4.0)

2.1 BREEAM

The UK's Building Research Establishment Environmental Assessment Method was created in 1990 and has certified over 115,000 buildings, and over 700,000 registered for certification (BREEAM-NL 2010). Eight versions of the rating system exist to accommodate different building typologies in various stages of construction and use.

BREEAM NL v 1.11 2010

A version of BREEAM designed for use in Holland was released in 2010. As with BREEAM's other systems, it groups sustainability issues into nine categories: Management, Health and Wellbeing, Energy, Transport, Water, Materials, Waste, Land Use and Ecology, and Pollution. Credit weightings for these categories are seen in Figure 1. The Innovation category offers points for techniques not covered in other credits and exemplary performance relative to credit thresholds. BREEAM-NL 2010 offers 11 credits out of 67 which can achieve an innovation credit for exemplary performance, each adding 1% score to the final building score to a maximum of 10% total. A 30% score is the minimum to achieve the lowest qualifying rating of "Pass".

2.2 LEED NC 3.0

The U.S. Green Building Council's Leadership in Energy and Environmental Design was created in 2000 and has certified 2,476 buildings, with over 10,000 registered (Green Building Facts 2009). Like its predecessor BREEAM, there are several typologically specific rating system versions. LEED NC groups 55 sustainability credits into five categories, plus one for Innovation in Design: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Environmental Quality. For 45 credits, the rating system requires a project to meet a quantitative threshold. For example, Sustainable Sites Credit 7.2 assigns one point if a sufficient percentage of the roof is covered with reflective or vegetated material. For the other 10 credits, LEED rewards higher performance with more points. For example, Energy and Atmospheres Credit 2 assigns one point for offsetting 1% of annual energy costs with renewable energy, and 7 points for offsetting 13%.

The Innovation in Design category allows for up to five additional points for either innovating beyond the system's categories, or by exceeding one of the credit thresholds. Although this creates a mild reward for surpassing a point threshold, there is usually no reward for eclipsing it. LEED 2009 NC offers 17 credits out of 60 where an additional innovation point can be garnered for surpassing a credit threshold, though only three such points can be accrued, out of a total 110 points. A minimum of 40 points must be achieved for the lowest rating of "certified".

2.3GREENCALC$^+$4.0

GreenCalc is an assessment tool for office buildings developed in 1997 by the Dutch Institute for Building Biology and Ecology, and revised in 2005 and rereleased as GreenCalc,+ currently in version 4.0. The wizard-drive program analyzes the total lifecycle environmental costs of emissions, resource consumption, land-use, and "nuisance" from a given construction, and expresses these environmental costs in Euros per year and per square meter (Van Keeken 2001). The index produced by the program gives the relationship between the new building and a normative building designed to typical convention in 1990. Included in the program's life cycle assessment are the building's modeled energy consumption, modeled water consumption, and all materials used in the building's construction. Improvement in any of the three categories beyond the 1990 baseline will increase a project's score, which has no prescribed upper limit. GreenCalc+, therefore, imbeds a score incentive toward exceptional performance relative to its metrics.

3.PRESSURE-STATE-RESPONSE FRAMEWORK AND LATENT ENVIRONMENTAL STATE CRITERIA IN RATING SYSTEMS

It is helpful to see metrics-based rating systems within the larger framework of action Albert Adriaanse developed in his work on indicators of environmental performance (Adriaanse 1993). This framework is used by, among others, the United Nations to monitor the increase in sustainable development (Van Keeken 2001). As discussed earlier, current rating systems exist to measure incremental change toward some quantitative goal; the framing of this goal is critically important to the rating system's ultimate utility. Adriaanse points out that

> The quality of a performance largely depends on the clearness and transparency of the targets formulated. Environmental performance indicators can be used a s a tool to enlarge clearness and transparency of both the given situation and the target formulated. (Adriaanse, 1993)

In his terms, as shown in Figure 2, the metrics of a rating system would be a policy-based Environmental Response (Decisions – Actions) taken by Agents as a response to the Environmental State. If these are indeed to have the desired effect on the environmental state, selection of the metrics must be clearly linked to the state of the environment on which impact is desired.

Note also that any single goal or metric, even if framed in terms of environmental state, is merely one indicator of the overall state of the environment—necessary but not sufficient for sustainability. Similarly a human body temperature of 98.6°F is a necessary indicator of health, but is not sufficient to describe health if, say, one's leg is broken.

It is worth reviewing the environmental state indicators which underlie the three rating systems examined herein. Note that these are not part of the active vocabulary of the systems, but provide the groundwork for the structure and orientation of the systems. Precise environmental state criteria are not articulated by rating system authors; this may have been considered outside the scope of the rating system's creation. Thus it is still not clear what the criteria of the end goals would be beyond broad, open-ended definitions of sustainability.

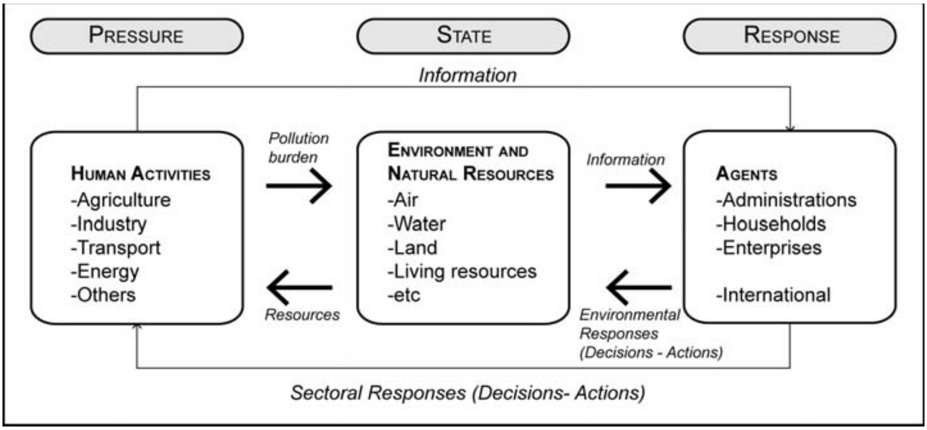

Figure 2: Pressure - State - Response Model Source: (Adriaanse, 1993)

3.1 BREEAM

According to the BREEAM literature, the first aim of BREEAM is "to mitigate the impacts of buildings on the environment", with an objective of setting "criteria and standards surpassing those required by regulations, and challenge the market to provide innovative solutions that minimize the environmental impact of buildings" (BRE Standard 2009, 7). To qualify as an innovative solution, a strategy must impact one or more of the following issues (BRE Standard 2009, 35)

- Mineral resource depletion
- Fossil fuel depletion
- Acidification
- Climate change
- Nuclear Waste
- Stratospheric Ozone Depletion
- Eco-toxicity
- Eutrophication
- Human Toxicity
- Photochemical ozone creation
- Waste Disposal
- Water Use
- Deforestation
- Urban Sprawl
- Reduction of Biodiversity
- Noise and Nuisance
- Loss of Heritage
- Indoor comfort
- Health and Safety
- Access and Inclusion

Here the BREEAM system is articulating a mixed set of indicators of environmental state and human activity burdens. It sheds some light on the overarching intended goals of this system, while stopping short of providing criteria for these indicators. The system is designed to assess a building at one point in time, and does not attempt to aggregate the building's impacts across its lifetime.

3.2 LEED

The USGBC's literature is less direct in articulating what sorts of environmental impact the rating systems attempt to mitigate. The introduction to the 2009 rating system provides a series of statistics and anecdotes to emphasize the problems of conventional building:

> The environmental impact of the building design, construction, and operations industry is enormous. Buildings annually consume more than 30% of the total energy and more than 60% of the electricity used in the United States. In 2006, the commercial building sector produced more than 1 billion metric tons of carbon dioxide, an increase of more than 30% over 1990 levels. Each day 5 billion gallons of potable water are used solely to flush toilets. A typical North American commercial building generates about 1.6 pounds of solid waste per employee per day in a building with 1,500 employees, that can mount to 300 tons of waste per year. Development alters land from natural, biologically diverse habitats to hardscape that is impervious and devoid of biodiversity. The far-reaching influence of the built environment necessitates action to reduce its impact (LEED BD&C Reference Guide 2009, xi).

It goes on to state that, "Green building practices can substantially reduce or eliminate negative environmental impacts through high-performance, market-leading design, construction, and operations practice" and cites many anecdotes of success.

From this it could be deduced that the primary LEED NC aims are to reduce total energy and electricity consumption, reduce CO2 emissions, reduce potable water usage for sewage conveyance, reduce solid waste production, and support biodiversity. Like BREEAM, the LEED system is articulating a set of indicators of human activity burdens, while stopping short of precise criteria for these. Also similarly to BREEAM, the assessment occurs at one point in time, and does not account for activity over the building's lifetime.

In its category rewarding innovation, LEED NC requires that a project exceed the requirements of another LEED credit, or "demonstrate quantitative performance improvements for environmental benefit" (LEED BD&C Reference Guide 2009, 594). These improvements must be comprehensive and applicable to other projects. Nowhere within the reference guide is an articulation of what sorts of environmental benefits qualify, what the criteria for these benefits are, and whether these must, like the overarching LEED aims, be framed in terms of reduction of human activity burdens.

3.3 GREENCALC+

GreenCalc+'s LCA-based assessment system attempts to directly measure environmental impacts, at least for the basis of relative comparisons. Per the Twin2010 model of sustainability indicators, the following impacts are assessed (Environmental Construction Classification 2002, 3):

- Greenhouse effect
- Ozone degradation
- Human toxicity
- Aquatic toxicity
- Terrestrial toxicity
- Photochemical oxidant formation
- Acidification
- Eutrophication
- Biotic resource consumption
- Abiotic resource consumption
- Energy consumption
- Land use
- Nuisance due to smell
- Nuisance due to traffic noise
- Nuisance due to sound
- Nuisance due to light pollution
- Nuisance due to increased disaster risk

Here GreenCalc+ is, like BREEAM, listing a mixed set of indicators of both environmental state and human activity burdens. Unlike the previous two systems, however, GreenCalc+ assesses a project across its anticipated lifetime.

4. RATING SELECTION CASE STUDY: PROJECT INTRODUCTION

This paper cites a specific case study to highlight the specific challenges in selecting an appropriate rating system, and using such a system to assess high ambition over time. The project, on which the author worked as a sustainable design consultant, entails the design and construction of a 91600 m2 (1,000,000ft2) office park near Schiphol Airport in Hoofddorp, the Netherlands. The phased build-out will take place over 10 years, and the aspirational client and designer intend the project to become increasingly sustainable as construction proceeds.

Research concurrent with design and construction is investigating building material health primarily, but also a number of other cutting edge building performance strategies. Not only would late-phase buildings accrue technical expertise in sustainable technologies from early-phase buildings, but as earlier buildings are maintained and refitted out they would incorporate the latest sustainable materials and strategies. Ideally each change would make the buildings more sustainable.

The national policy context is important to recognize; the Dutch government aims to reduce the environmental impact of all activities in order to achieve sustainable development in society within one generation. A series of national plans, including two covering building, were developed in the 90s, using the Brundtland-commission definition of sustainability as a starting point.[1] Plans for a sustainable built environment focus on the creation of impact assessment tools for various scales of development (van Keeken 2001). This context creates a public more conversant in and demanding of environmental assessment.

The assessment of materials for human and ecological health impacts was an important goal for this project. Here the Dutch building context provided a tremendous resource. Since 1993, the Netherlands Institute for Building-Biology and Environment (NIBE) has published a list of building materials and assemblies assessed using LCA for reference in design and construction decision making.[2] Building materials are classified based on their environmental impact across the lifecycle – from extraction and production, through a lifetime of use, to deconstruction and incineration or recycling. As with the LCA-based GreenCalc+ assessment tool, the criteria are energy consumption, resource depletion, land use impacts, emissions to air and water, health impacts, durability and reuse potential (van Keeken 2001). Each criterion is scored and weighted.[3]

4.1 PROJECT GOAL SETTING

Early in project conceptualization, and prior to selection of a rating system, the team set a number of high-level goals it intended to accomplish over the 10-year life of the office park's development. The team recognized that such goals were unreachable for construction of the first building, but as the project's body of research developed, subsequent buildings would become smarter and more sustainable. (Also, as park-scale strategies for energy production, heat exchange, and waste water treatment came on-line, the early-phase buildings would also become increasingly sustainable.)

- Eliminate all waste: The project aims to keep materials used in the project in safe, closed loops from manufacture through use to re-use/re-manufacture. The ideal is for building components to be diassemblable such that renovation would allow for material separation, and recycling with a high level of material purity. Here it is important to measure the potential for these materials to be cycled safely, a property of both assemblies and components.
- The project aims to provide the healthiest building materials available. This entailed a research effort to build a body of knowledge from which to select materials most supportive of human and ecological health. The challenge here is to track both the better characterization of materials in a building, (even if no ideal materials existed) and the actual quality of materials selected.
- Export Clean Energy: An end goal of the project is to become a net energy exporter upon full build-out. Early phase buildings will be grid-connected, though low-energy consumers, and will at a later date be shifted to an onsite biofueled cogeneration source.
- Create Healthy Spaces: The project aims to create better connectivity to the natural environment than any other building in the area. The idea is to create good, occupiable spaces inside and out.
- Create symbiosis: Another project goal is to create good support of flora and fauna existing on the site before construction began, and to improve both habitat and biodiversity.
- Achieve water balance: The project intends to collect rainwater, recycle greywater, and treat all blackwater onsite. As with energy production, this capacity will arrive in phases, where buildings will initially be connected to conventional utilities, and later switch over to the onsite facility.

Many of these goals are built upon an understanding that the project will grow as it builds out, but also change over time. There is a need to show both how the project performs at a point in time, and where it was along a trajectory toward a larger end goal. How best to do this with a conventional rating system?

In the framework of the Pressure-State-Response model, the project's approach was to provide a "positive pressure" on the natural environment, rather than a pollution burden. The project established three goals framed in the terms of environmental state criteria (Ecological health and habitat, Human health and well being, and Connection between people and the outside environment) and two goals framed in terms of project activity pressure (Renewable energy production, and Onsite treatment of water).

As a means to these ends, the project team decided to track metrics for the following:Energy demand reduction

- On-site renewable production
- Off-site renewable purchases
- Potable water use reduction
- Water cleansing
- Balanced water use
- Materials quantity optimization
- Design for reutilization
- Material health
- Quality daylighting and views
- Fresh air and comfort
- Acoustic quality
- Habitat creation
- Connection to outdoors
- Community amenities

5. DISCUSSION

It is important to note that goal setting for this project was not driven by a definition of success per a rating system; rather, a system was sought which could best reflect the level of achievement the project desired. Following the project goal setting, the team examined several rating system, particularly the three discussed in this paper. A system was needed which 1) could adequately reflect when the team had gone beyond best-practice, and could reflect the increasing sustainability over time of both the office park as a whole, and of the individual buildings within it; and 2) could communicate these results to the public.

Ultimately, the team decided to pursue a three-pronged approach:

First, a GreenCalc+ assessment was selected for clarity of results within the Dutch real estate market, while acknowledging that this did not capture all of the project's achievement in qualitative areas. This assessment will be performed for each building, as well as the office park as a whole. Whereas in the US the LEED systems have in the last several years begun to have recognition and traction in the real estate market, the longer-standing GreenCalc has sufficient penetration to be expected of projects with sustainable intentions.

Second, a BREEAM-NL assessment is planned to be undertaken for at least the initial buildings on the project, in part as a demonstration project of the new Dutch version of this system.

Last, and perhaps most importantly, the team has developed its own matrix-based method for tracking site-specific sustainability on the project. For each of the five major goals of the project, the team articulated four levels of accomplishment: 1) conventional practice, 2) current best practice,3) aspirational practice, and 4) end goal accomplishment. Rather than providing a single number score for the project's achievement at a point in time, a graphical "dashboard" provides a visual assessment of the current state of achievement, simultaneously evaluating all five goals rather than reducing assessment to a single number. It indicates where the project is performing well, and where further achievement is needed to achieve the ultimate goals.

As a part of this, the team developed a series of graphs to indicate the performance of the project relative to the ultimate goals, to emphasize the progress toward this end, rather than focusing on achievement of interim metrics. Here is where the team's third assessment approach differs most from convention: it articulates long-term goals at either local or global level, it maps progress toward these goals over time, and it maintains multiple dimensions of qualitative and quantitative evaluation, rather than collapsing into a single number.

Project construction began only recently, so the test of this system's long term utility admittedly is yet to come. Given the project owner's interest in measuring and demonstrating unique improvement over time, this project is a good first test candidate. These mappings are not yet developed as a system

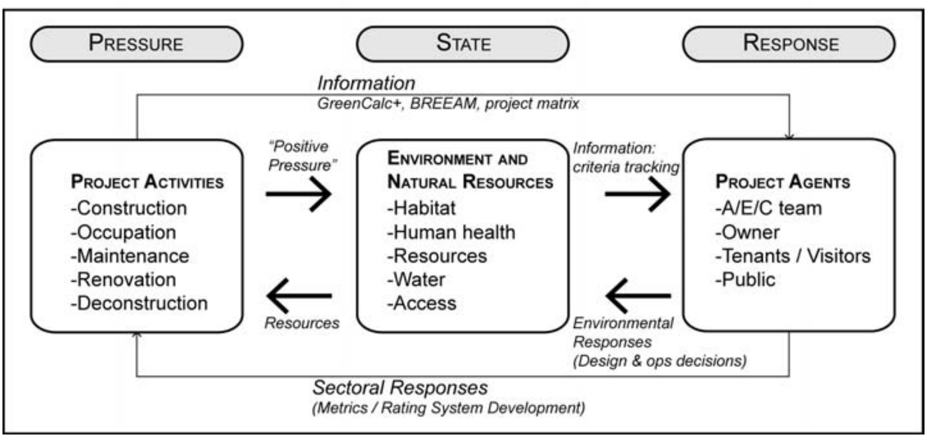

Figure 3: PSR Model for Case Study Project (based on Adriaanse, 1993)

to be universally applied, but are discussed here as an approach to assessment that may be undertaken in future projects intending to achieve radical sustainability. This may not yet translate readily to a US commercial market only beginning to understand a scorecard-based definition of sustainability. Ahead of any widespread adoption, this methodology may next prove useful to large institutional land-owners interested in long-term sustainability of their portfolios.

CONCLUSION

Briefly unpacking the discussions from the initial design phases of this project are illustrative for highlighting the latent properties of metrics-based rating systems.

First, it is evident that these systems proceed from a logic which assumes that sustainability will be achieved through incremental, quantifiable achievement. While serving a clear utility in communication within the economic market (often a non-technical audience) non-critical adherence to rating system logic is limiting in the ability to leap beyond this incremental change to achieve fundamental change. Ironically, these systems may also inhibit a single project's ability to incrementally improve itself over time.

Second, it is important for the end goal toward which the rating system is attempting to steer the built environment to be articulated. This will force deeper consideration of the alignment of indicators and criteria of both human activity pressures and the desired environmental state. Barring this, innovation is further constrained because other causal links may not be rewarded by the system.

Third, an area in which metrics-based rating systems are found to be weak is in the assessment of a project over time. Rating systems measuring building operations (such as LEED Existing Buildings Operations and Maintenance, or BREEAM In-Use) fill a void in the rating system continuum by addressing existing stock, the overwhelming majority of buildings. In theory these "longer snapshots" of performance could measure long term incremental achievement if buildings were continually evaluated. In practice this has not been undertaken. Beyond the implementation question, it is still problematic that the benchmarks against which projects are measured are defined generically, not by the building's own previous performance, hence mainly driving performance improvement by rating system requirements. Also, these rating systems manifest the second property described above, and do not articulate an end goal toward which existing buildings are ostensibly striving.

In conclusion, the professional building community is increasingly migrating toward an environment in which the discourse on sustainability surrounds metrics, and demonstrations of incremental improvement. It is essential that we retain an open dialogue about the higher-level goals toward which we are ostensibly moving our built environment. We must continue to assess our metrics to ensure that these are, in fact, moving us down the path toward these goals. Where quantitative metrics and rating systems do not capture our end goals, it is imperative that we continue to strive to fold subjective goals into a project's assessment.

It is critical that we do not become dependent on rating systems to define sustainability for us, given that many logics and images inherent in this aim cannot be fit into a system, no matter how large and diverse the collection of metrics. Mechanisms are needed to ensure innovation is rewarded outside the framework of rating systems, given the limited opportunities for innovation from within. Finally, rating systems must relentlessly become ever more aspirational if they are to achieve their own latent goals.

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ENDNOTES

[1]The oft-cited Brundtland definition of sustainable development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

[2]The NIBE assessment uses the TWIN model for its LCA calculations.

[3]Weighting of criteria uses a methodology developed in 1989 for the Indicative List of Building Materials. This list creates one summary score equal to (4 * energy) + (4 * depletion) + (6 * damage) + (8 * emissions) + (8 * health) + (2 * durability) + (6 * reuse / recycling).